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Elaboration of chitin nanogeopolymer spheres in treatment by adsorption of mining wastewater

Currently, water treatment is achieved by using complicated treatment processes that are relatively expensive and heavily reliant on disinfection by chlorine, a chemical that is detrimental to health. According to the UN's sustainable development goals, preserving natural resources will have positive impacts on living conditions by reducing diseases. Access to drinking water is a growing concern worldwide.

In this study, inspired by the natural defense mechanism that species such as crustaceans employ to kill pathogens and cover themselves with a compound called chitin (/ˈkaɪtɪn/), novel nanoscale geopolymer spheres were developed and applied in the treatment by adsorption of mining wastewater.

Chitin nanogeopolymer (CNG) spheres were immobilized with sodium alginate to synthesize alginate chitin nanogeopolymer spheres (Alg/CNG). Nanocomposite geopolymer material was characterized and the mineralogical composition, surface analysis, and microporous structure were shown. The adsorption parameters influencing the process were investigated in batch mode. The obtained results showed that the adsorption capacity of Pb(II) ions increased with time and equilibrium was reached after 40 min. The optimum adsorption pH was 6.67. The experimental results showed that the adsorption equilibrium of Pb (II) on Alg/CNG was well described by the Freundlich and Langmuir models whereas the adsorption rate was well fitted by the pseudo-second-order kinetic model. The maximum adsorption capacity obtained from the Langmuir isotherm was qmax = 578.88 mg.g-1.

Compared with other adsorbents, Alg/CNG exhibited a greater sorption capacity confirming that chitin nanogeopolymer (CNG) can be suitable for the removal of heavy metals in mining wastewater. Low-cost materials from crustacean shells, rice husk, and sugarcane bagasse can be processed to develop new water treatment filtering products to achieve a realistic alternative to existing technologies accessible to both developed and developing countries.

Keywords: Chitin nanogeopolymer spheres; Synthesis/characterization; mining wastewater; Adsorption; Modeling.

Biography:

Dr. Jacques Romain Njimou, obtained a B.Sc. and M.Sc. in Chemistry in Cameroon followed by a joint Ph.D. in Chemical Engineering and Inorganic Chemistry at La Sapienza Rome -Italy and Yaounde 1-Cameroon.

Dr. Jacques is a Senior Lecturer at the University of Ngaoundere. He has been selected for various grants including Erasmus in Rome, TATA-Fellowship in India, Volkswagen Foundation in Germany, Eugen-Ionescu in Romania, and Fulbright at the Indiana University of Pennsylvania (IUP).

His research focuses on nanodsorbents and nanocomposites to control the filtration of contaminants, drug release kinetics, electrochemical sensors in energy storage, and molecular encapsulation.

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