SCIENTIFIC RESEARCH ABSTRACT

VOLUME 2

CGCA-02

INTERNATIONAL CONFERNEC ON CERAMICS AND GEOMATERIALS IN CENTRAL AFRICA

Yaounde | Cameroon |April 08 – 11 2025

CGCA

International Conference on Ceramics and Geomaterials in Central Africa

Yaounde | Cameroon |April, 08 – 11, 2025

Scientific Research Abstracts

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Mot de la Présidente du comité d'organisation

Chers lecteurs, du monde académique, scientifique ou industriel. C'est avec beaucoup de plaisir que nous nous sommes investis pour l'organisation de cette deuxième édition de la conférence internationale sur les « Céramiques et géomatériaux en Afrique Centrale ».
Cette conférence s'inscrit dans une démarche structurante portée par le CACerS (Composite and Advanced Ceramics Society), que j'ai l'honneur de présider, en co-construction depuis plusieurs années avec le soutien de partenaires engagés :

- l'Université de Yaoundé I et sa Faculté des Sciences,
- la MIPROMALO, pilier national de la recherche sur les matériaux locaux et matériaux innovants,
- l'Université de Limoges à travers l'IRCER,
- l'American Ceramic Society, qui nous a fait confiance dès le départ,
- l'European Ceramic Society, dont nous sommes une société affiliée.

Cette conférence est l'un des jalons d'un projet global de recherche, de formation et d'innovation sur les geomatériaux et céramiques, visant à créer des ponts entre la recherche académique, les besoins industriels, et les enjeux sociétaux du continent africain.

Le thème de cette conférence touche au cœur de notre ambition : valoriser les géomatériaux et les céramiques à partir des ressources naturelles locales, dans une logique de développement durable, de souveraineté scientifique et de transformation industrielle.
Le Cameroun, comme plusieurs pays d'Afrique Centrale, regorge de ressources minérales sous-exploitées. En combinant ces atouts à la science des matériaux et aux nouvelles technologies comme la fabrication additive, nous pouvons créer une industrie des matériaux compétitive, durable et porteuse de solutions adaptées aux réalités africaines.

La CGCA02 : un carrefour d'idées, de savoir-faire et d'opportunités. Donner de la valeur aux matériaux locaux pour construire l'avenir.
Une conférence ancrée dans le respect des valeurs africaines

En tant que Présidente du Comité d'Organisation, j'ai tenu, avec toute mon équipe, à ce que cette conférence soit non seulement scientifiquement ambitieuse, mais aussi ancrée dans les valeurs de l'hospitalité, du respect, du partage et de la solidarité qui caractérisent les sociétés africaines.

Merci pour tous les soutiens et que cette synergie se pérennise et porte des fruits dans la sous-région et au-delà.
Bonne lecture !

Gisèle Lecomte-Nana

Few words from the President of the Organizing Committee

Dear readers, from the academic, scientific or industrial world. It is with great pleasure that we have invested in the organization of this second edition of the international conference on "Ceramics and Geomaterials in Central Africa".
This conference is part of a structuring approach carried out by the CACerS (Composite and Advanced Ceramics Society), which I have the honour of chairing, which has been co-constructing for several years with the support of committed partners:

- the University of Yaoundé I and its Faculty of Sciences,
- MIPROMALO, the national pillar of research on local and innovative materials,
- the University of Limoges through IRCER,
- the American Ceramic Society, who trusted us from the start,
- the European Ceramic Society, of which we are an affiliate.

This conference is one of the milestones of a global research, training and innovation project on geomaterials and ceramics, aimed at building bridges between academic research, industrial needs, and societal challenges on the African continent.

The theme of this conference touches on the heart of our ambition: to valorize geomaterials and ceramics from local natural resources, in a logic of sustainable development, scientific sovereignty and industrial transformation.
Cameroon, like several Central African countries, is full of under-exploited mineral resources. By combining these strengths with materials science and new technologies such as additive manufacturing, we can create a materials industry that is competitive, sustainable and offers solutions adapted to African realities.

The CGCA02: a crossroads of ideas, know-how and opportunities. Giving value to local materials to build the future.

A conference rooted in respect for African values

As President of the Organising Committee, I and my entire team were keen to ensure that this conference was not only scientifically ambitious, but also rooted in the values of hospitality, respect, sharing and solidarity that characterize African societies.

Thank you for all the support and may this synergy be sustained and bear fruit in the sub-region and beyond.
Enjoy reading!

Gisèle Lecomte-Nana

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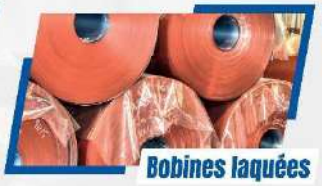
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ABOUT US

CACerS is dedicated to advancing teaching and research in ceramic materials while promoting the valorization of natural resources. Through collaborative projects with national and international partners, CACerS facilitates research and development initiatives, provides a platform for scientific exchange, and recognized outstanding contributions in the field of ceramics. The organization hosts an annual international CGCA conference which highlights African and international advancements in ceramics, providing a unique opportunity for young researchers to present their work on a global stage.

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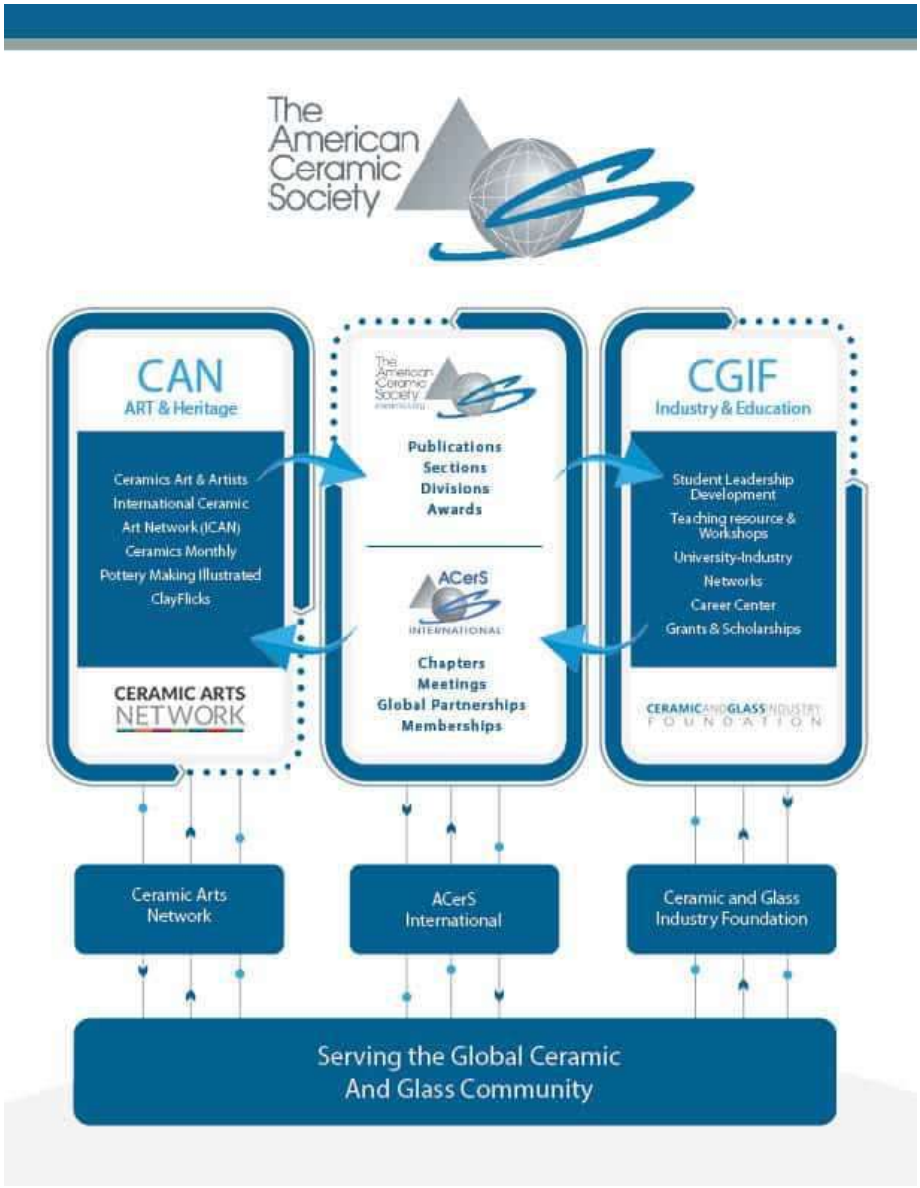

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- **rechercher l'harmonisation et la complémentarité des programmes de colloques, congrès, journées techniques, consacrés aux céramiques de toutes natures et à leurs applications,**
- **encourager et soutenir les actions de formation et de promotion dans le domaine de la céramique,**
- **représenter la communauté nationale auprès des associations similaires à l'étranger, notamment en Europe,**
- **organiser des journées, colloques, écoles… sur les céramiques.**

Le GFC collabore étroitement avec la Société Française de Métallurgie et de Matériaux (SF2M). Le GFC et la SF2M sont membres fondateurs de la Fédération Française des Matériaux (FFM), et contribuent ensemble à l'organisation des grands congrès Matériaux. Elles partagent leurs expertises au travers de leurs commissions thématiques communes (commissions mixtes) et fédèrent leurs moyens : la co-construction de leurs sites web en est un exemple.

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Table

Plenary Lectures

Please check the appropriate contribution:	☐ *Oral*	*or*	☐ *Poster*

L'AUDACE DE LA RECHERCHE CERAMOLOGIQUE FACE AUX DEFIS CLIMATIQUES

Issoufou Soulé MOUCHILI NJIMOM
DPT-PHILO/FALSH/UYI

La problématique climatologique immanente à l'exploitation technoscientifique de certains constituants de l'environnement naturel amène à s'interroger sur l'avenir de la vie et du vivant. L'on se demande si cette exploitation est aujourd'hui, inopportune, inadéquatement articulée aux besoins essentiels de développement ou tout simplement surévaluée et prise en étau par cette subordination de la recherche scientifique à l'idéologie néolibérale. Cette interrogation est d'autant plus pressante que la diversité des espèces vivantes subit des modifications climatiques qui provoqueraient au moins deux types de situations possibles : des mutations génétiques pour les espèces les plus résistantes, la disparition de certaines espèces vivantes qui échoueraient à une sélection naturelle artificiellement engendrée. Il faut donc comprendre les défis climatiques d'aujourd'hui en se prononçant sur la pertinence d'un engagement scientifique désorientée des possibilités diverses d'investissement de l'intelligence au profit d'un néolibéralisme qui subordonne la recherche aux désirs effrénés d'un mercantilisme à outrance.

MOTS CLES : Climat, recherche scientifique, céramologie, développement, néolibéralisme, vie, vivant…

Please check the appropriate contribution: *X☐ Oral* *or* *☐ Poster*

Green and circular economy: contribution of ceramic science to the recovery of oyster shell waste

GUILLEMET-FRITSCH Sophie

CIRIMAT Université de Toulouse, CNRS, Université Toulouse 3 - Paul Sabatier, Toulouse, France

Astract

Efficient waste management, particularly with regard to their reuse, has become a societal priority. Oysters represent a substantial fraction of the world's intensive aquaculture production. In France, barely 10% of this waste is recycled, due to a lack of recycling solutions. This phenomenon is valid all over the world. Oyster shells, once crushed, can be integrated into bricks, mortars and even roads. Their hardness and durability give them strength and longevity. Thus, many coastal regions have incorporated oyster shells into their architecture, which is a testament to their effectiveness. Oyster shells also have a natural ability to purify water. By placing layers of shells in water management systems, they can help reduce impurities and pollutants. Their high calcium carbonate content helps neutralize the acidity of water, improving its overall quality. In addition, oyster shells are also used as craft material. Finally, let us mention the use of shells in environmental restoration and coastal protection. This presentation aims to show how materials science can contribute to valorizing waste from the sea by recreating high-value objects in many fields. We will give examples of reuse and recycling actions to create by-products from oyster shells.

Keywords: sustainability, circularity, valorisation, ceramic waste, oyster shell, 3D printing.

References: no more than 6 (times New Roman, font size 10).

Examining the potential of calcined oyster shell waste as additive in high volume slag cement. A. Naqi, S. Siddique, H. Kim, J. G. Jang, Construction and Building Materials 230 (2020) 116973.

Potential Use of Oyster ShellWaste in the Composition of Construction Composites: A Review. P. Bellei, I. Torres, R. Solstad, I. Flores-Colen, Buildings 13 (2023), 1546.

Feasibility test of waste oyster shell powder for water treatment. S. Jung et al., Process Safety and Environmental Protection 102 (2016) 129-139.

A new recycling material for removing phosphorus from water. C.W. Lee, H.B. Kwon, H.P. Jeon, B. Koopman, Journal of Cleaner Production 17 (2009) 683-687.

Sustainable and Eco-Friendly Coral Restoration through 3D Printing and Fabrication, H. I. Albalawi et al., ACS Sustainable Chem. Eng. 9 (2021) 12634-12645.

A Novel Eco-Friendly Circular Approach to Comprehensive Utilizing Bittern Waste and Oyster Shell. W. Pan, Y. Yang, D. Yang, M. Arowo, S. Wu, Y. He, Q. Zeng, Processes 11 (2023) 1209.

[1] Corresponding author : sophie.guillemet@univ-tlse3.fr

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MATERIAUX BIO-SOURCES, MATERIAUX GEO-SOURCES : ECO-MATERIAUX DU FUTUR POUR L'AFRIQUE

Abdellatif IMAD

Université de Lille, France

L'Histoire de l'Humanité est étroitement liée à l'Histoire des Matériaux. En effet, l'Homme a su utiliser les matériaux naturels, locaux, disponibles et accessibles, pour apporter des solutions viables à ses besoins quotidiens : habitation, transport, outils agricoles, accessoires de cuisine, habillement, etc. Ainsi, il a développé des connaissances et des techniques pour transformer des Matériaux Biosourcés et des Matériaux Géosourcés (fibres végétales, fibres animales, bois, terre, pierre, etc.). En Afrique, le domaine de l'habitat en «terre crue» a connu un fort développement car il offre un hébergement dans des conditions confortables du point de vue thermique et acoustique. Aussi, il assure une durabilité en témoignent les édifices savamment construits, avec des formes architecturales extraordinaires, et qui sont pluri-centenaire, tels que : «Grande Mosquée de Bobo-Dioulass, au Burkina Faso», «Centre de Tombouctou, au Mali », «Mosqué Koutoubia, au Maroc », « Pyramides, en Egypte », « Vieux Palais de Foumbou, au Cameroun », etc. Aussi, nous pouvons souligner l'édification des routes en terre pour assurer la mobilité des personnes et des biens.

Pour des raisons historiques, culturelles et sociétales, d'une part, et avec l'avènement des « matériaux industriels de construction (béton, tôles, etc.) », nous avons assisté à une grande phase d'abandon des matériaux d'origine naturelle. Vu les dérèglements climatiques à l'échelle de la planète conduisant des catastrophes sur la Nature : sécheresses, inondations, incendies, cyclones, tremblements de terre, etc., l'Homme commence à repenser, timidement, à construire autrement en s'inspirant des techniques et des expériences ancestrales. Cette exigence environnementale s'impose en Afrique du fait de la raréfaction des ressources conjuguée à une demande croissante en termes d'habitations et de routes dans toutes les régions africaines. Ainsi, dans ce contexte de crise écologique, la valorisation des Matériaux Bio-Sourcés et des Matériaux Géo-Sourcés constitue une alternative viable et vivable en vue d'apporter des solutions soutenables et durables prenant en compte les spécificités locales. Ce défi nécessite une implication forte de tous les acteurs : académiques, professionnels, décideurs et des acteurs de la société. Aussi, il exige une nouvelle démarche multidisciplinaire et multi-sectorielle permettant de mieux maîtriser le Cycle de Vie des matériaux naturels.

Ainsi, la Nature constitue le grenier des éco-matériaux futurs en Afrique prenant en compte les aspects environnementaux, sociétaux et économiques..

e-mail : abdellatif.imad@polytech-lille.fr

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INDUSTRIAL INNOVATION. WAYS TO DECARBONIZATION OF INDUSTRY

BLANCHART Philippe[1]

[1] *Univ. Limoges, CNRS, IRCER, UMR 7315, F-87000 Limoges, France*

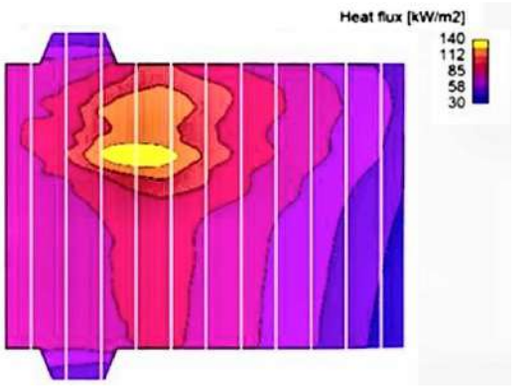
Abstract

Decarbonizing the industrial sector is essential to achieve carbon neutrality by 2050. Greenhouse gas (GHG) emissions have been rising continuously for a century, and the industry currently accounts for more than a quarter of global GHG emissions.

Heavy industries such as chemicals, cement, glass, and industrial ceramics are finding ways to reduce their environmental impact. While demand for cement, glass, and chemicals will continue to grow, decarbonization technologies and opportunities to transition manufacturing processes are rapidly emerging and becoming more cost-competitive.

For all countries, the path to industrial decarbonization requires both the emergence of corporate strategies and a set of state strategies to support innovation and investment.

Scientific studies on the challenges of industrial innovation encourage the adoption of practical steps that business leaders can take to accelerate the process. We present industrial development works in the production of cement, plaster and glass, which aims to use new decarbonized mineral resources, hydrogen combustion or the optimization of manufacturing processes. These works illustrate the possible changes in major sectors essential to our living environments.



Top view of a 25-m-length glass melting kiln for manufacturing bottles : simulation of the heat flux across the melted glass surface at 1200-1500°C, heated with natural gas and 50% hydrogen.

Keywords: Industry, Decarbonization, Cement, Plaster, Glass.

Keynotes

Please check the appropriate contribution: ☐ *Oral* *or* ☐ *Poster*

Mineralogical, mechanical and microstructural analysis of ceramics made from clay and talc mixtures

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Clays are used in various ceramic processes for producing building materials (such as bricks, and tiles) and for crockery. In several regions of Burkina Faso, local populations extensively use clays as raw materials widely use in traditional ceramics. The resulting products tend to be low quality, attributed to the empirical manufacturing and firing processes used by these populations, as well as the characteristics of the clay itself. This type of exploitation hinders the better valorization of these potential sites of clay raw materials. These ceramics must satisfy binding physical and mechanical properties despite their heterogeneous microstructure, regardless of the sintering cycle [1]. This applies to terracotta products, although sintered at a relatively low temperature (<1100°C). In this work we present a manufacturing process enhance the quality of finished products. To do this, the GAR clay, rich in talc [2] was used as an additive to increase the mechanical strength of the different ceramic materials. This approach reduces the sintering temperature due to mineralogical and structural changes. The mechanical properties of the final products were linked to their mineralogical composition and the heat treatment applied. We examined the microstructure of the created and sintered pieces, as well as evaluated the density and porosity of the sintered products. An essential feature of terracotta is its sintering-reaction process, which may occur with or without a liquid phase and involves nucleation and growth of transient or permanent phases [3-5].

In clay-based mixtures comprising 5 to 10% talc, and sintered at 1100 ° C with a final stage of 0.5 to 2 hours, new crystalline phases and a micron-scale composite microstructure are observed. The silico-aluminous matrix includes pores and a crystalline phase that is more or less anisotropic. As the talc content increases, the density of the shards rises while their open porosity decreases. Additionally, the mechanical strength of the sintered mixtures depends significantly on the initial composition and the baking cycle applied [6]. In these fragile ceramics, rupture occurs randomly due to the junctions between various particles, with breaks induced by microstructural defects. The breaking stresses exhibit considerable dispersion and scale effects. Weibull's probabilistic model, which is founded on the weak link law, was employed to assess the reliability of batches of these materials. The stress dispersion at rupture indicated the existence of different defect populations, facilitating an evaluation of the contribution and role of additives. Weibull's law estimates the probability of rupture for the material. Depending on the type of ceramics involved, fractures may arise from the activation of either surface or volumic defects. We observed stress dispersion at break varying by shade. Within the material populations, two to three subgroups can be seen except for the case o usually be identified, except for the 5% talc with SIT clay, which demonstrates homogeneity. Its Weibull module being the highest, indicates good reliability [7].

Key words: clay, talc, ceramic, microstructure, breaking stresses, Weibull

REFERENCES

1- Sié Kam, et al, Céramiques d'argile du Burkina Faso utilisées en construction immobilière *J. soc. Ouest-Afr. Chim. (2009) 027; 55 – 62*

2- Brahima SORGHO, Lamine ZERBO, Mohamed SEYNOU, Karfa TRAORE, Raguilnaba OUEDRAOGO, Moussa GOMINA, Philippe BLANCHART ; Caractérisation physico-chimique d'un talc naturel de Garango (Burkina Faso), Vol. 4, n°s 1 et 2 — Janvier-décembre 2012, Science et technique, Sciences appliquées et Technologies

3- Traoré K., Kabré T. S., Blanchart P., Gehlenite and anothite crystallisation from koolinite and calcite mix, Ceramics International, 29, 2003.

4- Prodanovic D., Zivkovicz B., Radosavljivic S., Kinetic of the deshydroxylation and mullitization process of the halloysite from the Farbani Potok locality, Serbia, Applied Clay sciences, 12, 1997.

5- Rezvani M., Eftekhari Y., Marghussian K. V., Utilisation of DTA in determination of crystallisation mechanism in SO_2 - AL_2O_3 – CaO – MgO (R_2O) glasses in presence of various nuclei, Journal of the European Ceramic Society ; 2004.

6- Xingzhong G., Hui Y., Ming C., Nucleation and crystallization behavior of Li_2O–Al_2O_3–SiO_2 system glass–ceramic containing little fluorine and no-fluorine, Journal of Non-Crystalline Solids, 351(24-26), 2005, 2133-2137

7- L. Zerbo, M. Seynou, B. Sorgho, G. Lecomte-Nana, M. Gomina, P. Blanchart ; Microstructure and Weibull distribution of rupture strength of clay-talc ceramics ; Cerâmica 65 (2019) 240-245.

Please check the appropriate contribution: ☐ ***Oral*** ***or*** ☐ ***Poster***

DEVELOPMENT OF INNOVATIVE ACOUSTIC MATERIALS USING ADVANCED MANUFACTURING TECHNIQUES

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Leveraging the versatility of additive manufacturing and other polymer processing techniques, we explore the creation of metamaterial structures that exhibit superior performance in mitigating unwanted noise. Solutions for noise mitigation are not one-size-fits-all and must be designed to meet the specific constraints and specifications of each case. The strategy must involve not only the development of acoustic porous materials and advanced resonant cavities but also robust procedures for integrating these materials into actual composite structures. Through a combination of experimental and numerical approaches, we demonstrate that material properties can be precisely tailored and correlated with process parameters to achieve optimal performance. Several examples developed in our laboratory, including acoustic micro-lattices, micro-channels, and stochastic porous materials, highlight the potential of using advanced manufacturing processes to create innovative acoustic solutions. Our research clearly shows that developing multifunctional materials has become crucial in a wide range of industrial applications, where noise reduction and vibration control are significant challenges.

Keywords: no more than 6 (times New Roman, font size 11).

References: no more than 6 (times New Roman, font size 10).

Please check the appropriate contribution: ☐ *Oral* *or* ☐ *Poster*

STATE OF ART ON CLAY RAW MATERIALS STUDIES IN THE CENTRAL AFRICAN REPUBLIC

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This work presents the status of work carried out on clay raw materials in the Central African Republic. The aim is to gather the results of sites that have undergone scientific studies to create a database of the clay raw materials of the Central African Republic. Five (05) clay sites have undergone physicochemical and technological characterization, temperature behavior studies, usage properties. These sites were the subject of two doctoral studies, one of which is entitled "Clay materials from Ombella M'Poko (Central Africa): Characterization and study of the physical, mechanical and microstructural properties of fired products" and the other on ”Production of silicate ceramics from clay raw materials and vegetable waste from Central Africa: physicochemical properties and sintering”. The results obtained, and published in international peer-reviewed journals, show that these clays can be used in ceramics, some of which can be exploited and valorized in their natural state, while others can be improved by various additions for a variety of uses.

Key words: Central African Republic, Clay raw materials, Status.

Please check the appropriate contribution: ☐ *Oral* *or* ☐ *Poster*

DU METISSAGE CULTUREL AU CONCEPT DE L'ANTHROPOMORPHISME DE L'ECOHABITAT

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The Sudano-Sahelian peoples despite all sorts of influence have retained the communication through art and culture. Anthropomorphism, sociology, symbolism, cosmogony and cosmology are the bases on which peoples perpetuated this culture through their habitations integrated in a natural environment. However, this dwelling today seems to lose its symbols and the values in favour of imported concepts and construction materials. It is with this in mind that we have carried out this work around cultural interbreeding in Cameroon. The fundamental concern which springs at the crossroads was the setting up of the houses and their installations, answer the question: How to continue to conceive and manage the dwelling from the four cultural areas of Cameroon? In order to achieve this, an approach has been developed, starting from the existing cultural background and being purely symbolic. Our finding is a habitat from locally available natural and bio sourced materials presented as writings and marks of Sudano-Sahelian man (Fulani), printed on a support and left to posterity.

KeyWords: Interbreed; anthropomorphism; sociology; symbolism; cosmogony; cosmology; dwelling; eco-habitation.

Please check the appropriate contribution: ☐ *Oral* *or* ☐ *Poster*

APPLICATION OF NANOTECHNOLOGY IN WASTEWATER TREATMENT FOR SUSTAINABLE DEVELOPMENT

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According to some expert estimates, the world population will rise to 9 billion by 2050. This will cause problems with water pollution, and with an increasing amount of waste that will accumulate in water bodies. Due to higher consumption of water, and drinking water shortage, a high emphasis will be placed on wastewater recycling. Conventional wastewater treatment methods include various physical, chemical and biological processes. The results of such treatment can be limited because of high investment cost or, in some cases, due to poor treatment efficiency. For that reason, new approaches are continuously being developed as a means of supplementing or replacing traditional water treatment methods. The presentation provides an overview of development of nanotechnology over time in the sphere of wastewater treatment, and examines the influence of nanomaterials on human health and environment. The future development trends of nanotechnology are also presented.

Keywords: nanotechnology, wastewater treatment, nanomaterials, nanoparticles, nanofiltration, nanoadsorbents, SDG6.

Matériaux Céramiques et ressources naturelles : une synergie pour un développement durable.

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Résumé :

Le Maroc bénéficie d'une richesse notable en ressources naturelles, comprenant notamment des argiles, des feldspaths, des schistes bitumineux, des phosphates et divers autres matériaux locaux. Ces ressources, après transformation, offrent de nombreuses possibilités pour la production de céramiques innovantes et durables.

La présente contribution explore la valorisation de ces matières premières naturelles dans la conception de matériaux céramiques à haute valeur ajoutée, spécifiquement développés pour relever les défis environnementaux contemporains. Les applications potentielles sont vastes et touchent plusieurs secteurs. Elles incluent des domaines aussi divers que la construction, l'environnement et l'agriculture. L'objectif principal est de réduire l'empreinte écologique tout en favorisant des solutions plus respectueuses de l'environnement.

Dans le secteur agricole, par exemple, l'utilisation des "engrais vitrifiés" à libération contrôlée pourrait permettre une gestion plus rationnelle de la fertilisation, contribuant ainsi à la préservation des sols et à la protection des ressources en eau souterraine. En ce qui concerne le domaine du bâtiment, les ciments à faible teneur en carbone développés dans le cadre de ces recherches représentent une alternative plus écologique au ciment Portland traditionnel.

Cette contribution présente des exemples concrets de projets de recherche et d'innovation, mettant en lumière la synergie entre les ressources naturelles marocaine et les matériaux céramiques. Elle illustre ainsi comment cette alliance peut participer activement à la construction d'un avenir durable, tant pour l'industrie locale et africaine que pour la préservation de notre environnement.

Mots-clés : *Maroc, valorisation, engrais vitrifiés, ye'elimite, membrane.*

Please check the appropriate contribution:	☐ *Oral*	*or*	☐ *Poster*

ECO-MATERIALS: LEVER OF INCLUSIVE LOCAL DEVELOPMENT, PILAR OF CLIMATE RESILIENCE.

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Mineral ecomaterials (development minerals, geosourced and biosourced materials …) are materials produced or transformed with low or no impact on environment. These ressources are used as construction materials at about 80 % as aggregate and therefore, are appropriated solutions for scalling up the sectors of habitat and infrastructure in developping coutries through eco-construction. Ecomaterials are also use as industrial and artisanal raw materials for production of many important goods. So, ecomaterals have contribute and will contribute significantly to local economic development. The objectives of this communication is to present the stake and challenge of optimal valorization of mineral ecomaterials with imphasis on their strategic interest for local sustainable and inclusive development, and for climate resilience.
A brief description of availability of local materials and biosourced materilas in a developping country as Cameroon shows their diversity and potentiality as well as their importance for national economy. Based on valorization of ecomaterials in African sub-saharian countries, it is shown that the present dynamic will keep going on and render these ressources levers of local and inclusive economic growth and pilars of climate resilience. According to this point of view, attention should be paid to aspects as accecibility, availability, appropriated technology of production, training, value chaine of production and distribution, insitative regulation and institutionnal framworks, and environmental considerations.

Key Words: *Local Materials; Inclusive Growth; Climate Resilience*

Please check the appropriate contribution: ☐ *Oral* *or* ☐ *Poster*

Bio-sourced ceramics membrane for water treatment

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Abstract

In sub-Saharan Africa, the accessibility to drinking water and sanitation is the lowest in the world. In Cameroon, there is a significant disparity in the accessibility to drinking water between urban and rural areas. In urban, peri-urban, and rural areas, people use surface and underground water for drinking purposes. Regarding the quality of drinking water, microbiological contamination is usually a problem in developing countries. In addition, inorganic and organic contaminants, can be present in the waters (which negatively affect health and aesthetic qualities of the waters). Research on the quality of surface and groundwater in Cameroon shows that water intended for consumption does not always meet recommended standards and may contain pathogenic microorganisms, suspended solids, high turbidity, and dissolved organic and inorganic substances. The poor quality of water intended for consumption has caused consumers to seek alternative treatment solutions. Thus, the implementation of point-of-use treatment technologies has become a major priority and is currently a scientific and technological challenge and concern. In this context, our work focuses on the valorization of local materials to formulate and develop bio sourced ceramic membranes for water treatment. Our scientific and technological contribution focuses mainly on two aspects: firstly, formulation and development from local materials of multilayer ceramic filters (flat and tubular) with antimicrobial agent for the physicochemical and microbiological treatment of drinking water, secondly, developing composite filters with ceramic matrix and activated carbon to improve the retention capacity of dissolved organic and inorganic substances in water. In the first part, we develop multilayer ceramic membranes which consist of a macro porous support, one or more mesoporous intermediate layers and a micro porous upper layer. The aim of this arrangement is to gradually reduce the pore size to improve the selectivity of the membrane. This research intends to bring out the optimal conditions for formulating ceramic filters having maximum productivity (permeation) with efficiency (selectivity) according to scientific constraints (porosity, mechanical resistance and chemical stability, tortuosity) and technological constraints (transmembrane pressure, retention rate, clogging) in the field (Belibi *et al*., 2014, Ndiapa *et al.*, 2019, Nongni *et al*., 2019, Ngiongboung *et al*., 2019, Yanu *et al*., 2020). The dispersion of silver nanoparticles within the microfiltration membrane by the in-situ reduction technique led to the production of a ceramic membrane containing silver nanoparticles having a crystalline structure, allowing a suspended particle removal rate of 99.8% and *E. coli* bacteria reduction rate of 99.98% (Ndiapa *et al.*, 2019). In the second part, we formulated and implemented a composite ceramic membrane for the removal of residual humic substances and trihalomethanes, which are potentially carcinogenic chlorinated derivatives (Bingyue *et al*., 2025). The work carried out in this context consisted, firstly, of developing and evaluating the effectiveness of a ceramic microfiltration membrane associated with a powdered activated carbon bed for the removal of humic substances in drinking water in a gravitational module, and secondly, fixing the activated carbon on the surface of the ceramic filter using chitosan as a binder, to remove dissolved substances by the tangential filtration process.

Keywords: bio-sourced ceramics, multi-layer ceramic membrane, silver nanoparticles, activated carbon, filtration, water treatment.

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References: no more than 6 (times New Roman, font size 10).

Please check the appropriate contribution: ☐ *Oral* *or* ☐ *Poster*

WASTEWATER DECONTAMINATION BY HETEROGENEOUS PHOTOCATALYSIS WITH TIO2 - REVIEW AND RECENT RESEARCH

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Water contamination by industrial effluents, including dyes and pharmaceuticals, represents a serious threat to the environment and human health. Various physicochemical and biological techniques have been developed to treat wastewater contaminated by these various dyes. These techniques may not be sufficiently effective in removing these dyes. To overcome these challenges, advanced oxidation processes (AOPs) have demonstrated their ability to rapidly degrade toxic contaminants present in wastewater. Among these processes, heterogeneous photocatalysis is attracting a great deal of interest in the field of photocatalysis due to its efficiency. Titanium dioxide (TiO2) is one of the most studied photocatalysts due to its chemical stability, affordability and efficiency in advanced oxidation reactions.

However, its wide band gap (3.2 eV for the anatase phase) limits its activation to the ultraviolet range, which restricts its use under sunlight. In addition, the rapid recombination of electron-hole pairs reduces its photocatalytic efficiency. To improve its performance, various strategies are being explored, including doping with other elements and modifying its crystal structure. In this context, the ultimate objective of this work focuses on modifying the properties of TiO_2-based ceramic materials to optimize the photodegradation of organic pollutants in water such as methylene blue (BM) and tetracycline (TC). To this end, we investigated metallic and non-metallic doping of TiO2, using Molybdenum and Lithium Fluoride (LiF).

Doped powders were synthesized by two methods: flash combustion and solid state preparation by a grinding process. The powders were prepared by varying experimental conditions, including dopant percentages, the type of fuel used for flash combustion and the grinding parameters applied during solid preparation. The aim was to assess the influence of these parameters on the physicochemical properties of the resulting powders, and consequently on their photocatalytic performance. The synthesized materials were characterized using a variety of techniques: X-ray diffraction (XRD) to identify crystalline phases, thermogravimetric analysis (TGA) to study their thermal stability, scanning electron microscopy (SEM) to observe their morphology, granulometry to determine particle size, BET analysis to assess specific surface area, diffuse reflection spectroscopy (DRS) to study optical properties, and X-ray photoelectron spectroscopy (EPR) to analyze the electronic states of materials.

Photocatalytic activity was assessed by photodegradation tests with methylene blue (BM) and tetracycline (TC) in aqueous solution. Flash combustion synthesis yielded LiF- and Mo-doped materials with remarkable photocatalytic properties. LiF promotes the formation of mixed anatase-rutile phases, enhancing photocatalytic efficiency, particularly with glycine fuel and an optimum doping of 2% LiF by mass. Mo-doped materials show a high adsorption capacity in the dark, revealing their photocatalytic potential. The influence of the O/F richness ratio and the fuel used (glycine, urea) during flash combustion synthesis was studied.

Optimization of the synthesis conditions showed that the stoichiometric ratio (O/F = 1) is ideal for glycine, while an oxidant deficit improves photocatalytic activity with urea. LiF-doped materials prepared by the solid route and milled show an increase in BET specific surface area and improved

photocatalytic efficiency after a second prolonged milling, although the milling time needs to be optimized to avoid contamination.

Methylene blue and tetracycline degradation tests confirm the powders' excellent performance, with maximum efficiency at neutral pH during the tetracycline antibiotic degradation test. EPR analysis reveals the presence of Ti^{3+}, confirming O^{2-}/F- substitution. These results suggest that the synthesized photocatalyst is a promising and effective material for water purification, particularly for the removal of antibiotics and dyes. In addition, trapping tests have suggested a potential photodegradation mechanism. The photocatalytic degradation mechanism was investigated by charge carrier trapping tests. The results show that superoxide radicals are essential in the degradation of organic pollutants, attacking methylene blue and tetracycline to convert them into non-toxic inorganic products. This understanding enables us to adjust experimental conditions and design more efficient photocatalysts.

In conclusion, this study highlights the potential of doped TiO2-based ceramic materials for photocatalytic applications, with performances superior to those of commercial materials. The mixed anatase-rutile phases of TiO2 play a crucial role in the efficiency of photocatalysts, and the synthesis methods employed enable us to obtain materials with optimized properties for water purification. These results open up interesting prospects for the development of more efficient and accessible photocatalytic materials for environmental applications, particularly in water treatment..

Please check the appropriate contribution: ☐ ***Oral*** ***or*** ☐ ***Poster***

Engineering Geology of the South Indian Ocean Islands

R. Goodary

Abstract:

The south Indian Ocean islands, commonly known as the Mascarene Islands, comprise of Mauritius, Reunion and Rodrigues islands and are subject to similar geological conditions. These islands came to existence after a series of volcanic eruptions in the Southern Africa. The series of basaltic eruptions occurred at different times, with Réunion island forming around 60 million years ago, Mauritius about 10 million years ago, and Rodrigues approximately 2.5 million years ago. The soil properties vary, based on their degree of alteration. The mineralogical and chemical compositions, along with their physical and geotechnical properties are widely used for their characterization. Mauritius is overlain by residual basaltic soil, mainly latosols and Dark Magnesium Clay (DMC) covering almost the whole island. Engineering projects are challenged by different natural hazards affecting the areas overlain by DMC. The study of landslide occurrences helped to identify the zones of highest risks and establish a chart of georisks for the Mascarene islands. Expansive soils, found in various regions of Mauritius, pose considerable challenges to civil engineering professionals due to their tendency to swell when wet and shrink when dry, causing damage to structures and infrastructure. Soil stabilizing strategies are used to resolve these challenges, with lime stabilization being the most common option in Mauritius. This procedure improves the engineering behaviour of problematic soils by decreasing plasticity, increasing bearing capacity, and improving compaction characteristics. Lime treatment for expansive Dark Magnesium Clay shows up to a 10 times improvement in California Bearing Ratio (CBR) values, significantly improving its load-bearing capacity. But stabilization with industrial cementitious materials further contributes to the carbon footprint and as such, alternative solutions will have to be proposed. This study clarifies the historical context of the Indian Ocean region by examining the geological evolution of the Mascarene Islands, the geomorphology of Mauritius, and the characteristics of its various soils, therefore highlighting the dynamic processes that have molded its unique landscape. The all new concept of soil stabilization by soil mixing has been proposed whereby clay minerals of different families share their properties and contribute to a green stabilization of the DMC.

DU PHENOMENE D'ARTIFICATION DE LA CERAMIQUE CONTEMPORAINE AU CAMEROUN

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Résumé

L'activité de la céramique renvoie à des représentations mythiques et millénaires qui ont cours depuis l'antiquité gréco-romaine. Elle fut marquée en Afrique par une production artisanale d'objets aux fonctions variées. Depuis la disparition de la civilisation Sao jusqu'à la fin du XXe siècle, cette production des objets de terre cuite était réservée aux femmes. Si le mouvement *art et cratfs* des années 1860 en Europe et Amérique anglo-saxonne commence à distinguer les céramistes industriels des céramistes d'art, cette démarcation terminologique entre les artisans potiers et artistes céramistes n'est pas suffisamment ancrée dans l'imaginaire des contempteurs de la céramique d'art africain. Les recherches sur l'expression de la céramique d'art à travers le continent restent embryonnaires malgré la mutation des procédés et l'artification des objets qui s'opèrent depuis les années 90 au Cameroun avec la création des écoles d'art. A la suite de ce constat, cet article vise à répondre à la question suivante : Comment l'art vient-il aux individualités, aux objets, aux façons de faire et de cogiter des céramistes d'aujourd'hui? La réponse à cette préoccupation reposerait sur un récit à caractère empirique et endogène des pratiques de l'art céramique par les artistes du terroir. Ainsi seront abordés des aspects liées aux : - Cadres terminologique et historique ; - Descriptif des procédés et énumération des obstacles épistémologiques liés au phénomène d'artification ; - Caractéristiques morpho-stylistiques, esthétiques et symboliques des artefacts.

Mots clés : Artification, céramique, art contemporain, phénoménologie

Please check the appropriate contribution: ☐ *Oral* *or* ☐ *Poster*

Processes and mechanisms for formulating pigments and lacquers with plant dyes and adsorbent materials

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Abstract:
In this paper, we show that mankind has used plant extracts and mineral matter for dyeing and coloring. In Congo Brazzaville, Alchornea cordifolia leaves are boiled with lianas and buried in mud to blacken them. In Gabon, the bark and leaves of this plant are used to blacken cloth and pottery. The fruits of this plant are used to dye mats and fabrics black [1]. Harungana madagascariensis is a plant used as a textile dye in Uganda. The bark of this plant is used to dye fabrics and mats in Cameroon [2,3].
Today, however, industrial development has rendered natural dyes and pigments obsolete with the advent of synthetic pigments and dyes. The latter are very harmful and have significant side-effects, such as the allergy and intolerance reactions observed in some people. We are currently witnessing a trend towards greater recourse to nature. This work therefore falls within the scope of the valorization of dye plants and local adsorbent materials (clays).
The aim of this keynote was to enable participants to appreciate how to develop processes and mechanisms for formulating pigments and lacquers with plant dyes and adsorbent materials, which are applications oriented towards environmental concerns for sustainable development.
Topics covered included general information on dye plants and clays, the chemical families responsible for color, characterization methods, pigment formulations and nitric and hydrochloric acid testing.

Keywords: Formulation, Pigments, Lacquers, Adsorbent substrates.

References:

[1] : Crete P. (1965). Precis de botanique : Systématique des Angiospermes, tome 2., révision de la 2ème édition.

[2] : Prajapati, N.D., Purohit, S.S., Kumar, T. (2003). A Handbook of Medecinal Plants. A Complete Source Book. Agrobios, India, P. 262.

[3]: Cronquist, A.J. (1987). An integrated system of classification of flowing plants. Columbia University press, 1262 p.

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ST1- Archéométrie et Céramologie

Oral

Please check the appropriate contribution: ○ *XOral* *or* ○ *Poster*

COMPARATIVE STUDY OF MPOLONGWE SEDIMENTS AND ARCHAEOLOGICAL CERAMICS (Kribi, South Cameroon)

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Abstract

This study focuses on archaeological ceramics and sediments collected in the Mpolongwe area, Kribi II subdivision in southern Cameroon. Chemical analyses were carried out on archaeological ceramics using neutron activation (NAA) and on the sediments using X-ray fluorescence (XRF).

The aim is to determine the distribution of chemical elements in archaeological ceramics, and then to compare the concentrations of immobile trace elements during weathering and firing processes between ceramics and sediments in order to establish provenance.

Ceramics are dominated by alumina (11.4 - 25.4%), followed by Fe_2O_3t (1.1 - 6.7%). TiO_2 (0.6 - 1.7%) is low, While Na_2O, K_2O and CaO rarely exceed 1%. However, anomalous high value of K_2O (8.4%) is recorded for the 2390 BP M4 ceramic, suggesting a difference either in the material used or in the production technique.

The elemental ratios, La/Sc (0.9 - 4.5), La/Co (1.4 - 14.0) and Th/Co (1.0 -16.6) obtained for archeological ceramics are comparable to that of sediments, suggest felsic source rocks. The archaeological ceramics and sediments from Mpolongwe are thought to be derived from the neighboring rocks, which are mainly garnet gneisses.

Key words: Mpolongwe – Sediments – ceramics - Chemical analysis - Provenance

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Please check the appropriate contribution:	*O X Oral*	*or*	*O Poster*

PROVENANCE STUDY OF CERAMICS FROM OMBESSA (CENTRE, CAMEROON)

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Abstract

This work is an archaeometric study of archaeological ceramics from Ombessa (mbam, centre-cameroon) with the aim to determine the provenance of their raw materials (local or imported?). For this purpose, chemical, Mineralogical and petrographic analyses were carried out on twenty-four sample of ceramics and one sample of local clay material[1]. The chemical results showed that the ceramic samples were produced with a raw material rich in silicon oxide and poor in calcium oxide. The chemical correlation diagrams of Al_2O_3/SiO_2, CaO/Na_2O and SiO_2/Fe_2O_3 oxides between ceramics and clay samples showed many groups of ceramics, probably from a variety of production [2]. However, the variation of the content of the oxides between the different groups of ceramics is small, this result suggests a production of ceramics from Ombessa with a variety of many local clay materials. The mineralogical composition of the clay material and ceramics present quartz, mica and feldspar in all the samples. Petrographic analysis confirmed the presence of all the minerals found by X-ray diffraction analysis. This mineralogical composition is related to the geological settings of the region due to the presence of a source of metamorphic rock. Therefore, a local production of the ceramics from Ombessa is attested.

Key words: Ombessa, archaeological ceramics, archaeometry, provenance

References:

[1] Z.L Epossi Ntah (2012), Archaeometrical studies: petrography, mineralogy and chemistry of selected ceramic sherds and clay samples from Cameroon-Regions of Mombal, Mfomakap and Zamala. Thèses de doctorat : université de Leipzig. 146 p.

[2] E.G Ntsama, (2024), contribution à l'étude archéologique et archéométrique de la céramique d'Ombessa (Mbam, Centre-Cameroun), Mémoire de master : Université de Yaoundé 1

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PETROGRAPHIC AND MINERALOGICAL STUDY OF TWO GROUPS OF ARCHAEOLOGICAL CERAMICS FROM MPOLONGWE (KRIBI, SOUTH CAMEROON)

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Abstract

Two groups of archaeological ceramics, dated from 800 to 900 BP and from 2280 to 2610 BP collected by Ngouoh [1] in the Mpolongwe area (Kribi II sub-division, Southern Cameroon) were analyzed by petrography and FT IR spectroscopy.
The study aimed to identify inclusion minerals in order to deduce the continuity of production between the two periods and the weathering features of the raw material.
The petrography of ceramics from 800 to 900 BP reveals metamorphic and sedimentary fragments, quartz, feldspar, biotite, muscovite, pyroxene, rutile and other oxides in a brownish-yellow (M1) to yellowish (M2) matrix.
Ceramics from 2280 to 2610 BP show the same minerals in inclusions in yellowish yellowish (M4 and M5), reddish (M6) and brown (M3) matrices, with the exception of the rutile specific to the M1 ceramic. This uniformity of mineralogical composition suggests that the same raw material in both periods.
In addition to quartz and feldspar, infrared spectroscopic analysis reveals muscovite, hematite, magnetite and organic matter. This suggests weathering of metamorphic and sedimentary source rocks by oxidation of ferromagnesian minerals in a hot, humid climate.

Keywords: Mpolongwe, ceramics, petrography, mineralogy, provenance, weathering

References

[1] Ngouoh Francois (2015) Archéologie des implantations humaines dans le bassin de la Lokoundjé durant l'Holocène, Thèse Université de Yaoundé 1.

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STUDY OF ARCHAEOLOGICAL CERAMICS FROM MPOLONGWE SITE IN SOUTH CAMEROON BY NEUTRON ACTIVATION ANALYSIS AND STATISTICAL MULTIVARIATE ANALYSIS.

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Abstract

This study presents the chemical characterization of ninety-four ceramic samples from Mpolongwe (south Cameroon) by neutron activation analysis and principal component analysis (PCA). The samples were collected from six pits of different ages (Ngouoh, 2019). Two pits were dated from 810 to 900 years BP and four pits from 2200 to 2620 years BP. The aim of the research is to determine if pottery production was continuous or not during the period of time between 810-2640 years before present in Mpolongwe. Data treatment by PCA revealed six compositional groups Group 1 is the most compositionally distinct group from the remainder of the dataset. Samples in this group have higher values of Rb, Ba, K, and Na. Groups 2A and 2B show some compositional similarity to each other, but are distinct enough to be categorized as separate groups. Samples in Group 3 show generally higher values of Ni and Zn. Group 4 is the most loosely-defined compositional group, and expansion of the dataset may result in this group being better defined or split into multiple groups. Samples in this group have elevated values in several rare earth elements and Sc, V, and Cr. Samples in Group 5 had elevated values of Ni as well as Ti.

Comparison of the samples from each pit to the compositional groups does not show a clear correspondence or clear-cut division between compositional groups and pits when considering their chronological ages. However, some trends are present: Groups 3 and 4 have more samples from the more recent pits, and Groups 1, 2A, 2B, and 5 have more samples from the older pits. These results suggest that pottery production was continuous in the period of time 810-26402BP in Mpolongwe, potters probably used the same raw materials through the time.

Keywords: Mpolongwe, ceramics, NAA, , continuity

References:

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CHEMICAL AND MINERALOGICAL EXAMINATION OF METALLURGICAL CERAMICS (TUYÈRES) FROM PONGSOLO LEKIE (CENTRE CAMEROON): AN ARCHEOMETALLURGICAL STUDY

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Refractory ceramics such as tuyères, furnaces and crucibles are needed during metallurgical process due to their heat resistance. Archaeological studies have confirmed the presence of iron smelting activities in Lekie between the 15th and 16th centuries AD (Essomba, 1988 and 1992a and b). In this study, eight fragments of tuyères collected in Pongsolo (one of the archaeological sites) were analysed by the means of X-ray fluorescence, X-ray diffraction and polarised optical microscopy to determine their chemical and mineralogical composition with the aim to deduce the nature of their raw material and their firing temperature or thermal behaviour during iron smelting. Macroscopically, five tuyères are reddish with some black parts on their surface, whereas the three others are black and slagged. X-ray fluorescence showed that all samples are rich in SiO_2 (60 –70wt.%) and have a content varying from 18 to 22 wt.% Al_2O_3. Most of the samples have a Fe_2O_3 content varying from 5 to 8wt.% except for two samples showing the highest amount with 10.00 and 13.94 wt.%. MgO, Na_2O and CaO, contents are low in all samples (<1wt.%). However, K_2O content is considerable in all samples with values ranging between 1.4 to 2.5wt.%. X-ray diffraction revealed three mineralogical groups of samples: The first group (2 samples) contains quartz, muscovite and kaolinite. The second group (3 samples) contains muscovite and quartz, and the third group (3 samples) contains mullite and quartz. The results of the polarised optical microscope agree with the mineralogical groups. The first group is characterised by a reddish matrix with an abundance of mica flakes (biotite and muscovite) and the presence of kaolinite indicates a firing temperature below 600°C. The second group has a dark matrix with few mica flakes, indicating a temperature range of 600–900°C due to the absence of kaolinite. The third group is characterised by a vitrified matrix, indicating a firing temperature above 1000°C. The presence of mullite, vitrification, and a layer of slag in the third mineralogical group suggests that iron smelting took place in the furnace at high temperatures between 1000 and not more than 1300°C as indicated by the presence of quartz.

Key words: Tuyères, archaeometallurgy, chemistry, mineralogy, raw materials, firing temperature.

Literature:

Essomba Jean Marie (1988). *Trois ans de recherches archéologiques au Sud-Cameroun. Bilan et perspectives (1984-1987).* Yaoundé, Université de Yaoundé/Multig

Essomba Jean Marie (1992a) Archéologie du Sud-Cameroun. Notes préliminaires de recherches au site de Nkometou (Mfomakap). Dans : J.-M. Essomba (dir. publ.), *L'archéologie au Cameroun* (Colloque de Yaoundé, janvier 1986). Paris, Karthala, p. 228-245.

Essomba Jean Marie (1992b). *Civilisation du fer et sociétés en Afrique centrale.* Paris, L'Harmattan, 699 p.

Please check the appropriate contribution:	*O XOral*	*or*	*O Poster*

TECHNOLOGICAL STUDY OF IRON AGE POTTERY FROM THE MPA'A SITE (DJOHONG, ADAMAWA-CAMEROON): MACROSCOPIC AND MICROSCOPIC ANALYSES

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Abstract

Twenty-one fragments of Iron Age pottery from the MPA'A site at Djohong (Adamawa - Cameroon) have been studied using a combination of macroscopic and microscopic analyses in order to reconstruct the production technology of this pottery at the various stages of the chaîne opératoire. Macroscopic observations were used to define the firing atmosphere and the decorative motifs of the pottery, while microscopic observations were used to identify the paste recipes (e.g. deliberately added temper) and the firing temperature. According to Soper [1], the technique used for the decorative motifs on all 21 samples appears to have been impression. More specifically, most of the samples seem to show tracing (N = 8), while others show roulette (N = 7) or scoub impression (N = 6). In terms of firing processes, most of the samples in this assemblage show a homogeneous reddish colour on the surface and in the core (N = 12), indicating firing in a well-controlled oxidising atmosphere. However, eight samples show different colours, either in the core or near the surface. Only 1 sample was completely grey, indicating firing in a reducing atmosphere. The petrographic analysis has allowed the identification of a main group among the (21) ceramic thin sections analysed, indicating that they were made with the same raw materials and paste recipe. All samples contain coarse inclusions of quartz and feldspar (plagioclase and microcline), poorly to very poorly sorted, with numerous opaque inclusions and small quartz and mica inclusions in a reddish and light clay matrix. A variability in firing temperature has been inferred.

Keywords: Djohong, pottery, technology, macroscopy, microscopy

References:

[1] Soper R. (1985), Roulette decoration on African pottery: technical considerations, dating and distributions. The African Archaeological Review3: 29-51

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ST2 – Prospections des minéraux : matières premières et valorisation

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Oral

Please check the appropriate contribution: ☐ *Oral* *and* ☐ *Poster*

Multiscale and 3D modelling from aeromagnetic data over the Djadom-Eta area, south-eastern Cameroon, NW margin of the Congo craton : dome-shaped BIF-hosted iron ore deposits inherited from Archean tectonics.

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Abstract

As a teacher-researcher in environmental physics, specializing in geophysics and geoexploration, taking part in this conference gives me a new perspective on this science. The Djadom area located at the southeastern Cameroon, Northwest (NW) corner of the Congo craton, is made of Archean formations covered by Neoproterozoic ones. These Archean formation are associated to Banded iron formation (BIF)-hosted iron ore deposits whose geometry is poorly documented. To address the issue, a combined approach that involves multiscale scale and three dimension (3D) inversion modeling to highlight structural feature and geometrical magnetic source bodies from shallow to depth of 6 km were performed on aeromanetic data through Geosoft software. The Djadom area exhibits high susceptibility (S) (S> 0.02 cgs) associated with low one (S <0.02 cgs). The magnetized zones are scattered along the WNW – ESE and WSW - ENE trend. In addition, magnetic effects evolution from the surface to depth display a dome-like magnetized bodies whereas a linear trend is recorded for low susceptibility bodies, respectively. Whole data combined with the previous literature about tectonic of the Ntem complex suggest that the dome-like magnetized bodies hosted by Banded Iron Formation might have inherited from Archean tectonics that affected the study area.

Keywords: DJADOM-ETA, Banded Iron formation (BIF), Congo-Craton, 3D inversion modeling, susceptibilities.

MAYO TSANAGA SAND (MAKABAYE-MAROUA, CAMEROON): A NATURALLY PREPARED SODA-LIME VITRIFIABLE MIXTURE

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Abstract

With the aim of adding value to local materials, sand from the Mayo Tsanaga, taken from the bed of the Makabaye river in Maroua, was characterized. Several investigative methods were employed, including particle size analysis, X-ray fluorescence, X-ray diffraction and melting temperature determination. Particle size analysis revealed a fineness modulus of 2, indicating a favorable particle distribution for certain industrial applications. Chemical analysis showed that the sand contains by mass 70.32% SiO_2, 10% Al_2O_3, 5% Na_2O, 7% K_2O, 3% CaO and 1.2% MgO. These results underline the silica-rich nature of sand, an essential component in glassmaking. X-ray diffraction has identified several minerals present in sand, including quartz, albite, microcline and anorthite. These minerals are often associated with vitrifiable properties. In addition, the melting temperature of the sand has been determined to be 1408°C, which is ideal for glassmaking processes. This sand, from a hitherto unexploited deposit, has a mineralogical and chemical composition close to that of a soda-lime vitrifiable mixture. By optimizing grain size, Mayo Tsanaga sand could be an ideal raw material for the soda-lime glass industry, offering interesting prospects for local development and the valorization of natural resources.

Keywords: sand, mineralogical and chemical composition, vitrifiable mixture, soda-lime glass.

References:

1. Barton, J., & Guillemet, C. (2005). *Le verre, science et technologie*. L'Editeur : EDP Sciences.
2. Bouchouicha, H. (2016). *Élaboration, caractérisation structurale et étude des propriétés de luminescence des verres et des vitrocéramiques alumino-silicatés de calcium dopés à l'europium* (Doctoral dissertation, Université de Lyon ; Faculté des sciences de Bizerte (Tunisie)).
3. BOUTALEB, A. (2021). *Optimisation des paramètres de mise en forme du verre sodo-calcique produit par le procédé float* (Doctoral dissertation, Ecole Nationale Supérieure des Mines et de la Métallurgie. Amar Laskri. Annaba).
4. Capilla, X., Coillot, D., & van Hullebusch, E. (2022). L'industrie du verre en France. *Matériaux & Techniques*, *110*(4), 401.
5. N'GUESSAN, Y. A., WOGNIN, V., COULIBALY, A., MONDE, S., WANGO, T. E., & Kouamé, A. K. A. (2011). Analyse granulométrique et environnement de dépôts des sables superficiels de la lagune Adjin (Côte d'Ivoire). *Revue Paralia*, *4*, 6-1.
6. TINE, D., FAYE, M., ATOUI, A., & FAYE, G. (2022). Caractérisation granulométrique et dynamique sédimentaire dans les plages septentrionales des rivières du sud : cas de la basse Casamance. *Afrique SCIENCE*, *21*(3), 157-173.

Please check the appropriate contribution: ☒ Oral or ☐ Poster

Petrographic features associated with alkali-aggregate-reactions in tropical aggregates

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Abstract

The lack of petrographic indicators to associate aggregates with AAR and other in situ concrete deffects has lead to random quarying of concrete aggregtes. This has resulted in several structural failures, and extra monitoring and repair costs within developing sub-Saharan Africa. Depending on the degree of alteration of the rocks, some mineral phases dissociate in alkaline cement pore solution, reacting with the alkali to form products that absorb moisture, expand and initiate microcracks. These reactions are referred to as alkali-aggregate reactions (AAR). As a preliminary endevour to prevent delitereous AAR and ensure rezilience of structures built using tropical aggregates, 9 granitic and 4 basaltic operational quarries within Cameroon were sampled. The sampled aggregates were petrochemically and petrographically characterised, then graded and leached in two alkaline/lime solutions, based on KOH and NaOH, at 40±2°C for 26 weeks. Periodic analysis of leachates' extracts, using ICP-OES, reviews release of alkali, silicon and iron by basaltic aggregates and sulfur by some of the granitic aggregates, as well as the consumption of Ca, initially saturated in both media. reduction in hydroxide ion concentration was most significant in the basaltic species, associating to their quite elevated contents of releasable iron and silicon. Newly formed phases were identified and quantified by XRD and FTIR of leached residues against those of as-collected aggregates. The deliterious AAR-indicator minerals of the basaltic aggregates are cristoballite and micro-crystalline quartz, associated to potential alkali-silica reaction (ASR). The quartz crystals of the granitic species are more or less stable in the alkaline media. However, the abundance of mica and releasable sulphide is a call for concern. From the studies, sulphide minerals (hauyne pyrrhotite and oldamite), mica and releasable iron-bearing phases are potential indicators of in situ deterioration of concrete with tropical granitic gneisses. In situ concrete degradation with these aggregates can be associated to ASR, in reactive basalts, and internal surfate attack (ISA) in granitic species. The Fe-dehydroxilation of the cement pore solution is a potential issue to both aggregate species, owning to their releasable iron contents.

Keywords: petrography, petrochemistry, alakali aggregate reactions, tropical aggregate, granitic, basaltic

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Please check the appropriate contribution: ☒ *Oral* *or* ☐ *Poster*

PETROLOGY OF MAGNETITE GNEISS FROM NDIKINIMEKI: IMPLICATION FOR THE SURVEY OF IRON INDICES AND RELATED SUBSTANCES.

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Abstract

Magnetite gneiss recently discovered at Ndikinimeki (East Bafia) interbedded with panafrican rocks raise a controversy giving that iron formation are known to belong to the Archean to paleoproterozoic craton in Cameroon. This study focuses on field characterization and chemical analyses with the aim to assess the depositional setting, the iron content and origin of the magnetite gneiss. Five samples of magnetite gneiss were subject to petrographic study, chemical analysis of the contents of major oxides, trace and rare earth elements by the ICP-AES and ICP-MS methods respectively. In the field, magnetite gneiss are interbedded with quartzites and biotite gneisses, and show alternative of light quartz-feldspar layers and dark layers rich in iron oxide. Under the microscope, their texture is heterogranular granoblastic and they are made up of quartz, alkali feldspar, opaque minerals and biotite. Chemically, these rocks have high silica and low iron contents. They also display high content in trace elements such as Barium (560 to 753); Rubidium (45-143); Zirconium (451-1080); Ytrium (78.5-187); Strontium (43.9 to 107) and rare earths (420-1008). The magnetite gneiss of Ndikinimeki display the characteristics of poor iron ores however they can be potential sources of rare earth elements useful in many fields of modern technology.

Key words: Ndikinimeki, Cameroon, Magnetite gneiss, Gneiss, Rare earth elements, Iron ore.

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Please check the appropriate contribution: ■ *Oral* *or* □ *Poster*

MINERALOGICAL CHARACTERIZATION AND TECHNOLOGICAL PROPERTIES OF FIRED BRICKS FROM RAW CLAY MATERIALS OF SUDANO-SAHELIAN ZONE OF CAMEROON

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Abstract

This study aims to determine the technological properties and the microstructural evolution of fired bricks made from clay materials of the soudano-sahelian zone of Cameroon. Six samples (MPB, MPD, MPG, MPZ, MPDB and MPZL) taken from the major fired brick production sites from North and the Far-North regions of Cameroon were characterized and fired at 750°C, 800°C, 900°C, 1000°C, and 1100°C. Geotechnical analyses of these samples reveal that these materials exhibit average clay mineral contents and plasticity limits. X-ray diffraction (XRD), X-ray fluorescence (XRF), Fourier Transform Infrared spectrometry (FTIR) and thermal (DSC/TG) analyses show the presence of quartz, feldspar (Ca-Na-K) and several clay minerals such as smectite, kaolinite and illite [1,2]. SEM shows that kaolinite occurs as lamellar hexagonal flakes with broken edges and illite occurs in the form of fibers and laths. The main oxides are SiO_2 (61-79%), Al_2O_3 (10-17%) and Fe_2O_3 (2-6%). The alkali (Na_2O, K_2O) and alkaline earth (MgO, CaO) elements are also present at small amount (≤8.4%). The physical parameters present a varied particle size distribution with a plasticity index range between 4.4%-18.4%.The technological properties of fired specimen show that the bulk density remain in the range recommended of <2g/cm^3, water absorption <20%, linear shrinkage is <5% and the mechanical strength varies significantly with increase of temperature. The mineralogy by XRD shows new mineral phases such as mullite and cristobalite which improve the mechanical strength with the increasing firing temperature. MPB shows a better quality of firing specimen with good technological properties at 1100°C.

Keywords: characterization, geotechnical analysis, technological properties, mechanical strength.

[1] E. Yanne, A.A. Oumarou, B.D. Nde and R.Danwe,(2018), Physico-Chemical and Mineralogical Characterization of Two Clay Materials of the Far North Region of Cameroon (Makabaye, Maroua). Advances in Materials Physics and Chemistry, 8, 378-386.

[2] D. Tsozué, A.N. Nzeugang, J.R. Mache, S. Loweh, N. Fagel, (2017), Mineralogical, physico-chemical and technological characterization of clays from Maroua (Far-North, Cameroon) for use in ceramic bricks production. Journal of Building Engineering. mai 2017;11:17-24.

Please check the appropriate contribution: ⊗ *Oral* *or* ☐ *Poster*

TITLE: Trona as local source of alkali in the production of ecological binder

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Abstract

The aim of this study is to synthesize a new ecological binder based on the geopolymer model, using laterite and volcanic ash as solid precursors, and a sodium hydroxide solution (10M) and a solution T as liquid precursors; trona being the local alkaline source trona is located in the Lake Tchad basin. The binders were formulated by mixing the solid precursor and the activating solution (prepared from 2, 4, 6, 8g of sodium hydroxide) in a liquid/solid mass ratio equal to 0.4. The mechanical and physico-chemical tests of all the samples were determined. The results show that the compressive strengths vary from 0 to 2.28 MPa and from 0.17 to 5.17 MPa at 14 and 28 days, respectively. The water absorption, apparent porosity and apparent density show that the less porous and densest sample has the highest compressive strength. Trona was analyzed by X-ray diffractometry and the results show at 2Θ = 8° a high peak corresponding ton tronite, and at 2Θ= 18° the peak of nahcolite. Subsequently, the samples with uncalcined laterite containing 2, 4, 6, and 8g of sodium hydroxide respectively that obtained the best compressive strengths were characterized by mineralogical analysis (FTIR, XRD) and scanning electron microscopy. Infrared spectra reveal the formation of the absorption band generally observed on the spectra of conventional geopolymer binders (1037-998 cm^{-1}), while micrographs highlight the details of the microstructure, the different samples reveal a heterogeneous microstructure, made up of pores of different sizes, microcracks and binder phases. The lower the sodium hydroxide solution content, the less dense the microstructures. Trona reacts better in the presence of goethite, enabling room-temperature activation of the laterite precursor to obtain geopolymeric ecological binders.

Keywords: Ecological binder, Trona, Geopolymer, Alkaline solution.

References

Ben, M.I., Hamdi, N., Srasra, E., 2018. The suitability of thermally activated red illite/kaolinitic clay as raw material for geopolymer binders. J. mater. Environ. Sci., vol 9, issue 3, page 946-954.

Cong, M., Bin, Z., Shenglai, G., Guangcheng, L., Youjun, X. 2019. Properties and characterization of green one-part geopolymer activated by composite activators. Journal of Cleaner Production 220, 188-199.

Sibel, G., Umit, A., 2016. Assessment of soda ash calcination treatment of Turkish trona ore. E3S Web of conferences, 01013.

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ST3 – Procédés d'élaboration des céramiques et des géomatériaux

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Oral

International Conference on Ceramics and Geomaterials in Central Africa

GRAAL EMC2 JRP CNRS-AFRIQUE CÉRAMIQUES POREUSES DURABLES CAMEROUN

CACerS Composites and Advanced Ceramics Society

Please check the appropriate contribution: ☐ *Oral* *or* ☐ *Poster*

Thermal, mechanical, and microstructural properties of inorganic polymer composites from quarry wastes (feldspathic minerals)

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Abstract

In the recent century, geopolymer materials have grown significantly due to their unique properties applicable in many different fields. In the present work, the heat evolution, thermal and mechanical behaviour of inorganic geopolymer composites (IPCs), based on solid solution of feldspathic minerals (pegmatite and granite) or sand quartz that were altered by a low fraction (15-20 wt%) of calcined clay. The isothermal calorimeter tests revealed that the heat flow evolution (dQ/dt) of mix design of different compositions was low compared to standard geopolymer materials due to low reactivity in alkaline medium of solid solution used. It was also found that the integrated heat flow during the geopolymerization decreases with the crystallinity of solid solution. The thermogravimetric analysis of all the samples revealed two main changes, before 120 °C and between 700 and 890 °C. The changes are attributed to the loss of water molecules and crystallization of albite and nepheline, respectively with an overall loss of mass which varies from 14.0 to 21.6%. The heating microscope up to 1200 °C shows a shrinkage of 50% for D3C4 and R2C1 samples. The study of mechanical and physical behaviours of geopolymer composites with different compositions showed that samples based on pegmatite and MK developed higher strengths (42.11 MPa and 106.75 MPa for flexural and compression) associated with lower water absorption (7.01%). The high strengths obtained were due to the combination of denser and homogeneous microstructure of IPCs. These materials are potential candidates for eco-friendly construction materials.

Keywords: Isothermal calorimetry; Heating microscope; Feldspathic minerals; Geopolymer composites; Mechanical strengths; Microstructure

CGCA International Conference on Ceramics and Geomaterials in Central Africa

GRAAL EMC2 JRP CNRS-AFRIQUE CÉRAMIQUES POREUSES DURABLES CAMEROUN

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UNE NOUVELLE APPROCHE POUR LA SYNTHÈSE À FAIBLE COÛT DE NANO-HYDROXYAPATITE À PARTIR D'HYDROXYDE DE CALCIUM ET D'ACIDE PHOSPHORIQUE TECHNIQUE: CARACTÉRISATION STRUCTURALE ET MORPHOLOGIQUE

HATIM Anass[1], KHADDOUDI Driss[2], ABIDA Fatima[3], AIT ALI OUYDIR Hicham[1], KOUZBOUR Sanaa[1], AGUNAOU Mahfoud[2], EL HAFIANE Youssef[4], ABOURRICHE Abdelkrim[5], BENHAMMOU Abdelaziz[5], HATIM Zineb[3], ABOULIATIM Younes[1]

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Résumé

Cette étude présente la synthèse de la poudre d'hydroxyapatite à partir d'hydroxyde de calcium et d'acide phosphorique technique, avec un rapport molaire Ca/P de 1,67. La synthèse a été réalisée à 25°C, suivie d'un séchage et d'une calcination entre 500°C et 1100°C. L'effet de l'acide phosphorique technique sur la composition, la structure cristalline, la stabilité thermique et les propriétés chimiques et morphologiques de la poudre a été analysé. Les résultats montrent que des particules de nano-hydroxyapatite ont été obtenues, avec une grande surface spécifique ($176{,}95 m^2.g^{-1} \pm 6{,}23 m^2.g^{-1}$)et une mouillabilité élevée (angle de contact de 18 ± 4°), bien supérieures à celles de l'apatite de référence [1]. L'analyse par diffraction des rayons X a confirmé la formation d'une phase unique d'hydroxyapatite avec des tailles de particules dans la gamme nanométrique (12,6 à 57,3 nm). Les analyses chimiques ont révélé la présence de traces de métaux et de fluor, provenant de l'acide phosphorique technique [2]. La spectroscopie FTIR a montré une augmentation de la fréquence des vibrations des groupes OH, et les analyses ATG/ATD ont mis en évidence la stabilité thermique jusqu'à 1500°C. Enfin, cette étude démontre que l'acide phosphorique technique offre une méthode économique pour la production d'hydroxyapatite adaptée à des applications environnementales (adsorption, photocatalyse) [2].

Mots-clés : Nano-Fluoro-hydroxyapatite ; Précipitation ; Acide phosphorique technique ; Hydroxyde de calcium ; Stabilité thermique ; Gap-optique.

References : [1] C. Avşar, S. Ertunç, Development of industrial waste management approaches for adaptation to circular economy strategy: the case of phosphogypsum-derived hydroxyapatite, J. Mater. Cycles Waste Manag. 26 (2024) 2770–2780. https://doi.org/10.1007/s10163-024-01998-4.

[2] A. Samant, B. Nayak, P.K. Misra, Kinetics and mechanistic interpretation of fluoride removal by nanocrystalline hydroxyapatite derived from Limacine artica shells, J. Environ. Chem. Eng. 5 (2017) 5429–5438.

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Please check the appropriate contribution: ☒ *Oral* *or* ☐ *Poster*

INFLUENCE OF NATURE OF ALKALINE SOLUTION AND CURE TEMPERATURE ON PHYSICO-CHEMICAL AND MINERALOGICAL PROPERTIES OF A GEOPOLYMER

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Abstract

This study investigates the impact of the nature and concentration of the alkaline solution, as well as the variation in the cure thermal temperature, on the technological properties of a geopolymer. The bricks of geopolymer are formulated from a mixture of raw clay and four alkaline activators (Conventional analytical solution (a); local $NaOH + Na_2SiO_3$ solution (b); local $NaOH + Sand$ solution (c); and local NaOH solution (d)) with varying concentrations ranging from 6M to 12M. Samples were shaped into prismatic molds and thermal cured at temperatures ranging from 60 to 90°C for a duration of 24 ± 1 hours. Geopolymerized adobes thus obtained were stored in cardboard boxes to undergo the various tests after a minimum period of 28 days. The physicochemical characteristics of the samples, including water absorption, linear shrinkage, density, porosity and the spray test, were then determined. The mechanical analyses (bending and compression) of the test pieces were carried out according to standard NF P 15-471. Mineralogy of the specimens was obtained by X-ray diffraction. Outcomes of these investigations revealed that the geopolymer ($GPc60_{\text{-}10M}$), formulated from locally sourced clay and a $NaOH + sand$ solution of 10M, exhibited favorable performance characteristics essential for civil engineering construction. These include a maximum linear shrinkage of 5.31%, a density ranging from 1.607 to 1.900, porosity of 29.90%, a mass loss following a rain erosion test of 0.56%, and an excellent compressive strength of 28 MPa. Mineralogical characterization results demonstrated that all formulated bricks contain quartz, kaolinite, goethite, and a novel phase $Na_2(AlSiO_4)_6(OH)_2.2H_2O$.

Keywords: alkaline solution; brick; clay; concentration; geopolymerization.

References:

Davidovits, J. (1991) Geopolymers: inorganic polymeric new materials, Journal of Thermal Analysis, 37, 1633–1656. http://dx.doi.org/10.1007/bf01912193.

Ouattara, S., Sorgho, B., Sawadogo, M., Sawadogo, Y., Seynou, M., Blanchart, P., Gomina, M., Zerbo, L. (2021) Development and characterization of geopolymers based on a kaolinitic clay," Science Journal of Chemistry, 9, 160–170. https://doi.org/10.11648/j.sjc.20210906.15

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Please check the appropriate contribution: ×*Oral or* ☐ *Poster*

Use of metakaolins from Eseka and Dibamba-Cameroon as an additive of CEM I Portland cement

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Abstract

The present study deals with two kaolins from Eseka and Dibamba-Cameroon, to determine their potential suitability as additive of CEM I 42.5 R. and optimize the properties of cement in the sense to promote low carbon cement. XRD was used to establish the mineralogical composition of two kaolins. While XRF was carried out to determine the chemical composition of kaolins and cement. Fine Metakaolin powders obtained at 700°C were used as additive in CEM I 42.5R. Furthermore, Consistency, Setting time, water absorption, compressive and flexural test, shrinkage test were evaluated. SEM was carried out to evaluate the microstructure variation. The substitution of CEM I with metakaolin results in a considerable increase in compressive and flexural strength from day 7 to day 28 at optimum value. The compressive and flexural strength at 28 days at optimum value of metakaolin increases to 52% and 44% respectively explaining the equilibrium oxides in the cement. The maximum value of strength of 20wt.% MK1 and 30wt.% MK2 at 7, 14 and 28 days appears in both cases when the ratio SiO_2/Al_2O_3 is between 2.8 and 2.9. Silica modulus and alumina modulus of cement – metakaolin have been improved when adding metakaolin. The properties of cement were optimized with the increase of 52% on compressive strength at 28 days.

Key words: Metakaolin, Mineralogy, optimization, Portland cement, microstructure

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Please check the appropriate contribution: ***X Oral***

Using ceramic tesserae to decorate public buildings in Yaounde: the case of the pediments of the Yaounde-Nsimalen motorway roundabout

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Abstract:

The use of local materials to decorate public buildings in the city of Yaoundé represents only 17% of the architectural decor, according to a study carried out by the Cameroon Society for the Copyright of Fine and Graphic Arts (SOCADAP) in 2022. This considerable poverty is the result of architects and many artists in the region failing to master the physical and mechanical aspects of using locally available materials. As a result, the few architectural decorations in the city that use clay as a base material, such as the Basilica of Marie-Reine-des-Apôtres in the quarter of Mvolye or the lower front of the first ministry in the city centre, have numerous physical and mechanical defects. These works of art, most of which are built outside, are subject to constant exposure to the elements, which contributes to their wear and tear in the face of the severe ravages of time. That's why it's essential to characterise clays so that they can be used objectively. What's more, clay with demonstrated anthropological and sociological advantages also contributes to the promotion and valorisation of our local heritage. To create the mosaics for the pediments of the Yaounde-Nsimalen motorway roundabout, we used clay collected on the banks of the River Nyong at Mbalmayo. Characterisation of the clay showed that its grain size was over 50% and its plasticity was 58%, giving it good physical properties. These mechanical properties of 10.4 megapascals enabled several ceramic mosaics to be made. Over and above this physical-mechanical and ceramic study, it emerges that the use of local clay to decorate public buildings in ceramic meets the appropriate properties of the material and intrinsic cultural values. The installation of 8 mosaics on the above-mentioned site is a demonstration of the results obtained after a long workshop production process for the technical, aesthetic and educational decoration of public buildings in the city of Yaounde.

Key word: Local material; Clay; Tesserae; Decoration; Public building

References:

BURDEK Bernhard, 2005, Design: History, theory and practice of product Design, Berlin, Ed. Birkhäuser Basel.
CLERRIN Philippe, 2005, La sculpture en terre, Paris, Ed. Dessain et Tolra
DANIEL de Montmollin, Patrick Buté, 2020, Pratique des émaux de grès. Minéraux et cendres végétales, Ed
Les Ateliers d'Arts de France.
DEJEANT, Florie, GARNIER, Philippe, JOFFROY, Thierry, 2021. Local materials, materials of the future: Local resources for sustainable cities and territories in Africa. Villefontaine : CRAterre. 96 p. ISBN 979-10-96446-38-4.
LAMNBERCY Elisabeth, 1993, les matières premières céramiques et leurs transformations par le feu, France, Ed. Argile.
NOTUE Jean Paul, 2000, Sculptures from Cameroon in sculptures, Paris, Africa, Asia, Oceania, Americas, Réunion des musées nationaux, Musée du Quai Brandly. GETLEIN Mark, 2008, Living with Art, New
York, Ed. Mc Graw-Hill.).

Please check the appropriate contribution: ☐X *Oral* *or* ☐ *Poster*

Characterization and 3D geological modeling of geomaterials in the alluvial plain of the Middle Sanaga (Cameroon, Central Africa).

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Abstract

Abstract

The geomaterial architecture of the Middle Sanaga in the Central Cameroon region was studied using a combination of traditional geological techniques and surface electrical resistivity imaging. Lithological columns from hand augers and wells were correlated with geophysical profiles. All these data were analyzed to quantify the volumes of sedimentary units that constitute major potential deposits of geomaterials (gravels, sands, and clays). Geoelectrical results show four main units from surface to depth: conductive UG1 (≤ 100 Ωm), semi-resistive UG2 (≤ 800 Ωm), resistive UG3 (1000 - 2000 Ωm), and highly resistive UG4 (over 2000 Ωm). The shimming results identify three sedimentary units: US1 consisting of pebbles; US2, consisting of medium to coarse sands; and US3 consisting of silty clays and sand-clays. Good correlations were also found between laboratory analyses and resistivity. These correlations showed that resistivity is influenced by grain size, mineralogy, and water content. These results can therefore be extrapolated to the entire valley. A 3D filling model has been developed. This model shows that the volume of UG1-US3 is estimated at 33549496 m3, of UG2-US2 is estimated at 18352728 m3, UG3-US1 is estimated at 7687875m3. This study has important implications for the knowledge and characterization of sedimentary units and, more specifically, geomaterials.

Key words: Geoelectrical imaging, geomaterials, alluvial plain, 3D geological modeling.

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ST4 – Céramiques poreuses et réfractaires

Oral

Please check the appropriate contribution: ☐ *Oral* *or* ☐ *Poster*

TITLE : Physico-Chemical Characterization and Stability Study in Acidic and Basic Solutions of Ceramic Filters from Mouka's Clay (Cameroon)

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Abstract

Porous ceramic filters made from clays and rice husk were obtained from the Far North Region of Cameroon (Mouka). The impact of the formulation (percentage of material (percentage of rice husk and clays and their particle size) on the shrinkage rates, then the influence of sintering temperature on the ceramic filters and the physico-chemical stability in acidic and basic medium were studied. The results showed that the filters formulated with a mixture containing 80% clay and 20% rice husk of 100 µm in size each gave the lowest filter shrinkage rate. These formulated filters were chosen for further analysis. Leaching tests showed that with filters at a sintering temperature of 830˚C the leaching was not observed under neutral (pH 6.8) and acidic (pH 5) conditions as compared to 950˚C and 1000˚C, where the leaching was observed. In basic (pH 9) condition, all the filters obtained released ions, and the leaching ions were : Fe^{2+}, Ca^{2+}, Mg^{2+} and Al^{3+}. Leaching tests revealed that the conductivity of the leachate for the filters sintered at 830˚C was lower than those sintered at 950˚C and 1000˚C. Meanwhile, conductivity decreases with increasing sintering temperature (temperature up to 830˚C) due to the fact that ceramization starts as from 850˚C which leads to an amorphous state that favours chemical stability. The ceramic filters sintered at 950˚C were applied to the filtration of water and the performance in terms of turbidity reduction was 95% and the flow rate after 50 minutes was 100×10^{-3}L/h.

Keywords : Ceramic Filter, Chemical Stability, Clay, Filtration, Leaching Test

The Influence of Chamotte on Densification and Mechanical Properties of Ceramic Membranes Made from Gabonese Kaolin

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Abstract

Porous ceramic membranes were successfully fabricated using low-cost local raw materials through roll pressing and sintering. Five ceramic paste formulations containing Gabonese kaolin, rice husk, and chamotte powders were fired within the temperature range of 1100–1300 °C. The resulting membranes were characterized by porosity (27.3 ± 1 to 58.5 ± 0.5%), pore diameter (4.7 ± 2.5 to 14.5 ± 1.3 µm), and mechanical strength (0.8 ± 0.1 to 10.0 ± 0.6 MPa). The study revealed that the incorporation of chamotte increased the structural reorganization temperature of the composite but did not affect the densification and mullitization temperature range. However, the random distribution of the inert phase (chamotte and quartz) caused non-uniformity in porosity, pore diameter, and mechanical strength. The membranes produced at 1300 °C exhibited properties suitable for microfiltration applications.

Keywords: Kaolin, Chamotte, Microstructure, Porous Ceramics, Mechanical Properties

Please check the appropriate contribution: ☒ *Oral*

NEW LATERITE-BASED GEOPOLYMER FOAM RESISTANCE UNDER DRASTIC CONDITIONS: A COMPARATIVE STUDY WITH A METAKAOLIN MODEL

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Abstract

The valorization of local materials in public building construction in emerging countries is a necessity from a sustainable development perspective [1]. In Cameroon, laterite is an abundant and easily accessible local resource that can be used for the development of light and insulating materials, which until now have been made from metakaolin. Moreover, since metakaolin is not easily accessible in Cameroon, it would be interesting to compare to a model mixture based on metakaolin and hematite. The objective of this study is related to the feasibility and characterization of geopolymer foams based on laterite or on a model mixture (metakaolin-hematite) in different drastic conditions, such as fire resistance and freeze–thaw cycles. The geopolymer foams were synthesized from a calcined laterite or metakaolin-hematite mixture, an alkaline silicate solution, a surfactant and metallic aluminum powder and then placed in an oven at 70◦C for 24 h. Structural data (X-ray diffraction) as well as determination of thermal conductivity and mechanical strength data of the foams were evaluated. The results show that the laterite and metakaolin-hematite mixture allows the elaboration of geopolymer foam, which is characterized by a low thermal conductivity (90 mW/(m. K)) and can be used as insulating materials. The freeze–thaw treatment does not affect the thermal and mechanical properties. The treatment at 1175 ◦C slightly improves the mechanical strength and the thermal conductivity, leading to a good application of these materials..

Keywords: Laterite, Geopolymer, Foam, Drastic conditions.

References: [1] R.C. Kaze, L.M. Beleuk ` a Moungam, M. Cannio, R. Rosa, E. Kamseu, U.C. Melo, C. Leonelli, Microstructure and engineering properties of Fe_2O_3 (FeO)-Al_2O_3-SiO_2 based geopolymer composites, J. Clean. Prod. 199 (2018) 849–859.

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Please check the appropriate contribution: ☒ *Oral* *or* ☐ *Poster*

KAOLINITE CLAY INTERCALATED BY UREA CERAMIC APPLICATIONS

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Abstract

Kaolinite-urea complexes were characterized by X-ray diffraction and IR spectroscopy. XRD patterns confirmed the intercalation of urea into kaolinite. The expansion of the basal spacing of kaolinite is increased from 0.715 nm to 1.069 nm with a monolayer of urea molecules between kaolinite layers. The occurrence of hydrogen bonds between urea and kaolinite are identified by infrared spectroscopy. The –C=O groups of urea mostly interact with –OH groups on kaolinite alumina surface, and the $–NH_2$ group interact with both kaolinite siloxane and alumina surfaces. The intercalation of urea in the interlayer of kaolinite is energetically favorable.

Kaolinite intercalated by urea has interesting applications in materials science. In particular, the sintering densification leading to ceramics is modified by using delaminated kaolinite layers. Kaolinite-urea results in ceramic processes at reduced temperature. This leads to environmental benefits by reducing CO_2 emissions during ceramic firing, contributing to more sustainable ceramic materials. Some different technological benefits are also achieved by using kaolinite-urea in different materials such as paper and polymer clay composites.

Keywords: clay, kaolinite, intercalation, urea, firing temperature.

Please check the appropriate contribution: ☐ *Oral* *or* ☐ *Poster*

Porous refractory ceramics using agrowastes and some kaolinitic clays

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Abstract

In the purpose of making low cost porous refractories bricks, two kaolin named MY3 and KG from the locality of Foumban in Cameroon are used together with a rice husks (Br) and coffee residues (Rc). The formulations made of mixture of chamotte, raw clay as a binder and agricultural wastes in varying proportions, are fired at 1200 ◦C for 4 h. The addition of chamotte from 10 to 60 % in the studied clays, contributes to a reduction of firing shrinkage. The mineralogy of the products is made of mullite (34–38 %) which is associated to cristobalite (10–19 %), quartz (14–20 %) and amorphous phase (23–39 %). The addition of 10–20 % of agrowastes causes a reduction in the apparent density of 13 % and an increase in the open porosity of 14 %. The characterization of products shows that firing shrinkage is less than 2 %; bulk density between 0.4 and 1.40 g/cm^3; open porosity more than 45 %. These products are qualified as insulating refractory materials with a limit using temperature of 1250 °C [1.2]. Therefore, they are insulating thermal refractory bricks witch can be used in intermediate walls of furnaces and which must ensure the minimum heat transfer [2.3].

Keywords: Kaolinite; Refractory; Chamotte; Agrowastes.

References:

[1] A. Pountouenchi, D. Njoya, A. Njoya, D. Rabibisao, J.R. Mache, R.F. Yongue, D. Njopwouo, N. Fagel, P. Pilate & L. Van Parys (2018) Characterization of Foumban (West Cameroon) region's clays and suitability evaluation for refractory bricks manufacturing, *Clay Mineral*, 53 (3), 447-457.

[2] A. Pountouenchi, D. Njoya, A. Njoya, J.A. Mbey, J.R. Mache, R.F. Yongue, D. Njopwouo, N. Fagel, P. Pilate & L. Van Parys (2023) Characterisation of refractory bricks from selected Cameroonian kaolinites, *Clay Minerals*, 58, 353–363.

[3] Djangang C., Lecomte G., Elimbi A., Blanchart. & Njopwouo D. (2010) Elaboration des céramiques poreuses à base de sciure de bois. *Anales de chimie*, 35, 1-16.

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Please check the appropriate contribution: ☒ *Oral* *or* ☐ *Poster*

Removal of methylene blue dye in aqueous solution by adsorption onto a ceramic membrane based on kaolinitic clay and mango seed shell.

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The growth of industrial activities has led to the release of a variety of toxic effluents into the natural environment, posing a danger to the environment. Consequently, their elimination has become a priority and is currently a major issue and concern for scientists. Textile industries contribute to various discharges of colored water, which are conducive to environmental pollution. It is therefore necessary to develop effective, low-cost technologies for the absorption of these dyes. This work reports on the development of new disc-like membranes based on a mixture of inexpensive, locally available raw materials. X-ray diffraction, X-ray florexence, thermogravimetric analysis, differential scanning calorimetry, flexural strength, porosity, density, hydraulic flow, hydraulic diameter and permeability and UV were used to characterize the raw materials and membranes. Sintering was performed at 1100°C, laboratory tests with methylene blue gave us a favorable result. The addition of a pore-forming agent to the membrane increases pore diameter, porosity, permeability and absorption of methylene blue. Among the different compositions studied, the membrane composed of 85% kaolinite and 15 % mango grain shell showed the best performance compromise, with a permeability of 298.59 $L.h^{-1}m^{-2}bar^{-1}$ and 98 % methylene blue adsorption. The adsorption of this basic dye on membrane was characterized by the application of Langmuir and Freundlich adsorption isotherms. The linear Freundlich model is the one that best represents the methylene blue adsorption process and also facilitates the tracing of the adsorption isotherm for this dye.

Key words: kaolinitic clay, pore-forming agent, membrane, adsoption, methylene blue.

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Please check the appropriate contribution: ✓*Oral* *or* ☐*Poster*

PROCESSING AND CHARACTERIZATION OF LOW-COST CERAMIC MEMBRANE USING CLAYS FROM MOROCCO

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Abstract

This study is part of PHC TOUBKAL Project, a collaboration between laboratories in France (IRCER and E2LIM) and Morocco (LEPE). The main objective of this research work is developing ceramic membranes for water treatment and the remediation of wastewater contaminated by emerging pollutants. This work aims to address global water contamination challenges while utilizing local Moroccan resources. Indeed, we aimed at replicating the microstructure of a reference functional membrane (from the E2LIM laboratory) using clay from Safi (Morocco).

To perform this work, the software ImageJ was used to analyze the reference membrane SEM images, specifically the pore size distribution and particle size distribution were investigated. In addition to the membrane analysis, the preparation of the clay powder was carried out to manufacture pellets. Firstly, the clay was ground using planetary milling for 3 hours at 68 rpm and sieved down to 40 µm. Secondly, the pellets were uniaxially pressed into 25 mm diameter discs at 25 MPa. To assess the effect of sintering temperature on porosity and some physical properties, the pellets were fired at different temperatures (900°C, 950°C, and 1000°C). The sintered pellets were characterized for open porosity, bulk density, and solid density using Archimedes' principle.

The results indicated that the reference membrane consists of two distinct layers: a selective layer on the internal walls and a support layer in the core and external walls. At this stage, we found that the porosity of the pellets was 32% at both 900°C and 1000°C, and 34% at 950°C. Therefore, the pellets sintered at 900°C and 1000°C resemble the support layer in the reference membrane. Preliminary tests demonstrated the potential of the studied clay from Safi, as a viable material for membrane fabrication. Therefore, contributing to the development of sustainable and cost-effective ceramic membranes for water purification and wastewater treatment.

Keywords: Porous ceramics, ceramic membrane, uniaxial pressing, clay from safi, porosity, particule size.

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International Conference on Ceramics and Geomaterials in Central Africa

GRAAL EMC2 JRP CNRS-AFRIQUE CÉRAMIQUES POREUSES DURABLES CAMEROUN

CACerS Composites and Advanced Ceramics Society

Please check the appropriate contribution: ☐✓ *Oral* *or* ☐ *Poster*

Elaboration and characterization based ceramic membrane on kaolinitic clays and rice husk ash using the Simplex Centroid Design (SCD).

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Abstract

The present work is focus on the elaboration and characterization based ceramic membrane on kaolinitic clays (MY3 and KG) and rice husk ash (CBR) using the Simplex Centroid Design mixing plan. Six (06) formulations were made and the shaped specimens were fired at 1050 ^{O}C, 5 ^{O}C/min rate and a soaking time of 2h. Six (06) responses were studied on the elaborated membranes : the flexural strength varying from 0.28 - 3.14 MPa; the porosity in the interval 34.72 - 38.24 %; the linear shrinkage in the range 2.03 - 2.67 %; the bulk density from 1.52 - 1.55 g/cm^3; the water absorption in between 22.90 to 24.63 % and the weight loss from 11.33 to 12.50 %. Due to the significance of the variance (variance >1), two responses were retained: the porosity and the flexural strength. They were subjected to mathematical modeling using the Minitab Software 2019. The mathematical models describing the two modelled responses, together with the response surfaces, isoresponses curves and Cox's diagrams, have made it possible to study the effect of the raw materials (MY3, KG and CBR), on the properties of the developed membranes. Taking the results of the model in account, an optimum mixture was found, made up of 82.5 % MY3; 10.0 % KG and 7.5 % CBR. Its characteristics are (3.14 ± 1.16) MPa of flexural strength and (37.74 ± 1.24) % of porosity, with an overall desirability of 53 %. The main phases contained in the optimum membrane are: mullite, quartz, rutile, cristoballite, tridymite and corindon. Although degradation in basic medium is more pronounced than in acidic medium, the degradation properties revealed that the optimum membrane can be in contact with acidic and basic solutions without degrading significantly at ambient temperature.

Keywords: Kaolinitic clays, rice husk ash, experimental design, ceramic membranes, physico-mechanical properties, mineralogy

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Please check the appropriate contribution: ✓*Oral* *or* ☐ *Poster*

ELABORATION AND CHARACTERIZATION OF POROUS CERAMICS USING CLAYS AND PEANUT SHELLS

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Abstract

The present work is a joint project between France and Cameroon, supported by the CNRS through the JRP funding (Project GRAAL EMC2). The general purpose is the development of sustainable, high-performance filters and membranes with optimized anti-biofilm properties based on Cameroonian clays and peanut shells [1] for water treatment. Emphasis will be laid on the mastering of sintering behavior, microstructure and mechanical properties of the studied compositions. To achieve this, three raw clays from Cameroon were selected (denoted H, K and M) together with agro waste (peanut shells denoted C). These materials were chosen because of their abundance and their beneficial properties. Different samples were prepared and the proportion of peanut shells was 0, 20 and 25 wt%. All the samples were shaped by uniaxial pressing and sintered at 1100 °C, 5 °C/min with a soaking time of 1 h.

The essential results of the present study showed that, the mineralogical composition of clays H and K consists of clay phases halloysite and kaolinite respectively while that of clay M consists mostly of montmorillonite and kaolinite. The major secondary phase identify in all clays consists of quartz. Quartz gives the raw material good mechanical strength, limits shrinkage and microcracking during heat treatment process. XRD analysis of C indicates the presence of cellulose as major phase. After sintering of all samples at 1100 °C, weight loss values obtained were <31 % while open porosity varied between 15 to 59 % and diametrical compressive strength varied from 1-6 MPa. SEM images agreed with the porosity values obtained. In addition, partial consolidation is highlighted through the occurrence of significant next long grain boundaries. Further investigations are to be done on the elaboration of ceramics via additive manufacturing (for complex shapes) and functionalization route.

Keywords: Porous ceramics, functionalization of ceramics, biosource additive, water filtration.

References:

[1] Barry, K.; Lecomte-Nana, G.L.; Sory, N.; Ouedraogo, M.; Sawadogo, L.; Sawadogo, M.; Sanou, I.; Seynou, M.; Zerbo, L.; Blanchart, P. Mullite Effect on the Ceramic Filters Effectiveness in the Removal of Arsenic from Borehole Water from Burkina Faso. *Open Ceramics* **2024**, *20*, 100679.

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Please check the appropriate contribution:	☐ *Oral*

Development of an intumescent inorganic coating on various substrates

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Abstract

The challenge of environmental protection is a fundamental issue in all industries (nuclear, civil engineering, aeronautics). Organic used in many safety-related applications and in large quantities to fight corrosion and fire. However, they are less durable and require a lot of energy to maintain. The development of new environmentally-friendly fireproof materials is a current challenge. Geopolymer-based coatings are a promising alternative due to their excellent properties, such as mechanical strength and fire resistance (up to 1300 °C) [i]. The aim of this work is to produce a high-temperature resistant and intumescent geopolymer-based coating on steel plates and organic plates (polyamide and polypropylene).

Geopolymer foam, dense geopolymers as well as multilayer geopolymer systems with different porosities were prepared with two different metakaolins, and cast on steel plates previously blasted with corundum for 4 min. Geopolymer coatings with intumescent additives were prepared and sprayed on the samples previously prepared on the steel plates and Fire resistance were carried out with a flame at 800°C.

The results showed that, adherence strength is around 3 MPa. The samples geopolymer coatings allow to reach only on the backside test flame a temperature maximum of 600 °C after 30 min. Intumescent geopolymer coatings permits to reduce this temperature at 300 °C. Aging tests of samples are currently being carried out as well as the challenge of intumescence.

Keywords: *Geopolymer, intumescent, coating, expansion, additives*

[i] L. Ouamara, A. Gharzouni, B. Naït-Ali, J. Jouin, G. Babule Guillaume, P. Duport, C. Chinaya, E. Guillaume, S. Rossignol, Thermally resistant geopolymer to 1300 °C: Scale-up and structural evolution, Open Ceramics, (16) 100462, 2023.

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ST5 – Matériaux composites et biosourcés

Oral

INTER-INTRALAYERED POLYMERIZATIONS OF SOME FORMALDEHYDE RESINS IN KAOLINITE

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The development of techniques to mitigate formaldehyde excess in formaldehyde-based resins has led to the use of kaolinites as filler materials[1]. While this approach demonstrates significant results, it is hampered by the poor dispersion of the mineral sheets, limiting the performance of the resulting composites. Consequently, kaolinite exfoliation/delamination becomes a crucial step, facilitating the polymerization of these resins within its interlayer space. However, a significant knowledge gap remains regarding the mechanism of polymerization within this interlayer space. This study investigates the interlayer polymerization and water resistance of poly(urea-formaldehyde) and poly(formamide-formaldehyde) within kaolinite. To effectively conduct this investigation, high crystallinity kaolinite underwent urea and formamide intercalation in an aqueous solution followed by immersion in a formaldehyde solution. The raw materials and products obtained after each step of the process were analyzed using X-ray diffraction, Fourier-transform infrared spectroscopy, and thermal analyses.The results demonstrate an expansion of the kaolinite interlayer space at each process stage, indicating the presence of these polymers within this interlayer space and mineral exfoliation with urea. Examination of these results reveals a three-step polymerization mechanism: initial hydroxymethylation, followed by polycondensation, and final hydroxymethylation. This mechanism, consistent with the results, suggests that poly(urea-formaldehyde) and poly(formamide-formaldehyde) are bound to kaolinite through weak van der Waals interactions and that the water formed during the process reinforces the structure of the layers. Water resistance testing indicates slow degradation and self-healing properties after 20 minutes of agitation immersion compared to synthesized poly(urea-formaldehyde).

Keywords: Kaolinite; Poly(urea-formaldehyde); poly(formamide-formaldehyde); polymerization; exfoliation; Intercalation.

References

[1] S. Chen, X. Lu, T. Wang, and Z. Zhang (2016), *Particuology*, vol. 24, p. 203 209, , doi: http://dx.doi.org/10.1016/j.partic.2015.05.007.

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Please check the appropriate contribution: ☑ *Oral or* ☐

GREEN AND REUSABLE COMPOSITE HYDROGELS FROM *HIBISCUS CANNABINUS L.* FIBER CELLULOSE NANOCRYSTALS AND CALCINED EGGSHELL FOR THE REMOVAL OF INDIGO CARMINE DYE FROM WASTEWATER

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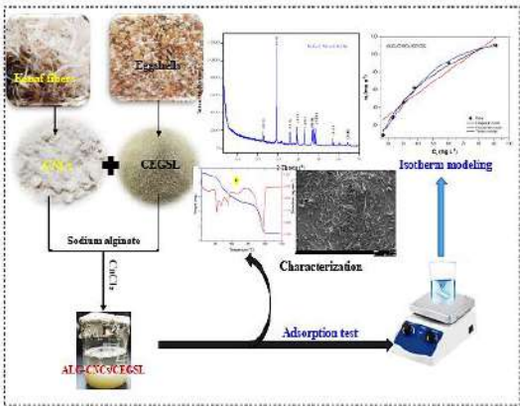
Abstract

The current research focused on the synthesis of a composite hydrogel adsorbent (ALG-CNCs/CEGSL) from local resources (cellulose nanocrystals extracted from *Hibiscus cannabinus L.* fiber and eggshell powder)[1], and its adsorption properties were successfully tested to remove Indigo carmine (IC) dye from the aqueous medium. Morphological and physicochemical structures of the synthesized composite was analyzed using SEM/EDS. X-ray XRD, and FTIR analyses. Adsorptive efficiency the adsorbent was tested in batch mode[2] and effect of adsorption parameters including, solution pH, contact time, adsorbent amount, and initial dye concentration were studied and the finding showed that IC dye adsorption by ALG-CNCs/CEGSL was strongly influenced by the pH of the solution[3]. The kinetic data were accurately described by the pseudo-second-order model ($R^2 > 0.999$), independently of the solution concentration. According to Langmuir isotherm model, the maximum adsorption capacity of ALG-CNCs/CEGSL for IC dye was found to be 121.56 mg g^{-1} under optimum conditions (room temperature, natural pH, adsorbent mass of 0.1 g, and contact time of 30 min). The regeneration and reusability of ALG-CNCs/CEGSL were tested over three adsorption/desorption cycles, and the results showed promising reuse of the composite after two cycles. These findings highlight the potential of an eco-friendly composite made from nanocellulose from kenaf fibers and eggshells as a less expensive and more effective local adsorbent material for the remediation of dye-laden aqueous effluents.



Keywords: Kenaf fiber, Cellulose nanocrystals, Eggshells, Indigo carmine, Adsorption

References:

1. X. Qin, A. Lu, L. Zhang. *Cellulose* (2013) 20:1669–1677. DOI 10.1007/s10570-013-9961-z.
2. C. Tcheka, B. S. Nen-Oure, T. Alifa, M. M. Conradie, and J. Conradie. *ChemistrySelect* 2024, *9*, e202402331 (1 of 13). doi.org/10.1002/slct.202402331.
3. G. Agbor Tabi, Lekene R B. Ngouateu, D. Kouotou, A. N. Odogu, A. V. Abega, J. Ndi Nsami, J. M. Ketcha. *Arabian Journal of Chemistry* (2022) 15, 103515. https://doi.org/10.1016/j.arabjc.2021.103515.

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Please check the appropriate contribution: ☒ *Oral* *or* ☐ *Poster*

THERMAL RESISTANCE EFFECT OF TYPHA MATERIAL ASSOCIATES WITH CEMENT AND LATERITE

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Abstract

The development of eco-materials sectors in Senegal is currently facing barriers of different natures: cultural, regulatory, technical or even human. These barriers come from both supply and demand. The diagnosis and analysis of the different barriers aim to identify possible remedial actions or mitigation measures [1]. Nevertheless, researchers will continue to characterize local materials for thermal insulation in buildings and industries. Among these materials, we can cite rice straw, bamboo, peanut shell and Typha. Typha is an aquatic plant that is present in the Senegal River Valley. Its rapid proliferation poses a threat to populations living along the river. Despite this consideration, Typha has interesting thermal properties to be considered a good insulator, especially thermal, in the field of construction; it can be associated with different binders such as plaster, cement, laterite and resin, etc.

Our work is part of the valorization of the Typha material by highlighting its thermal resistance under different climatic conditions. The reason is because materials with high thermal resistance help maintain indoor temperatures by minimizing heat loss in the winter and heat gain in the summer. This leads to reduced energy consumption for heating and cooling systems, ultimately lowering energy bills. In addition, we demonstrate its ability to store thermal energy for long periods of climatic stress.

Our study model is defined from a 2 cm thick briquette composed of Typha and different binders (plaster and cement) end then create a temperature gradient between the indoor and outdoor temperature. A program code is developed to simulate the material behavior under different parameters in MATLAB environment. The results obtained shows important thermal energy stored at a very thickness of Typha material. And a lower heat transferred at the boundary of the material. It means that we can make Typha brick with small thickness of material.

Keywords: Typha, thermal insulation, thermal resistance, energy efficiency, thermal characterization

Reference: [1] Final report 2013 of the energy efficiency program for buildings in Senegal Development of the market for local eco-materials in buildings in Senegal P.11.

Please check the appropriate contribution: ☐ *Oral*

Agricultural waste valorization in the improvement of the durability and thermal properties of compressed earth blocks (CEB)

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Abstract : The use of agricultural waste (peanut shell) as a stabilizer is intended to improve the water and thermal properties of BTC. To do this, a medium-plastic clay from Kongoussi (Burkina Faso) consisting of kaolinite (40 wt. %), muscovite (8 wt. %), quartz (34 wt. %) and goethite (10 wt. %) was mixed with the peanut shells at mass contents ranging from 10 to 40 wt. % with a pitch of 5 wt. %. The mineralogy of the peanut shells as well as the physical, mechanical and thermal properties of the CEB were evaluated. The study shows that peanut shells are mainly composed of type I cellulose combined with hemicellulose and lignin [**1,2**]. The incorporation of 15 to 25 wt. % of groundnut shell allowed a good adhesion between the groundnut shells and the clay matrix. In addition, test tubes containing 15 and 25 wt. % peanut shells had good physical, mechanical and hygrometric properties. In view of the improvement of these properties, these BTCs can be used for the construction of habitats.

Keywords: CEB, mechanical and hygrometric properties.

[1] D. Sedan. Study of physico-chemical interactions at the hemp/cement fiber interfaces. Influence on the mechanical properties of the composite, Thesis of the University of Limoges, France, (2007)

[2] M. Jonoobi, J. Harun, P.M. Tahir, A. Shakeri, A.S. Saiful, M. D. Makinejad. Physicochemical characterization of pulp and nanofibers from kenaf stem. Mater. Lett, Mater. Lett., vol. 65, p. 1098-1100, (2011)

Please check the appropriate contribution: ☐ *Oral* *or* ☐ *Poster*

EXPLORING THE RHEOLOGICAL PROPERTIES OF NATURAL FIBER REINFORCED COMPOSITE PASTES FOR 3D PRINTING

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3D printing is an innovative technology that is revolutionizing the construction sector by enabling waste to reduced by 30-60%, thanks to increased precision compared with conventional methods [1]. This study aims to assess the rheological properties of composite pastes reinforced with natural fibers, such pineapple and sisal, ensure their suitability for 3D printing. Experiments were carried out on three main formulations (1.5PAFA33, 0.5PAFA17 and 1PAFA33), manufactured according to Amziane's protocol [2], in the form of cylindrical samples 100mm in diameter and 50mm high. Parameters studied included extrudability limit, thixotropy and structural compatibility of the pastes under printing conditions. The results show that the 1.5PAFA33 formulation stands out for its high extrudability threshold (≈35 Pa) and maximum penetration (≈30 mm), reflecting good mechanical and structural stability. On the other hand, the 0.5PAFA17 and 0.5PAFA25 formulations, although more fluid (threshold <10 Pa), could be suitable for applications requiring less structural rigidity. The performance of these blends is validated by an optimum workability time of 10 minutes and stable printing parameters, such as a volume flow rate of 3666.6 mm³/s and a dynamic viscosity of 144 Pa-s. These results confirm the potential of natural fibers for the sustainable manufacture of 3D-printed building materials, paving the way for significant advances in eco-responsible construction.

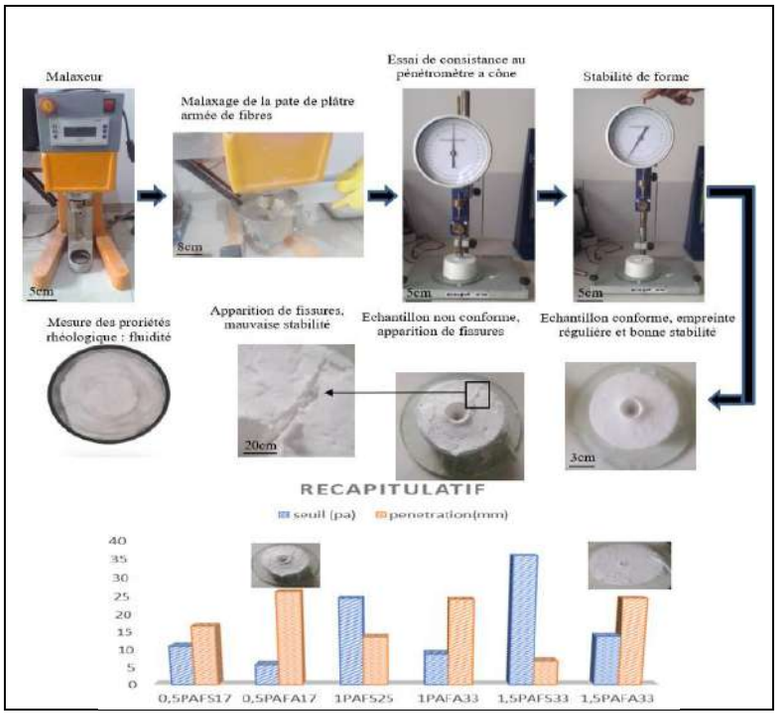

Fig. 1. Formulations et mesures des seuils d'écoulement des pâtes composites en vue de l'impression 3D

[1] J. Zhang, J. Wang, S. Dong, X. Yu, B. Han, « A review of the current progress and application of 3D printed concrete », *Composites Part A: Applied Science and Manufacturing*, vol. 125, article 105533, 2019.
[2] S. Amziane, A. Perrot, M. Sonebi, « Effect of metakaolin and natural fibres on three-dimensional printing mortar », *Proceedings of the Institution of Civil Engineers – Construction Materials*, vol. 173, n° 2, pp. 79–92, 2020.

EFFECT OF MOISTURE ON THE MECHANICAL PROPERTIES OF *RHECKTOPHYLLUM CAMERUNENSE* NATURAL FIBER/PLASTER COMPOSITE

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Abstract

The aim of this work focuses on the study of the effect of moisture on the mechanical properties of natural fiber composite (NFC) Plaster/***Rhecktophyllum Camerunense*** (RC). Indeed, the treated and untreated RC fibers reinforced plaster composites were fabricated and submitted to hygroscopic ageing in an environmental enclosure of 23%, 54% and 75% relative humidities at the temperature of 23°C. Flexural tests were carryout under a three points bending approach according to NF EN 6583 standard. Five specimens were tested for each case. The results indicated that the flexural properties of all the composites decreased with the relative humidity due to degradation of the fiber matrix interface.

Keywords: RC Fiber, Natural Fiber Composites, Water Absorption, Flexural Tests

References:

1. Béakou AR, Ntenga J, Lepetit JA, et al. (2008) Physico– chemical and microstructural characterization of ‘‘Rhectophyllum camerunense’’ plant fber. Composites part A: applied science and manufacturing journal 39(1): 67-74.

2. Noutegomo B, Betene E, Atangana A (2019) Study of the diffusion behavior of water vapor sorption in natural fber composite: Plaster/Rhecktophyllum camerunense. MOJ App Bio Biomech 3(1): 12-16.

3. Dhakal HN, Zhang ZY, Richardson MOW (2007) Effect of water absorption on the mechanical properties of hemp fber reinforced unsaturated polyester composites. Composites Science and Technology 67(7–8):1674-1683.

4. Le Duigou A, Davies P, Baley C (2009) Seawater ageing of flax/poly (lactic acid) biocomposites. Polymer Degradation and Stability 94(7):1151-1162.

5. Hu RH, Sun MY, Lim JK (2010) Moisture absorption, tensile strength and microstructure evolution of short jute fber/polylactide composite in hygrothermal environment. Materials and Design 31(7): 3167-3173.

6. Assarar M, Scida D, El Mahi A, et al. (2011) Influence of water ageing on mechanical properties and damage events of two reinforced composite materials: Flax–fbers and glass–fbers. Materials and Design 32(2): 788-79

7. Rangaraj SV, Smith L (2000) Effects of moisture on the durability of wood/thermoplastic composite. Journal of Termoplastic Composite Materials 13: 140-161.

ST6 – Valorisation des déchets, recyclage et éco-matériaux

Oral

Oral Communication

TITLE: Synthesis of a Composite Charcoal from Groundnut shells (*Arachis Hypogaea*) and Plastic Waste: Application to the Elimination of Methylene Blue in Aqueous Solution

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Abstract

This study focuses on the adsorption of methylene blue dye by a composite charcoal prepared from groundnut shells (GS) and polyethylene terephthalate (PET) plastic waste. The composite charcoal Groundnut Shells-Plastic Waste (GS/PET) was obtained at 400 °C, at a residence time of one hour and at a GS/PET ratio of 1:1.This adsorbent was characterized by different analysis such as FTIR, SEM/EDX and BET. The study of the adsorption of methylene blue (MB) in batch mode was done by varying several parameters such as; pH, contact time, mass of the adsorbent and initial concentration of the dye. The results of the adsorption tests obtained shown that the maximum pH was 6 for GS/PET for an equilibrium time of 10 min. The Langmuir model best described the adsorption of MB on GS/PET. The pseudo first and pseudo second order models best describe the adsorption kinetics on the composite; which shown that there is competition between physisorption and chemisorption. It appears from this study that the composite charcoal prepared is efficient for the removal of MB in aqueous solution.

Key words: Composite charcoal, Groundnut shells, Plastic waste, Methylene blue, Removal.

References

Ajala, Lo, Ali, EE, (2018), «Preparation and Characterization of Groundnut Shell-Based Activated Charcoal», *Journal of Applied Science and Environmental Management,* 24 (12) 2146.

Ayach A., Fakhi1 S., Faiz1 Z., Bouih A., malek A. O., Benkdad A., Benmansour M., Laissaoui A., Adjour M., Elbatal Y., Vioque I., Manjon G., (2017), «Adsorption of Methylene Blue on bituminous schists from Tarfaya-Boujdour», *Chemistry International,* 3(4) ,343-352.

Ignace A., Jacques K. F., Nikita T., Esta A. I., Taofiki A., (2020), «Adsorption of Atrazine from Aqueous Solution onto Peanut Shell Activated Carbon: Kinetics and Isotherms Studies», *American Journal of Applied Chemistry*, 8(3), 82-88.

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OPTIMIZED HYDROXYAPATITE-BASED MATERIALS FOR EFFICIENT ADSORPTIVE REMOVAL OF HEAVY METALS

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Abstract

The presence of heavy metals such as lead (Pb^{2+}) and cadmium (Cd^{2+}) in water poses a significant environmental challenge due to their toxicity and long-term impact on ecosystems (Nayak and Bhushan, 2021). In this study, three hydroxyapatite (HAp)-based adsorbent materials were synthesized using the wet precipitation method, with varying molar ratios to optimize their performance. The environmental potential of these materials was assessed through kinetic studies focusing on the removal of Pb^{2+} and Cd^{2+}. The residual concentrations of these ions were determined using graphite furnace atomic absorption spectrometry. The obtained results reveal high removal efficiencies for heavy metals: 94.69%, 91.05%, and 99.73% for Cd^{2+}, and 79.59%, 89.56%, and 97.72% for Pb^{2+}, corresponding to the three tested powders. The adsorption mechanism primarily involves surface complexation, promoting effective interaction between the metal ions and Hap. These findings highlight hydroxyapatite as a promising adsorbent material for treating water contaminated with heavy metals, paving the way for sustainable environmental applications.

Keywords: Hydroxyapatite; Adsorption; Heavy metals removal; Environmental remediation; Wet precipitation method; Kinetic study.

References:

Nayak, A., Bhushan, B., 2021. Hydroxyapatite as an advanced adsorbent for removal of heavy metal ions from water: Focus on its applications and limitations. Mater. Today Proc., International Conference on Technological Advancements in Materials Science and Manufacturing 46, 11029–11034. https://doi.org/10.1016/j.matpr.2021.02.149

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GREEN SYNTHESIS OF MAGNETIC TYPE ZEOLITES 4A AS CATALYST FOR THE ELIMINATION OF QUINOLINE YELLOW BY THE FENTON PROCESS : OPTIMIZATION AND KINETIC INVESTIGATION

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Abstract

This work describes the hydrothermal synthesis and characterization of zeolite 4A (Zeo-4A) and zeolite 4A magnetite (Zeo-4A@Fe_3O_4) from Cameroonian raw kaolin. The study also explores the application of magnetic zeolite type 4A in quinoline yellow removal via Fenton process. XRD, FTIR, SEM, EDX, NMR-MAS and DSC-TG characterizations show that Zeo-4A is crystalline with cubic morphology, while Zeo-4A@Fe_3O_4 exhibits a bonding interaction between zeolite and Fe_3O_4 leading to morphological structural changes. The degradation of quinoline yellow by heterogeneous Fenton process was carried out by varying several parameters, namely solution pH (3-7), H_2O_2 concentration (0.5-1.5 mol/L), quinoline yellow concentration (50-100 mg/L), and catalyst mass (50-100 mg). The results of catalytic performance tests reveal that the degradation efficiency with synthetic Zeo-4A is 1.71%, and with Zeo-4A@Fe_3O_4 and Fe_3O_4 is 92.60% and 92.65%, respectively, after 60 minutes. Confirmatory tests were carried out by response surface methodology based on the Box-Behnken design, and a degradation rate of 98.81% was obtained under optimum conditions of pH 3.84, 50.14 mg/L, 100 mg, and 1.5 g/L ; which is well in line with the model predictions. A significant quadratic regression model R^2 = 91.35% and the adjusted coefficient of determination value (adjusted R^2 = 82.04%) was observed using analysis of variance. The study of catalyst recovery and reusability shows that the catalysts remain stable with a degradation rate greater than 66% after five cycles. The kinetics results show that the degradation of E104 follows first and second order kinetic models, influenced by pH and catalyst mass, with optimum efficiency at pH 3. The characterization results of the material after degradation show that it maintains its structural integrity after use.

Keywords : Zeolite 4A, quinoline yellow, degradation, Fenton process.

Please check the appropriate contribution: ☐ *Oral* *or* ☐ *Poster*

Title: Development of Eco-Friendly Activating Solutions using Agro-Waste Cocoa Pod Ash and Rice Husk Ash for Geopolymers Formulated with Kaolinitic and Iron-Rich Clay Materials

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Abstract

This study investigates the potential of Cocoa Pod Ash (CPA) and Rice Husk Ash (RHA) as sustainable sources of potassium and amorphous silica in geopolymer production. A potassium-rich salt was extracted from CPA with a cumulative yield of 76.8% and used to prepare six geopolymer activators (S0-S50). These activators were then used to formulate geopolymers with locally sourced kaolinitic (OWC) and iron-rich (ORC) clay materials. The results show that the addition of K-salt enhances compressive strength, with optimal values of 27.25 MPa and 17.88 MPa achieved at 30% K-salt concentration (S30) for geopolymers formulated with OWC and ORC, respectively.

Keywords: Activating solutions, Agro-waste, Geopolymers, Sustainable construction materials, Waste management

Please check the appropriate contribution: ✓*Oral* *or* ☐*Poster*

Elaboration of Inorganic Phosphate Polymers Based on Volcanic Slag: Impact of Oyster Shell Powders on Physicochemical Properties

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Abstract

Phosphate inorganic polymers were synthesized by partial substitution of volcanic slag powders from Manjo and Mbouroukou (Littoral Region, Cameroon) by oyster shell powders at different proportions (0, 5, 10, 20 and 30%) as solid precursors at various concentrations of (8 M and 10 M) according to a mass ratio L/S of 0.45 in order to evaluate the physicochemical properties. The volcanic slag was characterized by X-ray Fluorescence, Fourier Transform Infrared Spectroscopy (FTIR) and X-ray Diffraction (XRD). The synthesized inorganic phosphate polymers were characterized by Fourier Transform Infrared Spectroscopy (FTIR), Optical Microscopy (OM), compressive strength and linear shrinkage. The FTIR spectra of the PIPs show new absorption bands between 889 and 869 cm^{-1} characteristic of the different vibration modes of the C - O bonds of the calcium carbonate group, which may justify the introduction of the oyster shell in the matrix of the PIPs. The images obtained by optical microscopy show that, depending on the rate of incorporation of oyster shells, clusters of particles that have not taken part in the reaction and that have accumulated at the level of the pores of the various PIPs are observed. For an addition rate of 5-10%, an increase in compressive strength is observed for the MajN variety at a concentration of 10M, i.e. 38.83MPa (5%). Thus, excessive addition (≥10% by mass of oyster shells) lowers the compressive strength. The overall properties of these inorganic phosphate polymers show that MajN volcanic slag would have a better use in the production of construction and civil engineering materials with an addition of 5% oyster shell.

Keywords: Inorganic phosphate polymers, volcanic slag, oyster shells, acid activating solution, additives.

Please check the appropriate contribution: ☒ *Oral* *or* ☐ *Poster*

INFLUENCE OF PARTICLE SIZE OF SILICA SAND POWDER ON COMPRESSIVE STRENGTH AND MICROSTRUCTURAL PROPERTIES OF WASTE FIRED CLAY BRICK-BASED GEOPOLYMERS

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Abstract

The main objective of this work is to study the influence of the granulometry of silica sand powder on the compressive strengths and microstructurals properties of geopolymers materials based of waste fired clay brick-based and calcined waste bricks clay. Commercial sodium silicate with a SiO_2/Na_2O molar ratio of 1.6 was used as the hardener. The geopolymers materials were synthesised after adding 10g of silica sand powder to raw materials with different particle sizes equal to 45, 63, 125 and 200µm and a solution commercial sodium silicate. The synthesised geopolymers materials were characterised by several analyses. The compressive strengths of the geopolymers materials based on waste fired clay brick-based and calcined waste bricks clay are equal to (45.75, 51.57, 64.89 and 29.54 MPa) and (40.29; 50.76; 50.88; 45.62 MPa) after addition of 10g of silica sand powder respectively (GP45, GP63, GP125 and GP200) and (GWB45, GWB63, GWB125 and GWB200). The geopolymers materials synthesised were characterised by measuring their compressive strengths and X-ray diffractometry. Functional groups were determined using infrared spectroscopy analysis and morphologies were recorded using a scanning electron microscope coupled to EDS.

Keywords: Geopolymers materials, silica sand powder, waste-fired clay brick,

Please check the appropriate contribution: ☒ *X Oral* *or* ☐ *Poster*

VALORIZATION OF GRANITE POWDER WASTE IN CERAMIC TILE PRODUCTION

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Abstract

Main Objective: This study aims to valorize granite powder waste from the GRACAM factory in the production of ceramic tiles, reducing its environmental impact and promoting sustainable resource management.

Materials and Methods: Physical and chemical analyses were conducted on granite powder. Five experimental briquette formulations were created from mixtures of clay, feldspar, quartzite, and granite powder, with granite content varying from 10% to 40%. After firing at 1050 °C, tests were carried out to evaluate linear shrinkage, porosity, water absorption, bulk density, and flexural strength.

significant results: The results indicate a reduction in linear shrinkage (from 4.41% for V2 to 2.61% for V5) and mass loss (from 4.98% for V1 to 3.86% for V5). Conversely, water absorption increased up to 15.70% for V5, and porosity rose from 3.77% (V1) to 6.62% (V5). Bulk density decreased with increasing granite content (from 2.08 g/cm³ for V1 to 1.97 g/cm³ for V5). Flexural strength also declined (from 15.32 MPa for V1 to 1.029 MPa for V5). The V1 formulation (80% clay, 20% granite powder) demonstrated the best mechanical and physical properties.

Conclusions: The valorization of granite powder waste in ceramic tile production is feasible. The V1 formulation offers a good balance between mechanical performance and industrial viability, making it a promising alternative for sustainable waste management and production cost reduction.

Keywords: Granite powder, ceramic briquettes, waste valorization, ceramic tiles.

References:

AFNOR. (1996). NF P 94-056 : Essai de granulométrie des sols. Paris : AFNOR.

AFNOR. (1999). NF P 94-051 : Essai de détermination des limites d'Atterberg des sols. Paris : AFNOR.

ASTM International. (1996). ASTM F417-96 : Standard Test Method for the Flexural Strength of Ceramic Tile. West Conshohocken, PA : ASTM International.

ASTM International. (2000). ASTM C20-2000 : Standard Test Method for Density and Absorption of Fine Aggregate by Water Displacement. West Conshohocken, PA : ASTM International.

ISO 10545-3. Détermination de l'absorption en eau et porosité apparente des céramiques.

ISO 13506. Diffraction aux rayons X : Analyse qualitative et quantitative de la structure cristalline des matériaux.

Please check the appropriate contribution: ☒ *Oral* *or* ☐ *Poster*

Faecal sludge management, from storage to recovery : the case of the Adjagbo STBV in Benin.

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Abstract

Population growth is accompanied by a high production of waste of all kinds, and household waste, in particular, raises significant health and environmental concerns. Among the waste generated by households, faecal sludge stands out, as its management remains a neglected aspect of urban sanitation and represents a major challenge to address. Indeed, faecal sludge contains a high concentration of biodegradable organic matter, which can be valorized for energy production and/or as a fertilizer for agricultural land.

This study aims to assess the current state of faecal sludge management in Benin and explore new sources of renewable, sustainable, and environmentally friendly energy.

A sociological survey conducted in Benin revealed that septic tanks and latrines are only emptied when they are completely full. However, the decantable organic matter in the tanks undergoes biological transformations, releasing malodorous volatile compounds, particularly carbon dioxide and methane (a powerful greenhouse gas). In urban areas, sludge is mechanically or sometimes manually emptied and then transported to faecal sludge treatment plants, where it is processed either through reed-planted drying beds or unplanted drying beds. Additionally, the collected sludge undergoes physico-chemical analyses at treatment plants. C/N and COD/BOD5 ratios of 0.07 and 2.83, respectively, were obtained. It is therefore essential to consider a combined biological treatment for energy valorization.

Keywords : Management, sewage sludge, recovery, grennhouse gases.

References: no more than 6 (times New Roman, font size 10).

[1] L. Bensmail et A. Touzi, « Valorisation de la biomasse à des fins énergétiques : Contribution de la production de biogaz au développement durable », p. 8, 2012.

[2] N. Topanou, B. Agbatchi, G. J. Gbaguidi, J. Fatombi, et F. P. Tchobo, « Uncovering the Challenges of Faecal Sludge Management in Benin’s Urban Hubs: The Cases of Abomey-Calavi and Natitingou », *JEP*, vol. 15, nº 07, p. 767-780, 2024, doi: 10.4236/jep.2024.157044.

[3] C. Defo, T. Fonkou, P. B. Mabou, P. Nana, et Y. Manjeli, « Collecte et évacuation des boues de vidange dans la ville de Bafoussam, Cameroun (Afrique centrale) », *vertigo*, nº Volume 15 Numéro 1, mai 2015, doi: 10.4000/vertigo.15994.

[4] C. Jean-Pierre, Jean-Marc Perret, Clément Crétollier, Paul Le Pimpec, Stéphane Troesch, et Mickaël Mesnier, « Guide technique sur les Matières de Vidange issues de l'assainissement non collectif : Caractérisation, collecte et traitements envisageables. » 2009.

Study of the effect of setting accelerators on the physical, mechanical and hydraulic properties of lime-calcined clay (LC2) cement

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Abstract

The effect of 2 and 4% of various setting accelerators on physical, mechanical and hydraulic properties of a lime-calcined clay (LC2) cement, considered as low carbon cement was investigated. The clay used was a halloysite type thermally activated at 750°C to obtain metakaolin. The setting accelerators used were sodium hydroxide (NaOH), local and imported sodium silicate (Na_2SiO_3) and Portland cement powder. The chemical and mineralogical characteristics of the raw materials were studied by X-ray fluorescence; Fourier transformed infrared spectroscopy (FTIR) and X-ray diffraction (XRD). Fresh pastes of cements were tested for initial setting time. The water absorption, porosity, density and compressive strength of hardened samples at 3, 7 and 28 days were determined. The results showed that, the incorporation of setting accelerators in the LC2 studied improved the setting performance of the mixtures, and 4% sodium hydroxide turned out to be the most effective, with an initial setting time of 58 minutes. Binders composed of 4% setting accelerators had a higher absorption rate compared to those composed of 2% setting accelerators. The addition of setting accelerators in the pastes contributed positively to improving the strength of hardened products at 28 days. However, the products with the highest strength are those that contained 4% Portland cement powder (32.89 MPa at ambient air curing and 33.74 MPa by water vapor curing). Setting accelerators contributed to improve the physical, mechanical and hydraulic performance of lime-calcined clay (LC2) cement.

Keywords: Low carbon cement; Lime-calcined clay cement, Lime; Setting accelerators, improved performance.

Please check the appropriate contribution: *Oral*

ELECTRONIC WASTE: TOWARDS ALTERNATIVE SOLID FUELS

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Abstract

The management of Waste Electrical and Electronic Equipment (WEEE) represents a major environmental challenge (Baldé et al., 2014). Their recovery as Alternative Solid Fuels (ASF) helps reduce environmental impacts by preventing landfill disposal, thereby limiting soil and water pollution from heavy metals and other toxic substances. Moreover, this approach contributes to reducing greenhouse gas emissions by replacing fossil fuels with a more sustainable energy source derived from the waste itself. This study aims to produce Alternative Solid Fuels (ASF) from Waste Electrical and Electronic Equipment (WEEE), capable of replacing fossil fuels in industrial boilers while minimizing the environmental risks associated with these wastes. A blending plan was used to determine the optimal proportions of ASF components, combined with materials such as starch, to produce high-quality ASF. Chemical analyses, including **lower heating value (LHV), ash content, and moisture content**, revealed the energy potential of the formulations. Preliminary results show that some formulations achieve an LHV above 20 MJ/kg, with a **waste-starch (90/10)** formulation standing out with an **LHV of 27.30 MJ/kg**. These initial analyses pave the way for the potential industrialization of ASF, although further studies are needed to assess their behavior in industrial processes. This study contributes to the sustainable management of WEEE and the energy transition.

Keywords: WEEE, valorization, alternative solid fuels, sustainable energy, environment.

References: Baldé, C. P., Wang, F., Kuehr, R., & Huisman, J. (2015). The global e-waste monitor – 2014: Quantities, flows, and the circular economy potential. United Nations University, International Telecommunication Union, & International Solid Waste Association.

Please check the appropriate contribution: ■ *Oral* *or* □ *Poster*

Used of calcined Oyster Shell as possible replacement of lime in LC3 system

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Limestone calcined clay cement (LC3) is among the cement that has garnered significant interest because it is more economical and more durable than conventional cement [1]. For recent years, research focus on the use of lime in the LC3 system [2]. This work aims to promote local materials such as marine waste as replacement of lime to the fight against environmental pollution. For this, an oyster shell and a kaolin from Coastal and Southern region of Cameroon respectively were calcined at 950°C for the oyster shells and at 600 and 700°C for the kaolin powder. The calcined products were subjected to mineralogical and thermal analyses (XRD and DTG/TG) before being substituted with Portland cement at 15% for the calcined kaolin and at 0, 5 and 10% for the calcined oyster shells. The different mixtures were used to produce cement mortars that have been subjected to physico-chemical and mechanical tests. The results show that the heat treatment open layers of metakaolins and give them amorphous structure. The use of calcined both oyster shells at 5% with 15% of MK improves the mechanical strength of the cement materials. This gain is more pronounced with the substitution of MK700.

Keys words: Oyster shell, LC3, calcination, mechanical properties.

Reference:

[1] M. Abdulqader, H. R. Khalid, M. Ibrahim, K. S. Adekunle, Al-Osta M. A., Ahmad S., Sajid M. (2023) Physicochemical properties of limestone calcined clay cement (LC^3) concrete made using Saudi clays. *Journal of Materials Research and Technology 25, 2769-2783*

[2] S. Her, S. Im, L. Junxing, S. Heongwon, G. Kim, S. Sim, Wi K., P. S. Dongcheon, Bae (2024) Exploring the potential of pulverized oyster shell as a limestone substitute in limestone calcined clay cement (LC3/) and its implications for performance. *Construction and Building Materials 425, 135*

Please check the appropriate contribution: ☐ *Oral*

STUDY OF SOME DURABILITY PARAMETERS OF CEMENT AMENDED WITH SUGARCANE BAGASSE ASH

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Abstract

The objective of the present work is to study the durability of cements amended with sugarcane bagasse ash. The raw materials used in this study were portland cement CEM II/ B-L42.5 and sugarcane bagasse ash (CBCS). For this purpose, ash was produced by calcination at temperatures ranging from 550°C to 750°C during 2- and 3-hours stages. Part of the cement was then substituted by the CBCS in proportions ranging from 0 to 25% by mass. The chemical and mineralogical composition studied by FRX, DRX and ATD/TG showed that these ashes are rich in amorphous silica (58.37 to 75.91%) with pozzolanic indices higher than 75%. The various cements formulated have physical, chemical and mechanical characteristics in accordance with the standards indicated for a pozzolanic cement. Mortars with 10% CBCS at 650°C calcination show the highest mechanical strength. The durability results of the formulated materials were compared with those of a control cement in acid, sulphate and chloride environments. The results obtained showed that this substitution provides a considerable improvement in durability. Thus, these ashes can be used as partial substitute for clinker.

Keywords: bagasse ash, amorphous silica, durability, pozzolanic activity.

References:

Chaib O., Mouli M., Hanifi M., Hamadache M. : Etude de l'influence des paramètres de la pouzzolane naturelle sur la résistance mécanique des mortiers à base de ciments composés. Journal of Materials and Environmental Science 7 (2) (2016), 422-428.

Ganon F., Yameogo A., Sorgho B., Zerbo L., Seynou M., Millogo Y., Ouedraogo R. : Préparation d'une pouzzolane à base d'une matière première argileuse du Burkina Faso. Chemistry and Chemical Engineering, Biotechnology, Food Industry 16 (4) (2015), 371-383.

Issiaka Sanou, Moustapha Sawadogo, Mohamed Seynou, Lamine Zerbo, Raguilnaba Ouedraogo: Study of the Mechanical Behaviour of Mortars Modified with Rice Husk Ask: Journal of minerals and Materials Characteriwation and Engineering, 2019, 7, 373-384.

Parisa Setayesh Gar, Narayana Suresh, Vivek Bindiganavile: Sugar cane bagasse ash as a pozzolanic admixture in concrete for resistance to sustained elevated temperatures.; Construction and Building Materials 153 (2017) 929–936

Donatello S., Tyrer M., Cheeseman C.R.: Comparison of test methods to assess pozzolanic activity; Cement & Concrete Composites 32 (2010) 121–127

Please check the appropriate contribution: ☑ *Oral* *or* ☐ *Poster*

Modelling effects of SiO_2, Fe_2O_3, $(CaO + Na_2O)$, and temperature on the properties of lateritic brick reinforced with glass powder: multi-criteria optimization using D-optimal mixture design

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Abstract

The effect of SiO_2, Fe_2O_3, $(CaO + Na_2O)$ and firing temperature on the characteristics of lateritic clay bricks produced using a clay mixture and recycled waste glass powder was investigated. The mixture was prepared and subjected to firing at temperatures of 750 and 1000 degrees Celsius. The by-products were characterized in terms of their linear shrinkage, flexural strength, porosity, and X-ray diffraction properties. The flexural strength equation demonstrates a synergistic beneficial interaction between SiO_2 and $(CaO + Na_2O)$, which increased the flexural strength, and an antagonistic interaction between Fe_2O_3, $(CaO + Na_2O)$ and temperature, which decreased flexural strength. The linear shrinkage equation demonstrates a synergistic interaction between Fe_2O_3 and temperature, which resulted in an increase in linear shrinkage. The XRD patterns indicated the presence of the following main crystalline phases: hematite, quartz, cristobalite, and sillimanite. The optimal mixture, which meets the desired requirements (porosity ≤ 20 %, flexural strength ≥ 4 MPa and linear shrinkage ≤ 2%), is chemically composed of 34 % SiO_2, 37 % Fe_2O_3, 14.5 % Al_2O_3, 3 % $(CaO + Na_2O)$ and 10.5 % of loss of ignition. The corresponding formulation in terms of raw materials is 78 % lateritic clay and 22 % glass powder sintered at 888 °C.

Keywords: Fluxing oxide, D-optimal Mixture Design, brick manufacturing, mechanical resistance, shrinkage

Please check the appropriate contribution: ☑ *Oral* *or* ☐ *Poster*

TITLE: Green Synthesis and Characterization of CA/CdNPs and CA/FeNPs Nanocomposites from *Bombacopsis glabra*: Application to Escherichia coli Elimination and Optimization of Ni^{2+} ion Adsorption in Wastewater.

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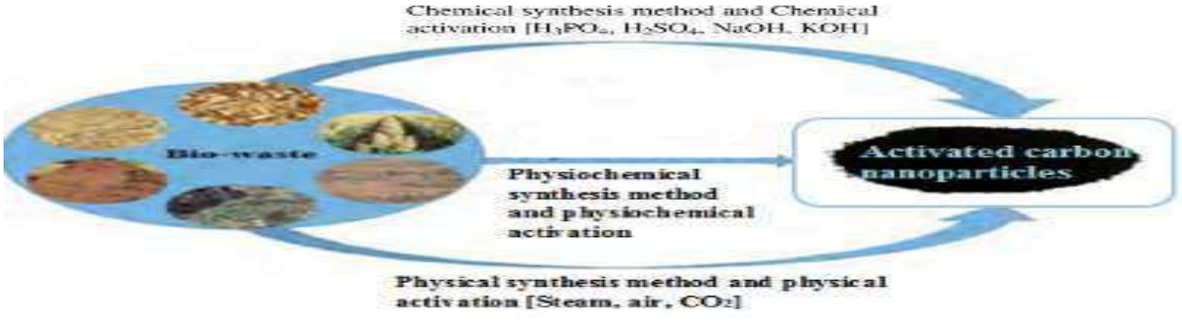
Abstract

Nowadays, infectious diseases remain a major public health problem. Moreover, due to resistance, unavailability and toxicity of available drugs, it highlight the need to search for alternatives to fight these infections. In this light, exploring nanocomposites from coconut shell waste could be a promising approach. In this work, the antimicrobial property of nanocomposites, which was prepared by the incorporation of cadnium and iron oxide nanoparticles onto activated carbon, were studied. The iron nanoparticles were synthesized biologically from aqueous extract and iron oxide nanoparticles from the methanolic extracts of coconut shell and loaded onto the activated carbon, prepared by chemical activation using sulphuric acid as activating agent. *Bombacopsis glabra* extract was used as a reducing and stabilizing agent. Iodine number, Fourier Transform Infrared spectroscopy (FTIR) and adsorption of methylene blue dye characterised the activated carbon and nanocomposite while the nanoparticles were characterised by UV-visible spectroscopy and FTIR. The antimicrobial activity of the synthesized nanoparticles and nanocomposites were examined by the broth microdilution method as described by Clinical, Laboratory Standard Institute (CLSI) for susceptibility testing on fifteen microbes (10 bacteria and 5 fungal srains), and the most active samples were assayed for their cytotoxicity using the resazurin colorimetric assay on *Vero* cell lines.



Keywords: Green Synthesis, Nanocomposites, Escherichia coli, Optimization, Adsorption

References:

Ankoro N. O., Kouotou D., Lunga P. K., Godwin A. T., Lekene N. R., Ndi J. N., Ketcha J. M., 2020, " Effect of Doping Activated Carbon Based Ricinodendron Heudelotti Shells with AgNPs on the Adsorption of Indigo Carmine and its Antibacterial Properties" Arabian Journal of Chemistry

Ayodhya D., Venkateshama M., Kumara A., S. G. Reddy G., B., Ramakrishna D., Veerabhadrama G.,2015, "Photocatalytic degradation of dye pollutants under solar, visible and UV lights using green synthsised CuS nanoparticles", Journal of Experimental Nanoscience

Gour A., Jain N. K., 2019, "Advances in green synthesis of nanoparticles" Artificial Cells, Nanomedicine, and Biotechnology, 47 :1, 844-851

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Oral

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Please check the appropriate contribution: ● *Oral* *or* ○ *Poster*

MACHINE LEARNING AND DEEP LEARNING METHOD TO PREDICT THERMAL COMFORT IN THE INDOOR ENVIRONMENT

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Abstract

Thermal comfort in indoor environments is a crucial factor affecting occupant health, productivity, and well-being. This study provides a critical review of machine learning and deep learning approaches for predicting thermal comfort, with a particular focus on the role of building materials as key regulatory elements. We examine various methods used in the literature, ranging from statistical models to advanced machine learning techniques (random forests, SVM) and deep learning architectures (neural networks, CNN, LSTM). A comprehensive comparison of their performance, advantages, and limitations is conducted using real-world datasets that incorporate environmental parameters (temperature, humidity, air velocity) and material properties. Our findings highlight the importance of considering the thermal inertia of materials to improve prediction accuracy. Finally, we discuss the challenges and future perspectives related to integrating these models into intelligent thermal comfort management systems for sustainable buildings.

Keywords: Machine learning, Thermal comfort, Deep learning, Energy efficiency

Please check the appropriate contribution: ☒ *Oral or* ☐ *Poster*

FEATURE SELECTION METHOD BASED ON POROSITY-HYGROSCOPY CORRELATIONS OF POROUS GEOPOLYMER MATRICES FOR THE PREDICTION OF MOISTURE CONTROL CAPACITY

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Abstract

Geopolymers are sustainable and environmentally friendly materials with strong hygroscopic properties, offering significant advantages for thermal comfort. Selecting the most impactful variables is essential for optimizing their performance. However, experimental tests to determine porosity-hygroscopy correlations are costly in terms of labor, time, and material resources. This study employs a machine learning approach to reduce the size of geopolymer matrices by automatically selecting the most influential parameters affecting their hygroscopic behavior. After evaluating this feature selection method on laboratory-collected data, the results demonstrate superior performance, with RMSE = 0.8491, MSE = 0.72, and MAE = 0.6179, reflecting minimal differences between actual and predicted hygroscopic values. These results surpass those of certain existing methods, emphasizing the importance of intrinsic parameters such as porosity, tortuosity, and pore diameter, as well as external factors like temperature and humidity. This approach can contribute to reducing experimental efforts and accelerating the development of innovative geopolymer materials.

Keywords: Machine learning, Thermal comfort, Feature selection, Porosity, Hygroscopy

Compressive Strength control of Geopolymer Cements Using Charred Groundnut Shells

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Abstract:

This study deals with the development of geopolymer cements using calcined peanut shells as a partial replacement of metakaolin and the modeling of its mechanical compressive strength. The first step of the study was to use calcined peanut shells, an agricultural waste as a 0, 10, 20, 30, 40, and 50% of weight substitute of metakaolin with an S/L ratio of 0.8 and 0.9 for geopolymer cements synthesis. The raw materials and the geopolymer cements obtained characterizations were performed using XRD, GTA/DSC, FT-IR and SEM analysis as well as by their physicomechanical properties. The results obtained revealed that the addition of calcined peanut shells decreases the compressive strength of geopolymer cement. These results also showed that materials with the S/L ratio 0.8 are less porous. The second step was to develop a numerical model for the mechanical compressive strength of geopolymer cement based on calcined peanut shells. To achieve this objective, an experimental design more particularly a mixing design with three independent variables was used as the modeling support. A statistical analysis of the results based on the analysis of variance (ANOVA) and the response surface method was performed. For this purpose, nine formulations were made and tested after 7 and 28 days. Modeling results shows that the compressive strength of geopolymer cements can be controlled using calcined peanut shells. This is of great interest for high-precision civil engineering works.

Keywords: geopolymer cement, design of experiment, mixing design, modeling

References:

Davidovits J. (1994). Geopolymers: Inorganic polymeric new materials. Journal of Materials Education, 16(1), 91-106.

Kamseu, E. (2020). Investigation of Groundnut Shell Powder on Development of Lightweight Metakaolin Based Geopolymer Composite: Mechanical and Microstructural Properties. 14, 449-461.

Please check the appropriate contribution: ■ *Oral* *or Poster*

Aggregate compaction model for high-performance concrete: influence on performance prediction

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Abstract

The objective of this work is to develop a compact granular skeleton that influences the prediction of the compressive strength of high-performance concretes. The study was carried out on the basis of the existing particle packing model, in particular, the funk and dinger model, but with a different approach and according to three distribution coefficients (q): 0.25, 0.37 and 0.5. The concept of packing density made it possible to evaluate the compactness of the skeleton in the dry state at the different distribution coefficients and the results gave the respective values: 0.63, 0.59 and 0.66. The formulations of the concretes were differentiated by varying the cement dosages between the minimum value (proportional to the porosity of the skeleton) and the maximum value of 900 kg/m³ in steps of 50 kg/m³, superplasticizer between 1 and 1,2% and the water-cement ratio between two values: 0.38 and 0.4. Subsequently, the parameters of each formulation (cement dosage, water, aggregates, compactness, compressive strength, etc.) were used as data for the prediction of compressive strength by machine learning. 48 concretes were formulated. Compressive strengths were carried out on the concretes hardened after a 28-day wet curing. The results show that 17 formulated concretes are classified as high-performance concretes with compressive strength varying between 56.2 and 70.8 MPa. Among the 17 high-performance concretes, 9 were formulated with the most compact skeleton (q=0.5). All these parameters were used as data to train the multiple linear regression model via the online editor google colab. The evaluation of this model results in 0.89 for the coefficient of determination (R^2) and 4.64 for the root mean square error (RMSE).

Keywords: High-performance concretes, machine learning, particle packing, packing density.

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Please check the appropriate contribution: ☐ *Oral*

Use of experimental design to develop ceramic membrane based on Koutaba Ebebda clays and cassava peel: application to water purification

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Abstract

This work concerns the development, characterization and study of the filtration capacities of membrane support based on kaolinitic clays and cassava peels. Ebebda clays was used as the main matrix (65-85 wt%) of the membrane support, Koutaba clay as a binder (15-35 wt%) and cassava peel as a pore-forming agent (0-20 wt%). Ten formulations were generated from an augmented simplex centroïd design with temperature as the process variable to study its interactions with the mixture constituents. Test membrane supports were sintered at 900 and 1100°C and characterized by XRD, FTIR, SEM, porosity, flexural strength and specific surface area. PM consists of C, H and O with a loss on ignition of 99.90 %. Results showed that porosity ranged from 23.30 to 59.99 %, flexural strength varied from 0.59 to 18.43 Mpa and specific surface area from 0.41 to 17.97g.m^{-2}. Polynomial mathematical model describe strong correlations and interactions between mixture constituents and temperature. The multicriteria optimization showed an optimum formulation consisting of 65 % EB, 18.64 % KG and 16.34% PM. This optimum has the following characteristics: 7.46 Mpa flexural strength, 43.26 % porosity and 0.55g.m^{-2} specific surface area; a permeability of 4,345.87 L.h^{-1} .m^{-2}. bar^{-1} and an average pore diameter of 1.31 µm. Thus this membrane is suitable for microfiltration process. The optimal membrane showed a bacterial retention capacity of around 90 % . Filitration of drinking water revealed a pH value of 8.8, turbidity of 3 NTU, TSS of 35 mg/LO2, electrical conductivity of 246 µS/cm, COD of 64 mg/L and BOD5 of 17 mg/L. The physical and physico-chemical properties are within the acceptable limits prescribed by ANOR and WHO, unlike the chimical properties (COD and BOD).

Keywords: Kaolinitic clays, cassava peel, augmented simplex centroïd design, ceramic membrane, characterization, water purification.

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ST8 – Matériaux au regard des changement climatique, énergies vertes et empreinte carbone

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Oral

Please check the appropriate contribution: ☑ *Oral* *or* ☐ *Poster*

Influence of ferrisilicates obtained from dissolved hematite and sodium silicate on the mechanical and microstructural properties of geopolymer materials

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Abstract

The aim of this work is to study the influence of ferrisilicates obtained from dissolved hematite and sodium silicate on the mechanical and microstructural properties of geopolymer materials. Hematite was dissolved in oxalic acid followed by nitric acid. The geopolymer materials named GHN0, GHN10, GHN20, GHN30, GHN40 and GHN50 are obtained by adding respectively 0, 10, 20, 30, 40 and 50 g of ferrisilicates to metakaolin. The hardener used is a commercial solution of sodium silicate with a molar ratio SiO_2/Na_2O equal 1.6. The different ferrisilcate pastes are added separately to the metakaolin-hardener mixture and mixed for 5 minutes. Each specimen hardened for 28 days was subjected to compressive strength tests. The obtained fragments was examined using Mercury Intrusion Porosimetry to get an idea about the nature of the pores present in their materials. X-ray diffractometry and Fourier Transform Infrared Spectroscopy were used to characterize ferrisilicates and geopolymer materials. The maximum compressive strength (71,59 MPa) is obtained by adding 20 g of ferrisilicate to metakaolin. The plot of differential logarithm of the intrusions as a function of the pore size diameter revealed that the geopolymers GHN0, GHN20 and GHN50 have mesopores in their structures.

Keywords: Ferrisilicate, Metakaolin, Geopolymers, Compressive strength, Pore structure, Surface fractal dimension.

Tchakouté, H.K.; Rüscher, C.H.; Djobo, J.N.Y.; Kenne, B.B.D.; Njopwouo, D. Influence of gibbsite and quartz in kaolin on the properties of metakaolin-based geopolymer cements. Appl. Clay Sci. 2015, 107, 188–194.

Please check the appropriate contribution: ☒ ***Oral*** ***or*** ☐ ***Poster***

Study of the formulation of a cement based on calcined clay from Ndjamena and rhyolite as additions.

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For sustainable development, reducing carbon dioxide (CO_2) emissions and saving raw materials are essential, particularly in cement industry. Research in the last decade has increasingly focused on producing cement with a low carbon footprint. The use of calcined clay has shown promise for replacing clinker in cement. It is in this context that our work is oriented, which consists of exploring the possibility of using a mixture of calcined clay with rhyolite to replace clinker in cement, to drastically reduce the price of cement on the Chadian market and the carbon footprint. To achieve this objective, three (03) formulations were made by varying the amount of clinker by 60%, 63% and 95% in accordance with the CEM II/CM cement type and following EN 197-5 standard. Clay calcined at 800°C for 60 minutes and rhyolite were used as additions and gypsum as a setting regulator. The chemical characterization of the materials was carried out by X-ray fluorescence and the pozzolanic activity of the additions was evaluated by the modified Chapelle test. The flexural and compressive strengths were measured using a hydraulic press. Chemical analysis showed that rhyolite and calcined clay are mainly composed of silica (SiO_2), alumina (Al_2O_3) and hematite (Fe_2O_3). The results of the mechanical tests showed that the use of calcined clay and rhyolite as additives increases the compressive strengths of the cements produced compared to the control cement. The presence of calcined clay helps to slightly increase the consistency and slightly reduce the setting time and density of the cement. The reduction of up to 63 and 60% of clinker in our formulations makes it possible to obtain cements with 28-day strengths between 47 and 52 MPa. The implementation of the results will reduce the cost of cement on the Chadian market by 15% and the CO_2 emissions associated with cement production by 30%. This study shows that the partial substitution of clinker with calcined Ndjamena clay and rhyolite is a promising avenue from an economic and environmental perspective.

Keywords: cement, sustainable development, clinker, calcined clay, rhyolite, pozzolanic activity.

References:

1) Akindahunsi A.A., Avet F., & Scrivener K., (2020). The Influence of some calcined clays from Nigeria as clinker substitute in cementitious systems. Case Studies in Construction Materials, 13. https://doi.org/10.1016/j.cscm.2020.e00443.
2) Antoni M.G., & Scrivener K.L., (2015). Effect of fineness in clinker-calcined clays-limestone cements [Advances in Cement Research, 2015, 27(9), 546–556 http://dx.doi.org/10.1680/adcr.14.00095 Paper]. 27(9).
3) Balde Y., Djangang C.N., Balde O.T, Blanchart P., & Njopwouo D., (2022). Study of the pozzolanicity of two clays from Kindia (Guinea) with a view to their use in the formulation of hydraulic bin. 9, 251–264.
4) Izoret L. (2022). The LCA approach and low-carbon cements 20.
5) Geryville D., Kacimi L., Cyr M., & Clastres, P. (2011). Improvement and study of the pozzolanic activity of some natural aluminosilicate materials. 148–157

Please check the appropriate contribution: ☐ *Oral* *or* ☐ *Poster*

TITLE: Mechanical, physical and microstructural properties of volcanic ash-based phosphate geopolymer materials using waste fired brick powder as an additive

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Abstract

The main objective of this work was to study the influence of waste clay brick powder on the mechanical, physical and microstructural properties of geopolymer materials based on volcanic ash in an acid medium. Volcanic ash was replaced by 0, 10, 20, 30 and 40 wt.% of waste clay brick powder. Phosphoric acid solution with a concentration of 10M was used as hardener. X-ray diffractograms of geopolymer materials indicate the presence of a new crystalline phase namely aluminium phosphate (Ap). The micrographic images of these specimens show compact and dense structures due to the presence of quartz particles but also to the new crystalline phase (aluminium phosphate) which plays the role of mineral fillers and microaggregates, thus enhancing the structures of geopolymers materials. However, the matrix of GPW40 is inhomogeneous due to the presence of aluminium phosphate particles observed in its XRD pattern and also in its SEM/EDS images with the high intensity of the phosphorus element in its structure. The compressive strengths of the geopolymeric materials increase with clay brick waste content (23 to 62 MPa for GP0 to GPW40, respectively). Water absorption percentages and porosity rates decrease from 8 to 6% and from 14 to 12%, respectively with increasing clay brick waste content. The new geopolymer binder obtained will allow us to improve the cohesion between waste clay bricks and volcanic ash in the synthesis of new high performance geopolymer materials, which could be used in the construction industry.

KeyWords : Volcanic ash, geopolymer materials, waste fired clay brick, hydrated aluminium phosphate

Please check the appropriate contribution: ☒ *Oral* *or* ☐ *Poster*

GEOTHERMAL POTENTIAL ASSESSMENT OF THE BARÉ-BAKEM LOCALITY (CAMEROON VOLCANIC LINE): CONTRIBUTIONS FROM GEOPHYSICAL AND GEOTHERMOMETRIC STUDIES

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ABSTRACT: In order to determine the geothermal potential of the municipality of Baré-Bakem, located in both the sedimentary basin of Moungo and the volcanic region of Nkongsamba (Cameroon Volcanic Line), geophysical measurements using electrical resistivity tomography were conducted along a 1km profile between two opposing thermal sources spaced 20 meters apart. The profile was acquired in the SW-NE direction using a 945m-long array with 64 electrodes spaced at 15 meters intervals. The ZZRes2Dinv44 software was employed to generate investigative images. The obtained results along the profile reveal the presence of two geothermal zones of interest trapped within permeable sedimentary formations at depths ranging from approximately 20 to 110 meters and close to the surface. From a geothermometric perspective, chemical geothermometers such as silica and Na-K-Ca were calculated by collecting water samples from these thermal sources and analysing the physicochemical parameters at the Laboratory of Geochemical Analysis of Waters (LAGE/IRGM) in Nkolbisson. The calculations indicate that the Baré-Bakem locality exhibits temperatures ranging from 51 to 90°C for near-surface anomalies and temperatures ranging from 283 to 300°C for deeper anomalies. These geothermal resources possess high energy potential suitable for electricity production.

Keywords: geothermal, tomography, chemical geothermometers, geothermal energy.

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Title: Direct synthesis of laterite-based zeolite-geopolymer for the capture of Carbon dioxide from Biogas

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The production of biogas by anaerobic digestion of rich organic waste is an alternative to respond to energy demand. However, at the exit of the bioreactor the biogas contains impurities such as carbon dioxide whose removal will improve its calorific rate. Zeolite- geopolymers, which are a class of adsorbent material combining the remarkable adsorbent properties of zeolites and the mechanical and thermal properties of geopolymers have been synthesized by the direct method to capture CO_2 from biogas. The laterite was used as a raw material for synthesis because of its significant content of aluminosilicates and its availability. The centered composite design permitted us to study the influence of the curing temperature, curing time and the porogen content on the iodine index and the specific surface, in order to deduce the optimal conditions of the synthesis of the zeolite-geopolymers. In the optimal zone, a curing temperature of 92°C, at 24 hour curing time and a 2%w/w of porogen content, provide an iodine index of 1528mg/g and a specific surface area of 541m^2/g. The curing temperature was the most significant factor followed by curing time. The synthesized zeolite-geopolymers have been used for the capture of CO_2 from biogas on a fixed bed in order to determine their maximum adsorption capacity. The Thomas model and the Yoon-Nelson model made it possible to determine a maximum adsorption capacity of 433mg of CO_2/g for a breakthrough time of 538s enhancing 64% of the calorific value of the sampled biogas.

Key words: Laterite, Zeolite-geopolymer, Iodine index, Surface area, Biogas, CO_2 capture

Please check the appropriate contribution: ■ *Oral* *or* □ *Poster*

EFFECTS OF INCORPORATING FERRIC IONS (Fe^{3+}) FROM HEMATITE INTO METAKAOLIN ON MICROSCOPIC PORE STRUCTURES AND COMPRESSIVE STRENGTH OF GEOPOLYMER MATERIALS

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Abstract

The main target of this work is to investigate the compressive strength and microscopic pore structure of metakaolin-based geopolymer materials containing various ferric ions content incorporate in the system. The ferric ion was obtained by dissolving hematite in oxalic acid followed by nitric acid. Geopolymers are obtained by the substitution of metakaolin with different amounts of ferric ions (0, 5, 10, 15 and 20 wt. % of metakaolin). Sodium waterglass is added separately to each paste and mixed for 5 minutes. Each formulation cured for 28 days was subjected to compressive strength tests. The fragments obtained were used to examine microscopic pore structure. Other fragments were pulverised to determine the mineralogical compositions and functional groups in the geopolymers. Maximum compressive strength (73 MPa) is achieved by replacement of metakaolin with 5 wt. % of ferric ions. The macropores found between 100 and 1000 nm on the cumulative pore volume and logarithmic difference intrusion curves of the reference geopolymer disappear when ferric ions are incorporated. The EDS mapping shows that Si, Al, O and Na are abundant in the geopolymers, associated with less Fe uniformly dispersed in the matrix. However, they also show some zones of Si- and Al-rich geopolymers and the metakaolinite particles embedded in the matrices. The surface fractal dimension is close to 2 in several regions, indicating that the pore surfaces are fractally smooth. It has been found that the incorporation of fewer ferric ions into geopolymers reduces the macropores content and promotes the development of compressive strength.

Keywords: Ferric ions, Metakaolin, Geopolymers, Compressive strength, Pore structure.

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Please check the appropriate contribution: ☑ *Oral* *or* ☐ *Poster*

Influence of Cao/Al_2O_3 molar ratio of synthetic calcium aluminate hydrates on the engineering properties of metakaolin-based alkali-activated materials

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Abstract

This study evaluates the infuence of the CaO/Al_2O_3 molar ratio of synthetic calcium aluminate hydrates on the properties of alkali-activated materials based on metakaolin. Calcium aluminate hydrates with CaO/Al_2O_3 molar ratios of 0.4, 0.6, 0.8, 1.0 and 1.2 were synthesised from bauxite and eggshells. Alkali-activated materials were prepared in which metakaolin was replaced by 0 and 10 wt.% calcium hydroxide and calcium aluminate hydrate with diferent CaO/Al_2O_3 molar ratios. Rice husk ash with a SiO_2/Na_2O molar ratio of 1.6 was used for the preparation of the hardener. The 28-day compressive strengths of alkali-activated materials containing 0 and 10 wt.% calcium aluminate hydrate with diferent CaO/Al_2O_3 molar ratios of 0, 0.4, 0.6, 0.8, 1.0 and 1.2 are 48.86, 63.59, 47.36, 47.89, 34.66 and 32.76 MPa, respectively. 22.08 MPa for that containing 10% by weight of calcium hydroxide. The apparent densities are 1.87, 1.79, 1.99 and 2.10 g/cm^3, respectively. It has been found that the best molar ratio of CaO to Al_2O_3 in the structure of the 10% by weight of calcium aluminate hydrate used to replace metakaolin, which is required to produce alkali-activated materials with higher mechanical and physical properties, is about 0.4.

Keywords: Metakaolin · Chicken eggshells · Bauxite · Calcium aluminate hydrates · Alkali-activated materials · Compressive strengths

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RETENTION OF LEAD ON A TWO-LAYER FILTER (LIMESTONE / POZZOLAN)

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Abstract

The aim of this work is to remove lead in its bivalent form from drinking water and industrial effluents by means of a bilayer filter (limestone/pouzzolan) using a technique (precipitation combined with adsorption). First, we carried out a limestone dissolution study. Secondly, we characterized the monolayer and bilayer filter. (total porosity is determined by the ratio of the total volume of the bed to the volume of water introduced.We then carried out filtration on the different beds (The arrangement of the layers was carried out based on laboratory experiments and literature).with different particle sizes (d= 0.5-1 mm for limestone), (d= 1-2 mm for pozzolan). Finally, we characterized the filtered solution. Removal was carried out on a bed of particles at different pH levels, with different filter media (limestone, pozzolan and limestone/pozzolan). Lead was determined by UV-Visible spectrometry at a wavelength of 283 nm. The results show that the reduced lead concentration of the filter material (limestone) depends on the pH of the different filter beds. The results obtained in terms of porosity are 0.5±0.05 (for the limestone bed), 0.54±0.05 (for the pozzolan bed) and 0.6±0.05 (for the limestone/pozzolan bed) and in terms of efficiency, the Pb^{2+} ion removal rate for the limestone bed is 45.15%, for the pozzolan bed its high porosity gives it a high retention capacity, despite which its Pb^{2+}ion removal rate is 75.5%. As a result, for the removal of Pb^{2+}ions from water, its efficiency has been shown to be relatively high and more effective when these two materials are combined into a bilayer filter, with its Pb^{2+}ion removal rate being 95.5%. In conclusion, the bilayer filter.

Keywords: Precipitation, Adsorption, Limestone, Porosity, Lead, Filter bed

Please check the appropriate contribution: ☐ *Oral*

Influence of the addition of synthetic calcium aluminate cement on the compressive strength, physical and microstructural properties of metakaolin-based geopolymer materials

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Abstract

This work aims to investigate the influence of calcium aluminate cement (CAC) on the compressive strength, physical and microstructural properties of geopolymer materials**.** CAC is a type of cement composed mainly of calcium aluminate ($CaAl_2O_4$) and calcite ($CaCO_3$). It is obtained from the reaction between calcined alumina (Al_2O_3) and calcite, calcined at high temperature. Calcium aluminate cement generally has high short-term mechanical strength and good corrosion resistance. The addition of CAC to geopolymers can improve their mechanical, physical and thermal properties. The CAC used in this work was prepared by homogeneously mixing chicken eggshell powder (calcium source) and bauxite (alumina source). This mixture, with a mass ratio of $CaCO_3/Al_2O_3$ = 1.0, was calcined at 900°C. Metakaolin and commercial sodium silicate with SiO_2/Na_2O molar ratio equal to 1.6 were used as aluminosilicate and hardener, respectively. Geopolymers have been formulated by adding 0, 10, 20, 30, 40 and 50 wt% by mass of CAC to each 100g of metakaolin. The X-ray pattern of metakaolin MK-MY3 shows the peaks of illite, anatase, quartz and traces of hematite. The one of CAC shows the presence of reflection peaks of calcite (Ca), calcium hydroxide (CH) and hematite (H). The compressive strengths of geopolymer are 29, 35, 28, 25, 24 and 23 MPa when 0, 10, 20, 30, 40 and 50% wt by mass of CAC are used as additives, respectively. SEM reveals that, the microstructure of geopolymer cement using 10% wt of CAC as additive (GCCA10) is more compact and denser than others. However, the one of geopolymer cement using 50% wt. by mass of CAC as additive (GCCA50) indicates the presence of Ca-rich zone. Water absorption analysis reports that, GCCA10 has the lowest water absorption percentage (16 %). It was found that, the quantity of CAC to use as additive to 100g of metakaolin to produce metakaolin-based geopolymer with more compact and denser microstructure, lowest water absorption and higher compressive strength is 10 wt%. we can conclude that the excess calcium inhibits the geopolymerization process in the profile of the precipitation reactions characterized by the presence of the white zones observed on the SEM images of GCCA50.

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Key words: Bauxite, Chicken eggshells, Metakaolin, Calcium aluminate cement, Compressive strengths

ST1- Archéométrie et Céramologie

Posters

NON-DESTRUCTIVE ANALYSIS OF EARLY IRON AGE CERAMICS FROM OBOBOGO (CENTRAL CAMEROON): MANUFACTURING TECHNIQUES AND NATURE OF RAW MATERIALS

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Abstract

The appearance of ceramics in Sub-SaharanAfrica is associated with a linguistic based migration model of a new way of life with (semi-)permanent settlements, agriculture, herding and metalworking from central to southern Africa within 2.000 years. The homeland of this Bantu expansion is expected to be in the border area between todays Cameroon and Nigeria. Although Shum Laka (9.000 - 900 BP) and Obobogo (3.000 BP) are the most famous sites in this region, their material was only examined through a stylistic morphological approach (Claes 1985, Lavachery 1998). The presented research is an archaeometric pilot study of ceramic samples from Obobogo, showing stick, spatula and comb impressions. Non-destructive techniques are used to determine the manufacturing techniques and the nature of the raw materials within this site and will be contrasted with the stylistic typology. The samples have been selected according to their colour, thickness and decoration and were documented and analysed by a 3D profilometer, portable X-ray fluorescence (pXRF) and Fourier Transform Infrared Spectroscopy (FTIR). Two macroscopic groups of ceramics were identified: Group 1 is characterized by a reddish to brownish colour whereas Group 2 shows light grey to dark grey colours on their surfaces. This differentiation is confirmed by pXRF. Ceramics from Group 1 show a content (av.) of 17.6% of silicium and 7.5% of aluminiun whereas the ceramics from Group 2 have a content (av.) of 12.6% of silicium and 15.04% of aluminium. The high content of aluminium in the ceramics from Group 2 suggests a high content of phyllosilicates and feldspars in this group but lower in Group 1. The FTIR-spectra indicate the presence of quartz, feldspars and phyllosilicates, suggesting firing with low temperature. The correlation between the geology of the region and the mineralogical and chemical results of the ceramics suggests a production with different local clays.

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Keywords: Obobogo, ceramics, characterization, non-destructive methods, technology, provenance, archaeometry.

References:

Claes P. (1985) Contribution à l'étude des céramiques anciennes des environs de Yaoundé, Mémoire de Licence, Université Libre de Bruxelles.

Lavachery P. (1998). De la pierre au métal : archéologie des dépôts holocènes de l'abri de Shum Laka (Cameroun). Université libre de Bruxelles, Faculté de Philosophie et Lettres, Bruxelles

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ST2 – Prospections des minéraux : matières premières et valorisation

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Posters

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Common clays of Sudano-Sahelian zone of Cameroon : variability, distribution, characterization and potential application

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Abstract

Clay materials from Far-North Region (six localities) and North Region (two localities) of Cameroon were investigated for their morphological variability and mineralogical composition to identify their potential origin and their variable domains of application. Samples were characterized by X-ray diffraction (XRD), Fourier Transform Infrared Spectrometry (FTIR), thermal analysis, particle size distribution and plasticity.

Morphologically, the studied clays are dark reddish to yellowish in the North and brownish yellow to brownish in the Far-North. The polyhedral and the massive structure are observed respectively at the top and the base of profiles in both Regions. The texture is dominated by the silt-loam class in all the studied sites. Mineralogically, kaolinite (1-32%) is the main clay mineral associated to illite (< 9%) and smectite (1-23%). Major non-clay minerals are quartz (30-74%), k-feldspar (4-28%) and plagioclase (1-23%), associated to traces of calcite, hornblende, ilmenite and rhodochrosite. The particle size distribution revealed a high proportion of silty and sandy fraction. The high proportion of quartz in the studied materials may be related to the nature of the parent rocks and the abundance of kaolinite might be due to the climatic conditions dominated by monosiallitisation processes. The studied clayey materials can serve as raw materials in ceramic to produce roofing tiles, solid and perforated bricks. However, the presence of smectite in some sample (up to 23%) may cause negative effects.

Keywords: clay, mineralogy, plasticity, sudano-Sahelian, Cameroon

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Poster

GEOLOGY OF RUTILE INDICES IN MPELE-EBOL (AKONOLINGA-CAMEROON)

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Abstract

The main objective of this work was to characterize rocks and sediments on the petrographic, granulometric and morphoscopic levels in order to determine the indices of rutile mineralization in the Akonolinga area in order to make proposals on the nature of the distributing province. The petrographic analysis showed that the rocks are made up of minerals such as: quartz, feldspar, biotite, muscovite, garnet, opaque minerals. The granulometric analysis showed that the sediments of the study area are fine sands, very well classified with an asymmetry mainly towards the fine elements and sometimes towards the coarse elements, typical of fluvial or torrential sediments. This sedimentation with horometric curves would be linked to the variation of the competence of the transport current. The granulometry of the rutile shows that they are mainly contained in fractions smaller than 1 mm. Morphoscopic analysis indicated a dominance of unworn grains over sub-blunted grains and blunted grains; thus illustrating a short sediment transport and a local source of input.The similarity between the morphoscopy of quartz grains and rutile particles showed that they have the same source. The mineralogical composition of heavy minerals includes: zircon, rutile, garnet, kyanite, tourmaline, zoisite, anatase, diopside, and opaque minerals. The abundance of opaque minerals was noted in all samples. The presence of ubiquitous minerals and minerals characteristic of metamorphic rocks showed that these sediments and their contents would have a magmatic and/or metamorphic origin.

Keywords: Akonolinga, Rutile, Indices, Mpele-Ebol, Central Cameroon.

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GEOTECHNICAL CHARACTERIZATION OF THE LOWLAND SOILS OF EBOLOWA: APPLICATION IN CIVIL ENGINEERING

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Abstract

The present study aims to determine the geotechnical properties of materials from the lowlands of the Ebolowa area, with a view to the implementation of civil engineering structures. Following a site survey, penetrometric tests were conducted at three locations spaced 400 meters apart, and samples were collected for identification, oedometer, and triaxial shear tests. The results indicate that the studied soils have a moisture content ranging from 27% to 33%, with a discontinuous grain size distribution. The plasticity index varies between 18% and 28%, reflecting the highly plastic nature of the materials. The average minimum dynamic cone penetration resistance of the materials (0.07 MPa) is very low, indicating a soft clay with poor bearing capacity. The materials show maximum cohesion values ranging from 19 to 82 kPa, with residual cohesion values between 8 and 79 kPa. The maximum friction angles range from 8° to 16°, while the residual friction angles vary from 8° to 13°, reflecting good initial resistance but increased instability after deformation. These materials exhibit compressibility values ranging from 0.077 to 0.172, indicating that the soils are moderately to lightly compressible. The combined physical characteristics and mechanical properties suggest that these materials are not suitable for the construction of civil engineering works. It is therefore recommended to carry out preliminary treatments, such as soil stabilization. The construction of structures on bored piles with grouting is advised in this area.

Keywords: Lowland, compressibilty, dynamic resistance, Ebolowa

References: Ngon ngon et *al*., (2016). A geological study of the clavey hydromorphic material of region of yaounde.
Poulet et *al*.; (2007). Archean crustial at the Northern border ot the Congo craton (South Cameroon) the charnockite TTG Link 333-342.
Kuete Barthelemy, (2015) Geotechnical characterization of compressible soils in the Municipality of Cotonou University D'Abomey 176p.

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Please check the appropriate contribution: ☐ ***Poster***

GEOLOGICAL AND GEOTECHNICAL CHARACTERIZATION OF HARDENED MATERIALS FROM THE BABONGO REGION DEVELOPED ON BASALTS IN THE ADAMAOUA, CAMEROON: UTILIZATION IN ROAD CONSTRUCTION.

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Abstract

This article studies the mineralogical, geochemical, and geotechnical characteristics of hardened materials developed on basalt rocks in a humid tropical climate, where the altitudes are lower and the relief is plateau-shaped, with a view to their use in road construction. The study was conducted on 02 lateritic gravel zones and 02 lateritic duricrust zones. X-ray diffraction and X-ray fluorescence were applied to these materials. The results show that the lateritic gravels in the Babongo region are brownish to reddish in color, with a sandy-clayey matrix. The duricrusts are reddish and alveolar. These materials are composed of kaolinite, hematite, magnetite, goethite, gibbsite, quartz, and anatase. All of these minerals are predominant in the duricrusts, except for quartz, which has higher concentrations in the lateritic gravels. The hardened lateritic materials have high contents of Fe2O3, and moderate levels of SiO2 and Al2O3. The interpretation of the geochemical indices CIA, MIA(O), and IOL, respectively associated with the A–CN–K, A–L–F, and SAF diagrams, as well as the AF–CNK–M diagram, shows that lateritization is moderate to high in the studied lateritic materials. This lateritization is more pronounced in the duricrusts. The geotechnical characteristics of the lateritic gravels (< 75 µm = 18.9%; IP = 19%; DSM = 2.1; CBR = 51%) indicate that they are suitable for use as a foundation layer for low to medium traffic (T1 to T3) and as a base or surfacing layer for low traffic (T1). The characteristics of the Babongo duricrusts (LA = 57% and 33%; MDE = 47% and 23%) indicate that these materials are suitable for use as a foundation layer for low traffic (T1 to T2) and as a base layer for medium traffic (T3).

Keywords: Basalt, plateau zone, hardened lateritic materials, petrography, geotechnical properties, and road construction.

References: Nguemedjo et al 2020, A petrographic, mineralogical, and geochemical characterizations of the lateritic harpans of Bamendjou in the western region of Cameroun. SN *Applied Sciences 2, 1481.*

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INVESTIGATION OF GEOTECHNICAL PROPERTIES OF DARK MAGNESIUM CLAY FOR COMPRESSED STABILISED RAW EARTH BLOCKS IN MAURITIUS

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Abstract

The Dark Magnesium Clay (DMC) poses a hazard in construction projects due to its expansive characteristics, causing instability as its volume varies with soil moisture content [1]. This study aims to evaluate the feasibility of using Dark Magnesium Clay as a building material for the fabrication of Compressed Stabilised Raw Earth Blocks (CSREB). Literature indicates that the texture and plasticity are key parameters in determining soil suitability for CSREB manufacture. It proposes a range of acceptable values of these properties where the soil can be used for the production of CSREB. The type of stabiliser can also be determined from the characteristics of the soil [2], [3]. BS 1377 part 2 [4] is the standard used to carry out the physical characterisation of the material. Particle size distribution is determined using the wet sieving method, combined with grain dispersion in solution. The same standard is used for the plasticity and linear shrinkage test. Experimental results indicate that the quantity of fine particles in DMC is excessive; with 80% of the grains pass the 0.063 mm mesh. The plastic and liquid limits are 49.4% and 81.3% respectively. It gives a plasticity index of 31.9%. These values do not fit in the range recommended by [3]. Moreover, the soil's linear shrinkage is 15.0% which is already high for blocks requirements. However, these values are defined for a quick assessment of soil. Adding coarse grained material to the soil is suggested to improve its physical properties. It shall improve the mechanical strength of soil and limit the drawbacks of high content of clay. Thorough experimentation is believed to confirm this theory and determine the optimal proportion of each component to achieve the best product quality.

Keywords: Dark Magnesium Clay, Compressed Stabilised Raw Earth Blocks, geotechnical properties, expansive soil, Mauritius

References:

[1] Dr. A, C. W.Chan Chum Yuk, « A practical guide to geotechnical site characterization for Mauritius. Final report », Mauritius Research Council, University of Mauritius, mai 2023.
[2] S. Maini, Production and use of compressed stabilised earth blocks Code of practice. Auroville Earth Institute, 2015.
[3] P. Doat, Éd., Compressed earth blocks: standards ; [guide]. in Series technologies, no. 11. Brussels: CDI, Center for the Development of Industry, 1998.
[4] Methods of test for soils for civil engineering purposes Part 2. Classification tests, BS 1377 part 2, 2 mai 1996.

Please check the appropriate contribution: ☐ *Oral* *or* ■ *Poster*

STUDY OF THE LITHOSTABILIZATION OF LATERITIC GRAVELS OF BANGUI MIXED WITH AGGREGATES OF MAGMATIC ROCKS: APPLICATION IN ROAD CONSTRUCTION

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Abstract

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The construction of good roads in Central Africa Republic still remains a crucial problem. Note that out of a total of 25,000 km of road, only 692 km are paved, ca. (2.8%); the rest is lateritic. In addition, the rate of degradation of paved road is high and this situation hinders the construction of new tarmac road. To help resolve this issue, a formulation for high performance sustainable roads is needed. Geotechnical tests were made on lateritic gravels of Boali and diorite aggregates of Ngouaka. Then, lithostabilization tests using various mixtures of these materials were carried out with a view of their applicability in road construction. Based on the CEBTP 1972 standards, the results of the geotechnical tests carried out on the raw material show that they can be used for the foundation layer and the base layers of T1 traffic. Concerning the mixtures, the plasticity index (IP) decreases with increasing aggregates' content. The optimal water content values decrease with the addition of diorite aggregates while the dry densities increase. The lithostabilization results show that the lateritic gravels improved with 15%, 20%, 25%, 30% and 35% of aggregates present optimal geotechnical characteristics for use in heavy traffic base layers (T2, T3, T4, and T5 respectively); only lateritic gravels mixed with 10% of aggregates can be used in the base layer of T1 traffic.

Keywords: Lateritic gravels, Diorite aggregates, Enhanced characteristics, Geotechnical, Formulation, Road Construction

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Please check the appropriate contribution: ☐ *Oral* *or* *X Poster*

ETUDE DE LA STABILISATION DES SOLS A L'AIDE DE LA CHAUX ET DU CIMENT : CAS DE LA ZONE DE PK 21

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ABSTRACT

The objective of this study is to stabilize a soil with cement and lime. The raw materials used are: soil taken from the Yabassi council at the village called NKOLMBONG PK 21, cement, lime and water. The tests of measurements of the physical characteristics such as the natural water content, the specific weight were carried out. Identification tests such as particle size analysis, Atterberg limits, Proctor test, CBR have been performed. Mechanical tests such as compression and three point bending were carried out as well as the hardness test. All these tests were carried out at SOIL AND CONCRETE LABORATORY at Bonamoussadi-Douala. The results obtained for the average natural water content gave 14.62%, the specific weight 2,623T/m^3. The results obtained by the particle size analysis were: 17.7% sand, 49.6% silt, 32.7% clay. The Atterberg limits gave 41.5% liquid limit, 25.2% plastic limit, 16.3% plasticity index. The normal Proctor test gave 10.70% optimum water content, 1,934g / cm^3 maximum dry density. The CBR gave 13.70%. Finally, we conclude that, cement and clay causes changes in its water content, increase in dry density and increase in the bearing index immediate.

Key words: stabilized soil specimen, lime.

REFERENCES BIBLIOGRAPHIQUES

[1] M. bayat et Asgari 'Effect of cement and lime treatment on geotechnical properties of a low plasticity clay', 2013.
[2] Salem Islam et Laoubi Oussama, " Caractérisation d'une argile expansive faiblement traitée par différents types de ciment et reconstituée à faible énergie de compactage » thème de Master soutenu à l'université Mohamed Boudiaf – M'Sila, p.89, 2004.
[3] Khemisa and Mahamedi 'Cement and lime mixture stabilization of an expansive over consolidated clay' ACS Elsevier 2014.

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TITLE: Trace metal geochemistry of marshy sediments in the Yaoundé urban zones: Implication for heavy metals assessment

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Abstract

Sediment contamination by trace metals in Yaoundé's agricultural, urban and industrial zones raises major environmental concerns linked to the impact of human activities on soil quality and surrounding ecosystems. This study involved the geochemical analysis of trace metal contents (Cr, Zn, Cu, Ni and Pb) by atomic plasma mass emission spectrometry (ICP-AES) and physicochemical parameters (pH, Eh and grain size) on 30 samples of recent sediments taken from various (agricultural, urbanized and industrial) lowlands in the city of Yaoundé. The results confirmed, through the high proportion of fine particles (clays and silts) compared to solid particles (sands), the low transport, typical of these accumulation zones. The enrichment and contamination factor values confirm the anthropogenic impact of trace metal inputs through products present in market garden crops, atmospheric and solid pollutants from metallurgical, automobile activity, and domestic waste. A positive correlation was established between various trace metals and between these metals and the fine (silty) fraction of sediments. Trace metal levels are generally higher than those of the geochemical background. The geo-accumulation index classifies them as moderately to heavily polluted with Cr, moderately polluted with Cu, Zn and Ni, and unpolluted to moderately polluted with Pb. The pollutant load index confirms the polluted nature of these sediments, with values >1 in all samples. Analysis of the spatial distribution of these elements shows that, Cr is concentrated mainly in Yaoundé III and V and comes mainly from urban and industrial activity. Pb, Ni and Zn show significant concentrations in urbanized and agricultural areas. Cu is also concentrated in agricultural, urbanized, and industrial areas. Yaoundé VI and VII districts represent a high-risk area for pollution and have a high environmental impact.

Keywords: Urban lowlands, Trace metals pollution, urban sediments, physicochemical parameters, Yaounde

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PETROGRAPHIC, MINERALOGICAL AND GEOCHEMICAL EVOLUTION OF THE ALTERATION PROFILE OF THE NYAMBAKA BASALTS (ADAMAWA, CAMEROON): BAUXITIZATION PROCESS

Chimeu[1]Akaba Marie Alex, Fuh[1,2] Calistus Gentry, Nkoumbou[1]Charles, Ndjigui[1]Paul-Désiré, Yongue-Fouateu[1]Rose,

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Abstract

Bauxite deposits are known in Ngaoundal and Minim-Martap on the Adamawa plateau in Cameroon. No prospecting and characterization study has been carried out on the geological formations of Nyambaka, a neighboring locality. To fill this gap, a field survey made it possible to draw up a geological map where a basalt flow rests on granites. Samples were collected on the outcrops and along a 20 m deep well on the basalt. The alteration products of the granites are ferruginous crusts rich in alumina while those of the basalts are iron-bearing bauxites. The basalt alteration process begins with a high concentration of gibbsite, kaolinite, goethite, hematite metahalloysite and quartz in the coarse saprolite. These will oscillate towards the surface, marking a clear increase in gibbsite and ferruginous minerals. Chemical analyzes reveal a progressive decrease in the concentrations of SiO_2, K_2O, Na_2O, MnO, P_2O_5, and CaO from the fresh basalt to the surface. Conversely, the concentration of TiO_2, remains relatively stable while Fe_2O_3 and Al_2O_3 contents increase significantly. Variations in the Chemical Index of Alteration the Laterization Index and the Ruxton Ratio illustrate a marked evolution of the parent rock, dominated by phases rich in alumina and iron under the effect of hydrolysis processes, such as monosiallitization and allitization. This processes leads to the accumulation of gibbsite and the formation of iron-rich ortho-bauxites. Rare earth spectra show positive cerium anomalies. Furthermore, the correlation between major elements, trace elements and REEs supports the existence of distinct soil horizons, developed on basalt under redox conditions. The alteration profile of the Nyambaka basalts presents the characteristics of bauxitic laterite.

Keywords: Nyambaka, Adamawa, Cameroon, granite and basalt, bauxitisation;

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PETROGRAPHY AND GEOCHEMISTRY OF THE BIFS IN THE SOUTHERN PART OF THE NKOM MASSIF EAST OF KOPONGO, CAMEROON

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Abstract

Recent mining exploration has uncovered banded iron formations (BIFs) in Kopongo, north of Edea, Cameroon, associated with Paleoproterozoic rocks attributed to the northern part of the Nyong Complex (Congo Craton). The Nkom massif, located east of Kopongo, has drawn attention for its mining potential. A geological survey covering 440 km² identified 50 km² of two types of BIFs: oxide-pyroxene BIFs and oxide-iron silicate BIFs. All BIFs exhibit heterogranular granoblastic textures. In addition to iron oxides, pyroxene, and quartz, the silicate-rich BIFs contain olivine and amphibole. Their mineral assemblages correspond to granulite and amphibolite facies. Chemical analyses (ICP-AES, ICP-MS) reveal high Fe_2O_3 + SiO_2 content (96.33%) and relatively low Al_2O_3 and TiO_2 levels. Trace elements such as Nb, U, Th, Hf, and Sc are present in low concentrations. Rare earth element (REE) spectra show negative Ce and Eu anomalies, except for one sample with positive anomalies, alongside a slight enrichment in light REEs compared to heavy REEs. Discriminant diagrams confirm a hydrothermal origin for these BIFs, with no volcanic clastic contamination. Economically, the studied BIFs have lower grades compared to those in southern Cameroon, but their volume could make them viable for exploitation.

Keywords: Cameroon, Paleoproterozoic Nyong Complex, Nkom BIF, hydrothermal origin.

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Please check the appropriate contribution: ☐ *Oral* *or* ☐ *Poster*

Geological context of the Boda diamonds, South-West of the Central Africa Republic

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Abstract

The Central Africa Republic (CAR) is full of many minerals (gold, diamond, coltan, uranium, iron, etc.). The presence of diamonds is reported in several localities. At Boda, in the southwest of the CAR, diamonds are mined artisanally in alluvium in rivers and in placers. The question on their origins remains without an answer. For this purpose, a geological survey was undertaken and diamond samples, accompanying minerals, heavy mineral concentrates, earthworm castings and fresh rocks were collected. The studies in the laboratory concern the petrography of fresh rocks, the geochemistry of rocks and of accompanying minerals, the identification of heavy minerals, the microchemistry of diamond and the inclusions in diamond crystals. The first results of cartography, petrography and geochemistry will be presented. The sector is made up of gneiss overlain by outliers of Carnot sandstone and a thrusted nappe of schist.

Keywords: Boda-RCA, diamond, gneiss, schist, sandstone, thrust

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poster

Mineralogical, physico-chemical properties of clays from Maroua (Far North Cameroon): potential for use as raw materials for the production of building materials.

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Abstract

Located in the southern part of the Chadian basin between latitudes N 10°33' 0", 10°39'0"14°33 and longitudes E 14°24'0", the Maroua clays belong mainly to sedimentary-type geological formations. The physico-chemical and mineralogical properties of these formations in and around Maroua were studied with a view to their use as raw materials for the production of building materials. Field work enabled profiles to be described and optimum thicknesses of clay materials to be estimated. It emerged that the clays in and around Maroua vary in color from brown to yellow and red. The clay materials have a medium polyhedral structure and a thickness of 2 to 6 m. The physical, mineralogical and geochemical characteristics of the Maroua clays were determined using techniques such as granulometry, Atterberg limits, DRX, FTIR, ATG-ATD and FRX. From a granulometric point of view, clays from Maroua and surrounding areas are fine soils with compositions comparable to those used in the production of solid and perforated bricks. They are not very plastic, have a maximum extrusion acceptable to molding and could be used to produce bricks and pottery. Their mineralogy shows smectite, kaolinite and illite in the clay phase, with associated non-clay minerals such as quartz, feldspars, rutile, calcite and, secondarily, hematite and amphibole. medium-IR FTIR analysis reveals the poor crystallinity of kaolinite and the ferriferous nature of smectite. In addition, thermal analysis of the same materials shows recrystallization at temperatures of around 880-950°C and 1100-1150°C. Geochemically, these silico-alumino-ferric clays have very low proportions of alkali, alkaline-earth and TiO2. This chemical composition classifies Maroua's clay materials as commercial clays, but also makes them suitable for the production of red sandstones.

Keywords: Clays, mineralogy, building materials, ceramic, Cameroon

Please check the appropriate contribution: ☐ *Poster*

METALLOGENIC STUDY OF ETAIN AND COLTAN SEDIMENTS FROM THE GRAND LAC RETENTION IN MAYO DARLE: ADAMAOUA REGION

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Abstract

This study aims to conduct a metallogenic analysis of the sediments in the Grand Lac area at Mayo Darlé, northern Cameroon, in order to trace the origin of tin and coltan indicators following a field survey. A macroscopic examination of the rocks was carried out, and samples were collected for petrographic, sedimentological, and morphoscopic analyses.The results reveal the presence of three types of granite rocks, differentiated by their mineralogical composition: biotite and amphibole granites, leucocratic granites, and greisen hosting the mineralization. The mineral paragenesis found in the greisen consists of Quartz (Qtz), Potassium Feldspar (Kfs), Tourmaline (Tr), Sphalerite (Sph), Cassiterite (Cs), and Orthoclase (Op). The opaque oxides observed are likely to be tin, coltan, or associated mineralizations in the rocks.The stratigraphic organization of alluvial profiles P1 and P2 shows five distinct material layers: an organo-mineral layer, a red clay layer, a dark clay layer, a gravel layer, and a basal salo-clayey layer in both boreholes. The alternation of these layers suggests lateral displacement of the riverbed deposits. The cumulative curves display a sigmoid shape, indicating steep slopes and a well-formed curve. The Sorting Index (So), coupled with these profiles, suggests that the sediments are well classified, well sorted, and homometric.The morphoscopic analysis of the coltan and tin grains in the alluvium shows that the grains are predominantly angular (44.67%), sub-angular (33.67%), and sub-rounded (19.67%), while very angular (1.33%) and rounded (0.66%) grains are less represented. This indicates the existence of a proximal source for these minerals. The majority of the tin and coltan grains are believed to originate from the massifs located south of Grand Lac.

KEYWORDS: sediments-morphoscopic-heavy minerals-sequential organization.

REFERENCES:NGUENE (1982). Geological and Geochimical of the Mayo Darle Tin deposit, West-Central Cameroon, Central Africa. These of Doctorat d'Etates Sciences a New Mexico Institute of Mining and Technology Socorro, New Mexico April 1982, 136-140p.

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Posters

☐ *Poster*

INFLUENCE OF SUBSURFACE GEOLOGICAL HETEROGENEITIES ON ROAD CONSTRUCTION : INTEGRATED ANALYSIS OF 2D ELECTRICAL RESISTIVITY IMAGING AND GEOTECHNICAL TECHNIQUES IN A HUMID TROPICAL ZONE (SOUTH CAMEROON, CENTRAL AFRICA).

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Abstract

The economic evaluation of a nation is partly determined by the quality and durability of its road infrastructure. This study, carried out on the topographic positions of a road alignment in southern Cameroon, assesses the influence of subsurface geological heterogeneities on road projects. It incorporates subsurface geoelectric and geotechnical techniques. The results show that at the top and mid-slope, the upper layers have an average bearing capacity of 4.8 bars. The underlying layers consist of sandy clays with an average bearing capacity of 1.15 bar. Further down, the layers vary between 9.9 and 33.4 bar. At the bottom of the slope, the soils have a low bearing capacity. The geoelectrical results show that the superficial layers (700 Ωm) indicate poor mechanical behaviour. Below this, a resistive geological structure is observed (over 2000 Ω.m). The conductive, semi-resistive, and resistive layers show notable spatial variability. Laboratory tests reveal that the materials are silty to sandy clays, with pockets of lateritic gravel and show high sensitivity to water. The classification of materials reveals good performance in road construction. The coefficient of variation of resistivities discretises the subsoil into geoelectric layers. The C.V. > 35% indicates strong heterogeneity at the surface and at depth, with moderate heterogeneity (15% < C.V. > 35%). The joint application of geotechnical and geoelectrical methods reveals the variability of soils both laterally and vertically, providing essential data for adapting them to local road construction and guaranteeing their durability.

Keywords: electrical imaging, geotechnical engineering, heterogeneity, dynamic penetrometer, mechanical sounding.

References:

J.T.D Gonçalves, M.A.B Botelho, S. L Machado, & L.G Netto, (2021), Correlation between field electrical resistivity and geotechnical SPT blow counts at tropical soils in Brazil. *Environmental Challenges*, *5*, 100220.

S. A Ganiyu, M.A Oladunjoye, M.O Olobadola, A. P Aizebeokhai, & B.S Badmus, (2021), Investigation of incessant road failure in parts of Abeokuta, Southwestern Nigeria using integrated geoelectric methods and soil analysis. *Environmental Earth Sciences*, *80*, 1-19.

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DESIGN OF SUITABLE REFRACTORY BRICKS FOR INDUSTRIAL HORIZONTAL ANODES BAKING FURNACES USING CAMEROONIAN LOCAL MATERIALS

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Abstract

This study explores the design of refractory bricks for anode baking furnaces using two raw materials: bauxite (Ba) from Minim-Martap and clay (My1) from Mayouom - Foumban, both located in Cameroon. The Ba and My1 powders were initially calcined at 1500°C before being blended to produce alumina refractory bricks with 70 wt.%, 80 wt.%, and 90 wt.% alumina content. The samples were then sintered at 1400, 1500, and 1600°C. The bulk density (BD), water absorption (WA), and apparent porosity (AP) of the sintered samples were evaluated using the Archimedes water displacement method. As the sintering temperature increased from 1400 to 1600°C, BD rose from 2.01 to 3.36 g/cm³, while WA and AP decreased from 20% to 3% and 31% to 11%, respectively. However, shrinkage increased from 3% to 10%. The modulus of rupture (MOR), determined using the three-point bending test following ASTM C133, improved significantly from 13 to 93 MPa with temperature. The elastic modulus (EMod), assessed via ultrasonic testing with 10 MHz transducers, also increased from 19 to 182 GPa. X-ray diffraction (XRD) analysis confirmed the formation of mullite ($Al_{4.56}Si_{1.44}O_{9.72}$) and corundum ($Al_{12}O_{18}$) as the primary crystalline phases. Scanning electron microscopy (SEM) images at various magnifications revealed a dense and compact microstructure. Optimal results were obtained at 1600°C for 80% alumina refractory bricks, demonstrating enhanced properties that can extend the service life of anode baking furnaces.

Keywords: Refractory, Bricks, Anode, Furnace

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Please check the appropriate contribution:	☐ *Oral*	*or*	✔ *Poster*

FEASIBILITY OF PRODUCTION FIRED BRICKS BASED LATERITIC SOIL AT VERY LOW TEMPERATURE

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Abstract

The present project deals with the production of lateritic soil based bricks under different curing temperatures (28◦C–150◦C). A fraction of 10–30 wt% amount alkaline solution was added to improve the reactive phase content. The raw materials and hardened products were characterized using X-ray diffraction (XRD), fourrier transform infrared spectroscopy (FTIR), mechanical properties and scanning electron microscope analysis. The results show that the addition of alkaline solution (30%) and the curing temperature (150◦C) have a beneficial influence on physical properties (bulk density: 1.77 g/cm3, water absorption: 16.98%, and porosity: 30.13%) and mechanical performances (flexural: 6.61 Mpa and compressive: 13.57 MPa). Compared with the code requirements for stabilized earth blocks, the compressive strength was higher than the minimum required. Microstructural investigations were also carried out to confirm the macrostructural properties. The above-mentioned process appears to be a suitable candidate for engineering applications such as the stabilization of earth roads.

Keywords: alkaline solution, bricks, laterite, microstructure, physico-mechanical properties

References:

1. Mbumbia L, Mertens De Wilmars A, Tirlocq J. Performance characteristics of lateritic soil bricks fired at low temperatures: a case study of Cameroon. Constr Build Mater. 2000;14(3):121–31. https://doi.org/10.1016/S0950-0618(00)00024-6
2. Mbumbia L, Mertens De Wilmars A. Behaviour of lowtemperature fired laterite bricks under uniaxial compressive loading. Constr Build Mater. 2002;16(2):101–12. https://doi.org/ 10.1016/S0950-0618(01)
3. Sontia MJV, Kaze CR, Adesina A, Deutou NGJ, Djobo YNJ, Lemougna NP, et al. Influence of thermal activation and silica modulus on the properties of clayey-lateritic based geopolymer binders cured at room temperature. Silicon. 2022;14:18. https://doi.org/10.1007/s12633-021-01566-7

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On the relationships between the particles size distribution model parameters and the soils fractions and behaviour of termites mound soils.

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Abstract

The Macrotermes spp termite mounds, also called epigeal termite mounds in relation to their shapes, are the most impressive earthen constructions of the termites. Their technical performances give them resistance to precipitation and they often remain for a long time even after the departure of the colony [1]. The particular physico-chemical properties of these termites mound soils and their abundance in certain regions have led to specific traditional uses such as the manufacture of earth bricks [2] [3] , pottery and others. In order to enhance the value of these local materials, these soils have been studied with the aim of determining their geotechnical properties and modeling their granulometric distribution in order to : i) choose the parametric models that best apply to the granulometric curves of the soils studied ; ii) study the link between the parametric values of these models and the granulometric fractions of the soils studied, on the one hand, and between the values of the same parameters and the geotechnical quantities, on the other hand. The methodology that was devoted to this study consisted in carrying out the granulometric analysis by sieving and sedimentometry, in determining the Atterberg limits and the proctor parameters (optimum proctor and dry density) of the soils studied. Eight mathematical models were tested for modeling the granulometric curves of termite mound soils using Origin 8 Pro software. The evaluation of the models was based on the values of the reduced coefficient of determination R^2, the adjusted Chi-square (Chi^2) and the test Akaike Information Criterion (AIC). The results obtained showed that all the mathematical models simulated the granulometric curves well because the coefficient of determination varies between 0.85 and 0.99. However, the best model is that of Yong. The critical size dc of Yong is positively correlated with the medium and coarse sand content of the soils studied, with an adjusted coefficient of determination $R^2 = 0.70$. It should also be noted that there is a link between Yong's dc parameter and the proctor optimum and the plastic limit of soils.

Keywords: Termites mound soils, granulometry, Modeling.

References:

[1] Pascal Jouquet, Saran Traoré, Chutinan Choosai, Christian Hartmann, David Bignell Influence of termites on ecosystem functioning. Ecosystem services provided by termites. European Journal of Soil Biology 47 (2011) 215-222).

[2] Ngoulou, M., Elenga, R.G., Ahouet, L., Bouyila, S. and Konda, S. (2019) Modeling the Drying Kinetics of Earth Bricks Stabilized with Cassava Flour Gel and Amylopectin. Geomaterials, 9, 40-53. https://doi.org/10.4236/gm.2019.91004.

[3] Bouyila, S. Elenga, R., Ahouet, L., Ngoulou, M. and Konda, S. (2019) NaOH Activation of Raw Soils : Effect of NaOH Content on the Drying Kinetic and Its Modeling. Geomaterials, 9, 55-66. https://doi.org/10.4236/gm.2019.92005.

☐ *Poster*

POTENTIALITY OF SOME LATERITIC CLAYEY MATERIAL FROM MEIGANGA AS RAW MATERIAL IN FIRED BRICKS MAKING

NGONO MBENTI Michèle Stella [1*], NTOUALA Roger Firmin Donald [2], KAZE Rodrigue Cyriaque [3], NANGA BINELI Marie Thérèse [1], NGO'O ZE Arnaud [1], ONANA Vincent Laurent [1]

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Abstract

The Meiganga lateritic clays and termite mounds were characterized for their use as construction materials. The six collected samples were subjected to mineralogical, geochemical, and physico-mechanical tests. Quartz, kaolinite, hematite, goethite, gibbsite, muscovite, and anatase are the main minerals in raw materials, while after firing at 1050°C, mullite is formed at the expense of kaolinite. The SiO_2/Al_2O_3 ratio ≈ 1 indicates the relatively abundance of kaolinite. The organic matter and volatile content (4.44–11.54%) induce the development of secondary porosity favorable to producing hollow products. Considering linear shrinkage values globally less than 5% and flexural and compressive strengths greater than 2 and 7 MPa, respectively, four clay materials are suitable to produce bricks at all the studied temperatures, whereas two others only after firing at 1050°C. As the studied characteristics do not depend on the nature of the material, exploring termite mound material in the Meiganga area would provide additional good-quality material to make up for any deficit that might arise.

Keywords: Mineralogy; Porosity; Mechanical characteristics; fired clay bricks; Meiganga.

References:

J.A. Mbey, F. Thomas, A. Razafitianamaharavo, C. Caillet, F. Villieras, A comparative study of some kaolinites surface properties, Appl. Clay Sci. 172 (2019) 135 – 145.

V.L. Onana, R.F.D. Ntouala, J.A. Mbey, A. Ngo'o Ze, V.K. Kabeyene, G.E. Ekodeck, Mineralogy and preliminary assessment of the potential uses of alluvial clays from Batouri (Eastern-Cameroon), Cerâmica 65 (2019)407 – 415.

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Please check the appropriate contribution: ☐ *Oral* *or* ☒ *Poster*

EFFECTIVENESS AND COMPARATIVE ANALYSIS OF RED LATERITIC SOILS AND ROCK DUST IN STABILIZING EXPANSIVE SOILS

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Abstract

Civil engineers confront difficulties with expansive soils like Dark Magnesium Clay (DMC), a soil type present on the island of Mauritius, due to its tendency to shrink and swell. This may result in structural instability and expensive repairs. [5] Lime and cement stabilization techniques are effective but costly and harmful to the environment. This study evaluates Rock Dust and Red Soil for the stabilization of expansive soils with no additional value, aiming for an environmentally sustainable and economical solution. [3] The geotechnical properties of the soil improved significantly. Research experiments according to BS 1377 standards were conducted to assess changes in the geotechnical characteristics of soil mixtures containing varying quantities of these additions.[4] The Free Swell Index (FSI), indicative of expansive activity, decreased from 131.58% in untreated DMC to 105.56% with 10% Rock Dust and 60.95% with 50% Rock Dust. The incorporation of Red Soil decreased FSI from 131.58% to 90.00% at 30% and to 85.00% at 50%. Increased additives lowered Plasticity Index (PI). Rock Dust enhanced the PI from 30.8% to 39.7% at 50% additive concentration, indicating stability. The Plasticity Index (PI) reduced in Red Soil. With more Rock Dust and Red Soil, Maximum Dry Density (MDD) rose, suggesting a more compact particle structure. The Optimum Moisture Content (OMC) dropped from 33.3% at 0% additive to 22.1% at 30% Red Soil, indicating less compaction moisture. At 50%, the OMC rises to 33.75%, indicating rehydration or soil structural changes. Rock Dust additions' OMC dropped from 15% to 12%. Rock Dust shows clay mineral exchange cations and pozzolanic reactions. [1];[2]

Sustainable zero-value additions for widespread soil stabilization, best stabilization materials, and cost-effective geotechnical solutions improve soil performance and reduce environmental impact.

Keywords: Expansive, Additive, Dark Magnesium Clay, Swelling characteristics, Zero-value

References: [1] Rajeshwar G, Anoop A, Aqiil S, Harshini S, Goodary Y. Effect of Rock Dust on the Geotechnical Properties of Dark Magnesium Clay, 2022. https://doi.org/10.11159/iccste22.186.
[2] Reddy NG, Tahasildar J, Rao BH. Evaluating the Influence of Additives on Swelling Characteristics of Expansive Soils. Int J of Geosynth and Ground Eng 2015;1:7. https://doi.org/10.1007/s40891-015-0010-x.
[3] Goodary R, Adriamalala M, Beeharry R, Aujayeb A. Stabilisation of Volcanic Dark Magnesium Clay using Lime, 2017. https://doi.org/10.11159/icgre17.192. [4] British Standards BS 1377, Methods of tests for soils for civil engineering purposes, 1990. [5] K.S. Subba Rao, 2000. Swell-Shrink Behaviour of Expansive Soils - Geotechnical Challenges. Indian Geotechnical Journal, 30 (1).

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ST4 – Céramiques poreuses et réfractaires

Posters

Please check the appropriate contribution: ☐ *Oral* *or* ☐ *Poster*

DESIGN AND CHARACTERIZATION OF A POROUS CERAMIC FOR HIGH PRESSURE FILTRATION AND PURIFICATION AT MODERATE TEMPERATURE

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Abstract:

Porous ceramics, known for their high porosity and interconnected pore structures, are ideal for filtration and purification applications. This study focuses on creating high-performance porous ceramics from locally sourced clay materials, targeting high-pressure filtration and purification of bore-hole water, wastewater, and water/oil emulsions at moderate temperatures. The primary production methods include die casting and molding, while techniques such as particle-stacking sintering, foaming agents, gel casting, sol-gel processes, polymeric sponge methods, and freeze-drying can achieve the desired porosity and pore structures. These ceramics effectively retain heavy metals, bacteria, and viruses while reducing water turbidity. Raw material selection is critical; for example, Barry et al. achieved 67–79% porosity using freeze-tape casting, Manni et al. reached 30.2–63.8% porosity with Moroccan clay and coffee waste, and Maury Njoya et al. achieved high permeability using kaolinite clay and peanut shells. This study combines clay with organic pore generators—peanut shells, sawdust, and cassava starch—in varying proportions (10% to 40%) to produce ceramics, which are molded and fired at different temperatures. Analytical techniques, including flexural and compressive strength tests, porosity measurements, and permeability assessments, will evaluate the ceramic's efficiency. The as-obtained porous ceramics are expected to exhibit 40% to 70% porosity and compressive strengths of 2 to 10 MPa, making them suitable for household water filtration, air filtration systems, and membrane separation technologies...

Keywords: Porous Ceramics, High pressure Filtration, Purification, raw materials, Pore-forming agent

References:

1 Barry, K.; Lecomte-nana, G.L.; Seynou, M.; Faucher, M.; Blanchart, P.; Peyratout, C. Comparative Properties of Porous Phyllosilicate-Based Ceramics Shaped by Freeze-Tape Casting. Ceramics 2022, 5, 75–96

2 Maury Njoya, I.Q.; Lecomte-Nana, G.L.; Barry, K.; Njoya,D.; El Hafiane, Y.; Peyratout, C. An Overview on the Manufacture and Properties of Clay-Based Porous Ceramics for Water Filtration.Ceramics 2025, 8, 3. https://doi.org/10.3390/ceramics8010003

3 A Manni et al Valorization of coffee waste with Moroccan clay to produce a porous red ceramic (Class BIII) https://doi.org/10.1016/j.bsecv.2019.03.001

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Please check the appropriate contribution: ☐ *Oral* *or* ☒ *Poster*

Properties of ceramic membranes obtained from kaolinitic clay mixed with palm and mango wastes from Cameroon: Application to wastewater treatment from breweries.

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This work focuses on the development of new ceramic membranes based on mixtures of low cost and locally available raw materials as kaolinitic clay and additives such as palm kernel shells and mango seed shells, used as pore-forming agents to increase pore size, and also on their efficiencies in rejecting organic and inorganic pollutants from brewery wastewater. The physical and chemical properties of raw materials were characterized (XRD, SEM, DTA/TG, EDX and FTIR). Sintering was performed at 1100°C, the permeability and mechanical properties of circular membranes was determined. The membrane filtration operation was used to assess the physicochemical parameters of the wastewater. The membrane composed of 85 % kaolinite, 15 % mango seed shells showed the best performance. The effective treatment of the breweries wastewater reduced the level of contamination by organic pollutants in the discharge water, with a reduction in concentration from 700 to 14 mgO_2/L of COD (Chemical Oxygen Demand) and 250 to 06 mgO_2/L of BOD_5 (Biological Oxygen Demand for 5 days), representing removal efficiency of 98 % and 97.6 % respectively. The treated water is alkaline, with a reduction in pH from 10.79 to 7.77. Suspended matter, turbidity and electrical conductivity had removal rates of 88 %, 90.6 % and 99.8 % respectively. A significant reduction in the salinity of this wastewater contributed to a sodium and chloride ion rejection rate of 93 % and 79 % respectively, an important result for good reuse of the treated water in agriculture and domestic work.

Key words. Kaolinite clay, pore-forming agents, ceramic membranes, brewery wastewater.

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ST5 – Matériaux composites et biosourcés

Posters

Please check the appropriate contribution: ☐ *Oral* *or* ■ *Poster*

Microwave Assisted Extraction of Mucilage from the Pods of *Abelmoschus esculentus*: Influence of extraction time on structure and physico-chemical properties

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Abstract

Okra mucilage has shown great promises for the food, pharmaceutical and health-care industries. Different extraction procedures of the mucilage, with an influence of the extraction procedure on the properties of the mucilage have been reported throughout the years. However, to exploit the full potential of okra mucilage as a functional ingredient, it is pivotal to know if variations in an extraction method's parameters influence the okra mucilage properties. Herein, okra pod mucilage (OPM) was extracted using microwave assisted extraction (MAE) at 320W with different extraction times (1-4 min) and hot water-assisted extraction (HWE). Thereafter, OPMs were characterised by infrared spectroscopy (FTIR), evaluation of the degree of esterification (DE), solubility and pH in polar solvents (distilled H_2O, EtOH and DMSO). On the organoleptic properties, the OPMs exhibited a pleasant smell characteristic of sugars. The FTIR spectra confirm the presence of bands characteristic of OPM polysaccharides and the values of DE (6.46 – 9.87%) suggest an influence of the microwave treatment time on the esterification rate. The obtained OPMs had contrasting solubility (52-86% in distilled H_2O, 4-46% in EtOH, 0-58% in DMSO) and pH (4.62-7.42 in distilled H_2O, 6.07-6.86 in EtOH, 6.07-6.69 in DMSO) owing to influence of MAE time on the structural characteristics of OPM polysaccharides. This study shows that a variation in MAE time influences the structural and physicochemical properties of OPM polysaccharides. This can be used to extract OPM with tailored properties for specific applications in different industrial fields.

Keywords: Okra pod mucilage, degree of esterification, microwave extraction time, solubility, pH.

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Please check the appropriate contribution: ☐ *Oral* *or* ☐× *Poster*

Thermomechanical performance of biosourced materials based on cement and plaster with variable typha content for housing.

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Abstract : Poster

Eco-materials are promising materials for achieving the sustainable development goals set by the United Nations by 2030. Bio-sourced materials in construction improve thermal performance in buildings. They reduce energy demand and carbon emissions. In this article, we present the results of the thermal and mechanical characterization of different samples based on cement and plaster with the addition of typha fibers in different proportions. Thus, after performing mechanical tests on the different composite matrices (cement typha and plaster typha) using tensile and compression presses, a thermal characterization using the asymmetric hot plate method allowed us to determine the thermal conductivities of the matrices with different components: 0%, 10%, and 20% typha proportions. With these thermal and mechanical results, we used them to study their conductivities, diffusivities, thermal resistances, tractions, and compressions based on their densities. In addition, we compared their thermophysical and mechanical performances to understand the effectiveness of each composite material for its application in the built environment.

Keywords: characterization, thermal, mechanical, typha cement, typha plaster, conductivity, diffusivity, thermal resistance, traction, compression, and density

ST6 – Valorisation des déchets, recyclage et éco-matériaux

Posters

CGCA International Conference on Ceramics and Geomaterials in Central Africa

GRAAL EMC2 JRP CNRS-AFRIQUE CÉRAMIQUES POREUSES DURABLES CAMEROUN

CACerS Composites and Advanced Ceramics Society

Please check the appropriate contribution: ☐ *Oral* *or* ☐ *Poster*

TITLE: Activation of volcanic ash as support for FeOx gliding arc plasma deposition and application in the catalytic oxidation of Rhodamine 6 G.

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Abstract

This study reports the chemical activation of volcanic ash (VA), a local material to promote the subsequent deposition of FeOx nanoparticles through a gliding arc plasma-assisted route to obtain an efficient Fenton catalyst for a better degradation of Rhodamine 6 G in aqueous solution. Plasma-oxidation of Fe (II) solution within the pores of activated VA was performed, then followed the maturation of crystallites (deposited precipitated) thanks to plasma post-discharge species. The obtained materials were characterized by Fourier transform Infrared spectroscopy (FTIR) in transmission mode, X-ray diffraction (XRD), Nitrogen Physisorption, Thermogravimetric analyses, Scanning electron microscopy (SEM) and Energy Dispersive X-ray spectroscopy (EDX). The acid activation of volcanic ash for 2 h (AM-2) using H_2SO_4 solution, followed by gliding arc plasma-assisted hydrolytic precipitation of Iron oxide during 30 min (AM-FeOx-30/0) significantly decreased the size of agglomerates particles of VA, leading to the increase by two orders the magnitude the total pore volume as well as the specific surface area. SEM and EDX analyses attested to the incorporation of Fe within the activated volcanic ash framework. The studies also show that plasma-deposited iron oxide nanoparticles are located within different phases of VA. For the obtained AM-FeOx-30/0 material after 30 min of gliding arc plasma deposition on activated VA, Iron oxides are located within the Augite and Goethite phases. While, for the material obtained after plasma-deposition (30 min) followed by ageing at 100◦C through a water boiling bath for 4 h (AM-FeOx-30/4), Iron oxides are located within sodium Diopside and Goethite phases. Fenton catalytic activity of the different materials was evaluated for degradation of Rhodamine 6 G and revealed degradation degrees of 31, 95, 79, and 80 % respectively for VA, AM-2, AM-FeOx-0/2 and AM-FeOx-30/4 in the optimum condition (t=20 min, pH=7, [catalyst]=3 g/L, [Rh6G] = 25 mg/L, 1 mL of H_2O_2 at 30 %. Recyclability tests confirmed the stable catalytic activity of plasma-supported material after 4 runs. These results highlight the valorisation of volcanic ash for the improvement of Fenton catalytic degradation of organic pollutants in solution.

Keywords: Iron oxides, Volcanic ash, Plasma-precipitation, Heterogeneous Fenton, Supported catalyst, Hetero-structure

References: [1] A. Tiya Djowe, E. Acayanka, A.P. Mbouopda, F.W. Boyom-Tatchemo, S. Laminsi, E. M. Gaigneaux, Producing oxide catalysts by exploiting the chemistry of gliding arc atmospheric plasma in humid air, Catal. Today 334 (2019) 104–112. [2] A. Tiya Djowe, P.N. Lemougna, A. Emadak, M. Pitap Mbowou, S. Laminsi, U. C. Melo, taking advantage of iron contained in natural volcanic ash for catalytic degradation of Rhodamine 6G *Surf*, Interfac.

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Please check the appropriate contribution: ☐ *Poster*

COMPARATIVE STUDY OF THE EFFECTS OF EGGSHELL ASH AND SNAILSHELL ASH ON A GEOPOLYMER BINDER

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Abstract

The aim of this work is to compare the effect of eggshell ash and snailshell ash on metahalloysite-based geopolymers from the Balengou halloysite. The raw materials were sieved and calcined at 75 µm and 750°C for the halloysite and 80 µm and 900°C for the shells. The geopolymers were prepared using a mixture of aqueous sodium hydroxide solution (10M) and commercial sodium silicate mixed in a ratio of 1/2 as the activating solution. During the preparation of the geopolymers, the ratio L/S = 0.83 was used for substitutions of up to 20% of metahalloysite by shell ash, then the ratio L/S = 1 was used for substitutions of up to 35% of metahalloysite by shell ash. The final products obtained were characterised at 28 days of age by infrared spectroscopy, compressive strength, flexural strength, porosity, absorption, density, stability in water and resistance to acid attack by H2SO4. The results show that some of the products have better mechanical strengths than the control geopolymer. The variation in the masses of the geopolymers observed in the two cases of substitution from the first days to the ninety (90) days showed us that the geopolymers are stable in water. Observation of the resistance to H2SO4 acid attack of the geopolymers in the two substitution cases showed that for concentrations greater than 1, they swelled after 24 hours immersed in the acid solutions; whereas for concentrations less than or equal to 1, swelling was observed after 72 hours.

Keywords: geopolymer, halloysite, metahalloysite, eggshell ash, snail shell ash.

Please check the appropriate contribution: ☐ *Poster*

TITLE: PHYSICAL CHARACTERISATION AND USE OF QUARTZITES AS AN INPUT IN THE MANUFACTURE OF CERAMIC TILES: THE CASE OF SA'A QUARTZITES

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Abstract

The potential for using quartzite residues as a raw material in the composition of an industrial ceramic mass for the production of ceramic tiles was studied by means of an experimental design. Physical and mechanical tests were carried out to determine whether quartzite platelets from the Sa'a area have good properties for use as wall tiles. The variable responses to tests on water absorption (0.91%), porosity (2.39%), compressive strength (104.8 MPa), flexural strength (8.65 MPa) and abrasion resistance (185.02 cm2/g) attest to the quality of Bek Group Sarl cladding tiles. Similarly, tests on the raw materials revealed that the clay used has good plasticity, making it suitable for the production of ceramic tiles. A composite plan of formulations was used to analyze the effects of the residue content (10; 20; 30%) on the physical-mechanical and geotechnical properties of the specimens. The presence of residues had no significant effect. In conclusion, the specimens containing 10% quartzite residue and sintered at a temperature of 1100°C meet the requirements of the ISO 13006 standard for ceramic tiles.

Keywords: Quartzite, characterization, formulation, coating tiles, ceramic tiles .

References: [1] Muller,A, Wanvik, E J, and Kronz A 2005 Norwegian kyanite quartzitzs- potential ressources of hight purity quartz. Report, Geological Survey of Norway NO-7491 Trondheim,Norway,69p. [2] Jodicke H, Nover G, Kruhl H J and Markfor R 2007 Electrical Properties of a Graphite-rich Quartzite from a Former Lower Continental Crust exposed in the Serre San Bruno, Calabria (Southern Italy). Phy. Earth Sciences. Third Edition, Oxford University Press Inc., New York 654p.

Please check the appropriate contribution: ☐ *Oral* *X Poster*

VALORIZATION OF END-OF-LIFE TV SCREEN POWDER IN THE FABRICATION OF KAOLINITIC CLAY-BASED CERAMIC BUILDING MATERIALS

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The rapid growth in the production of electrical and electronic equipment (EEE) and their short lifespans have led to an increase the volume of waste generated from these devices (WEEE). Due to the presence of hazardous substances (e.g., PbO) contained in television screens, their end-of-life may result in environmental problems if they are not properly treated [1]. This work aims to propose a solution for the valorization of these wastes in the production of ceramic building materials. They are produced from a blend of kaolinitic clays (MY3 and KG) from Western Cameroon [2] and end-of-life TV screen powder (ETV). The proportions of ETV used range from 0% to 20% by mass, with a MY3/KG mass ratio of 2.33. The ceramic substrates are obtained by uniaxial pressing at 22 MPa and drying at 100°C for 24 hours for the various formulations. The thermal treatment was carried out at 1200°C with a 2-hour dwell time. The main properties measured include linear shrinkage, corrosion resistance, microstructure (porosity, consolidation), and mechanical properties.

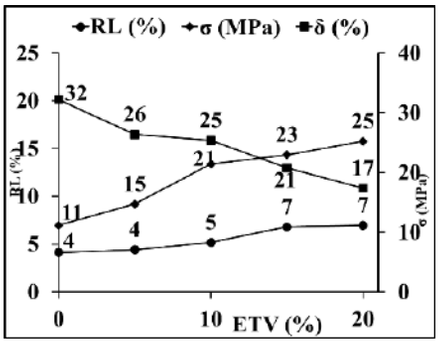

Fig 1. Variation of shrinkage (RL), porosity (δ), and mechanical strength (σ) as a function of the % of ETV.

The results indicate that the ceramics formulated with TV screen powders exhibit enhanced resistance to mechanical shock. Increasing the ETV content contributes to the consolidation of the ceramic matrix. The measured values range from 11.2 MPa (0% ETV) to 25.2 MPa (20% ETV). The observed linear shrinkage is relatively low and increases with the ETV content, varying from 4.1% (0% ETV) to 7.0% (20% ETV). Porosity progressively decreases with increasing ETV content, ranging from 32% (0% ETV) to 17% (20% ETV). Scanning electron microscopy (SEM) images reveal porous surfaces dominated by open cavities that can be interpreted as cracks. Despite the low shrinkage, the addition of ETV contributes to the consolidation of intergranular contacts and, consequently, to an improvement in the mechanical properties of the produced ceramic materials.

Keywords: Waste Valorization, End-of-Life TV Screens, Kaolinitic Clays, Ceramic Building Materials

Références :

[1] Ausset S. (2013) Procédé de recyclage de mélanges ABS-PC issus de déchets d'équipements électriques et électroniques (DEEE). Thèse Doctorat, Université Sciences et Technologies - Bordeaux I, France.
[2] Mouafon M., Lecomte-Nana G. L., Tessier-Doyen N., Njoya A., Njoya D. & Njopwouo D. (2021) Processing and characterization of low-thermal conductivity, clay-based ceramic membranes for filtering drinking water. Clays and clay Minerals, 3, 339-353.

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Oral

Optimization of the production of Bio-oil and Bio binder from Palm Kernel Shell (PKS) through Microwave Vacuum Pyrolysis for Bio Asphalts Application

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Abstract

In this research, Bio oil and Bio binder were produced and optimized from the valorisation of Palm Kernel Shells (PKS) using Microwave Vacuum Pyrolysis. PKS is an enclosed shell obtained as residue from processing palm kernel. After prior preparation of our biomass material the optimization of the production of bio-oil and bio binder was done by the study of the influence of some factors on the bio-oil yield during pyrolysis using the response surface methodology and more precisely the Centered Composite Design. The results of the physical Characterisation of PKS analysis gave a high volatile organic matter content of 62.32%, water content of 5.45% and its general high lignin level makes it's a good raw material for bio-oil production. Also, the FTIR results of the PKS indicated the presence of phenols, alcohols and Carboxylic acids. The optimum bio-oil yield was 43.7wt% obtained at the optimum microwave power of 715KW, pyrolysis time of 42 min and a bio absorber content of 40% and that of bio binder was and 37.85wt% obtained at optimum microwave power of 717KW, pyrolysis time of 13 min and a bio absorber content of 45 %. The water content of the bio-oil resulted to 50.04 wt. %. The optimum bio-oil was characterized with FT-IR revealed that the peak of 3339.7, 1416 cm^{-1} attributed to O–H stretching vibrations depicted the presence of alcohol and carboxylic acids, respectively. The most significant element in the bio-oil and bio binder obtained via Gas Chromatography–Mass Spectrometry (GC–MS) are Phenol and alkyl phenols such as 3-methyl phenol. Carboxylic acid; Hexadecanoic acid, 6-octadecenoic acid and oleic acid were identified in both samples. This bio binder obtained from bio-oil will be applied in the production of bio asphalts hence this will reduce the consumption of petroleum asphalts and the reduction of environmental pollution caused by the slow degradation of PKS.

References

1. Rafat Hossain, M., Ganesan, P., Jewaratnam, J., & Chinna, K. (2017). Optimization of process parameters for microwave pyrolysis of oil palm fiber (OPF) for hydrogen and biochar production. *Energy Conversion and Management*, *133*, 349–362. https://doi.org/10.1016/j.enconman.2016.10.046
2. Boubacar Laougé, Z., Çığgın, A. S., & Merdun, H. (2020). Optimization and characterization of bio-oil from fast pyrolysis of Pearl Millet and Sida cordifolia L. by using response surface methodology. *Fuel*, *274*(December 2019). https://doi.org/10.1016/j.fuel.2020.117842
3. Okokpujie, I. P., Onokwai, A. O., Onokpite, E., Babaremu, K., Ajisegiri, E. S. A., Osueke, C. O., Akinlabi, S. A., & Akinlabi, E. T. (2023a). Modelling and optimisation of intermediate pyrolysis synthesis of bio-oil production from palm kernel shell. *Cleaner Engineering and Technology*, *16*, 100672. https://doi.org/https://doi.org/10.1016/j.clet.2023.100672
4. Okokpujie, I. P., Onokwai, A. O., Onokpite, E., Babaremu, K., Ajisegiri, E. S. A., Osueke, C. O., Akinlabi, S. A., & Akinlabi, E. T. (2023b). Modelling and optimisation of intermediate pyrolysis synthesis of bio-oil production from palm kernel shell. *Cleaner Engineering and Technology*, *16*(July), 100672. https://doi.org/10.1016/j.clet.2023.100672

Keywords: Palm kernel shell, bio-oil, bio binder, Optimization, Microwave Vacuum Pyrolysis

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Please check the appropriate contribution: ☐ *Oral* *or* ■ *Poster*

Physico-mechanical and mineralogical characterization of lime-stabilized clay materials from the Soudano-Sahelian zone of Cameroon (Yagoua, Djidoma and Datchéka Doubangou)

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Abstract

The aim of this study was to carry out a physical-mechanical and mineralogical characterisation of lime-stabilised blocks of clay materials from the Far North of Cameroon, in the localities of Yagoua (SY1), Djidoma (SDj) and Datchéka Doubangou (SDo). The study looked at compressive strength, apparent density, apparent porosity, water absorption, linear shrinkage, X-ray diffraction and infrared spectrometry. The formulated blocks were stabilised at 6, 8, 10 and 12% and cured at 21, 28, 100 and 365 days. After curing, physical-mechanical and mineralogical tests were carried out on the specimens. The physical tests focused on the apparent densities, which showed increasing results as a function of the stabiliser content and curing; they ranged from (1.40 - 1.90) for SY1 and SDj to (1.50 - 1.90) for SDo. Apparent porosity, linear shrinkage and water absorption showed decreasing results as a function of stabiliser content and curing time. Compressive strengths exceeded 2 MPa at 28 days in accordance with the Cameroonian standard for BTS. An increase in compressive strength can be seen as a function of the stabiliser rate and the curing time at 28 days, 100 days and 365 days. The values at 28 days are between (2.39 - 2.76 MPa) for SY1; (2.30 - 2.80 MPa) for SDj and (2.40 - 3.40 MPa) for SDo in wet compression. With regard to dry compression, the strength values increase significantly. At 365 days, values of: (8.33 - 12.56 MPa) for SDo; (7.33 - 13.71 MPa) for SDj and (12.51 - 15.01 MPa) for SY1 in wet compression. XRD mineralogical analysis of powder shows the appearance of new mineral phases: calcite, portlandite, thaumasite, stratlingite, Ettringite, Ankerite, C3S, vaterite and CA. These results are confirmed by Fourier transform infrared analysis, with the appearance of the new 2929 and 2848 cm-1 vibration bands linked to CH bonds and the vibration band around 1425 cm-1 characteristic of the carbonate formation (calcite).

Key words: Clay materials, bulk density, compressive strength, mineralogy

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Please check the appropriate contribution: ☐ *Oral* *or* ● *Poster*

EFFECTS OF CHEMICALLY TREATED COCONUT FIBERS ON THE HYDRIC, PHYSICO- MECHANICAL AND THERMAL PROPERTIES OF PLASTER MATERIALS RESULTING FROM HYDRATED CLAY-LIME MIXTURES

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Abstract

The present study investigated the use of coconut fibres derived from agricultural waste, treated with a sodium bicarbonate solution, to enhance the propertles of thermal insulating plasters made from hydrated clay-lime mixtures. The investigation focused on the effects of treated fibres on the hydrie, physico-mechanical, and thermal properties of the plaster. Plasters were prepared using clay stabilized with 4 wt% hydrated lime and varying proportions of treated coconut libres (0, 2, 4, 6, 8, and 10 wt%). Flexural strength, compressive strength, and hydric tests were conducted on the samples. The results revealed that the inclusion of 4% trented fibres yleided the highest compressive strength of 13.11 MPa. Additionally, the use of coconut fibres treated with a 5 M sodium bicarbonate solution Improved the thermal conductivity to 0.31 W/mK. compared to 0.6 W/mK for samples without fibres. These findings demonstrate that chemical treatment of fibres significantly enhances both the mechanical and thermal properties of the plaster, suggesting its potential for eco-friendly construction applications.

Keywords: Clay, Treated coconut fiber, Marble waste, Plaster, Mechanical and thermal insulating properties

References:

[1] Barbero S et al (2014) Analysis on existent thermal insulating plasters towards innovative applications: evaluation methodology for a real cost-performance comparison. Energy Build 77:40–47.

[2] Andiç-Çakir Ö et al (2014) Physical and mechanical properties ofrandomly oriented coir fiber–cementitious composites. Compos Part B: Eng 61:49–54.

[3] Sivakumar Babu G, Vasudevan A (2008) Strength and stiffnessresponse of coir fiber-reinforced tropical soil. J Mater Civ Eng 20(9):571–577.

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Posters

Please check the appropriate contribution: ☐ *Poster*

Application of augmented simplex-centroïd mixture design in developing and optimizing new low-cost microfiltration membranes from clays and cassava peels for bacteria removal

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Abstract

The sharp increase in waterborne diseases due to bacterial contamination is limiting the supply of safe water in developing countries. This study focuses on the development and optimization of a low-cost ceramic membrane based on natural resources and local waste for eliminating bacteria from water. The augmented simplex centroïd mixture design (ASCD) was used. The obtained optimal formulation consisted of 65% Ebebda clay (EB) 18.64% Koutaba clay (KG), and 16.34% cassava peel (PM) with a holding temperature of 1100°C. The raw materials and membrane were characterized by chemical analysis using X-ray florescence, X-ray diffractometry, Thermal Gravimetric/Differential Scanining Calorimetry (TG/DSC), FTIR, scanning electron microscopy, SBET, porosity and flexural strength. The optimal membrane has 43.26% of porosity, 7.46 MPa of strength, 0.55 m^2/g of specific surface area, an average pore diameter of 1.31 µm and a water permeability of 4 345,87 $L\ h^{-1}\ m^{-2}\ bar^{-1}$. The ability of the membrane support to retain Pseudomonas aeruginosa, Klebsiella pneumoniae, Salmonella sp and Staphylococcus aureus bacteria present in contaminated water was finally assessed. Retention tests showed 100% of P. aeruginosa, 97.37% of K. pneumoniae, 93.69% of Salmonella sp, and 90% of S. aureus, making this new, less expensive ceramic membrane a potential candidate for the water treatment.

Keywords: Bacteria retention, cassava peels, ceramic membranes, kaolinitic clays, optimization more

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Digital Study of substitution of aluminum by iron in the formation of ferro kaolinite and molecular dynamic of their alkaline activation

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Abstract

The substitution of aluminum ions in octahedral layer and potentially silicon ions in tetrahedral layer is the physico-chemical phenomenon which leads to the formation of the disordered structure of laterite, disordered structure which explains its alkaline activation at low temperature. Molecular dynamics modeling and simulations were used to understand the reaction mechanisms during alkaline activation in order to explain the physicochemical properties of the geopolymers obtained. Kaolinite n [$2SiO_2.Al_2O_3.2H_2O$] (n=10) was modeled with AVOGADRO software, aluminum atoms were progressively substituted by iron atoms and then the energies and iron oxide percentages of the structures obtained were calculated. Among the twenty (20) structures obtained, the structures corresponding to the substitutions of 9 and 16 aluminum atoms by iron in the simulation box correspond to the approximate structures of the Northern laterite $20SiO_2.5Al_2O_3.AlFeO_3.4Fe_2O_3.20H_2O$ and that of the Center $20SiO_2.2Al_2O_3.8Fe_2O_3.20H_2O$ respectively. Calculations showed that these substitutions lead to Ferro kaolinites containing 23.55% and 42.05% of Fe_2O_3, a percentage very close to that of iron oxide Fe_2O_3, obtained by chemical analysis which were 24.00% and 42.50% respectively for the Northern and Central laterite. Then, the molecular dynamics of alkaline activation was simulated using the AMSJobs software. These results explain the increasing values of compressive strength obtained in geopolymers, ranging from 0.63 MPa for the kaolin-based material to 1.88 MPa for the Northern laterite-based geopolymer and then 6.25 MPa for the Center laterite-based geopolymer. The digital interpretation of these sequences leading to laterites is crucial for developing practical applications, particularly in the durability of construction materials.

Keywords: Molecular dynamics, digitalization, ferro-kaolinite, alkaline activation

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