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STEEL SLAG INDUSTRIAL WASTE SOLID RECYCLING AS SUPPORT MATERIAL OF Fe-Cu AND Al-Cu OXIDE NANOPARTICLES FOR ENVIRONMENTAL APPLICATIONS

Alien/Blanco Flores[1, 2], Arteaga-Larios/Nubia[2], Israel/Rodriguez-Torres[2], Maria/Ojeda- Escamilla[2], Helen Paola/Toledo Jaldin[3], Victor Sanchez Mendieta[4] and Alfredo Rafael/Vilchis Nestor[4]

[1]Ingenieria Mecanica, Tecnologico de Estudios Superiores de Tianguistenco, Mexico
[2]Instituto de Metalurgia, Universidad Autonoma de San Luis Potosi, Mexico
[3]Posgrado en Ciencia de Materiales, Universidad Autonoma del Estado de Mexico, Mexico
[4]Centro Conjunto de Investigacion en Quimica Sustentable UAEM-UNAM, CCIQS, Mexico

A steel slag waste from Cuba and Mexico metallurgy industries (SSC and SSM respectively) were used for Fe-Cu and Al-Cu nanoparticles deposition to synthesize a nanocomposite by a chemical reduction method. These are studied as adsorbent materials in the fluoride and malachite green dye adsorption. The solid wastes and nanocomposites were characterized by TEM, SEM, FT-IR, XRD and BET techniques. The nanoparticles were formed as bimetallic oxides. These were embedded in various shapes particles forming agglomerations, onto steel slag surfaces. The sizes of these particles range from 1-3 nm and 6-20 nm for SSM and SSC respectively. XRD showed the presence of phases related with Cu and Fe species. The Cu moieties concentration was higher than Fe. The deposition of Al on the surface was higher than that of Cu. The formation of copper aluminum oxides and Al-Cu alloys and amorphous phases were identified in the XRD difractogram. The malachite green adsorption kinetic indicated physisorption and chemisorption as the main mechanisms of adsorption in nanocomposites. The adsorption capacity was 88.26 and 63.55 mg/g for Cuban and Mexican nanocomposites (SSW/Fe-Cu and SSB/Fe-Cu respectively). The fluoride adsorption kinetics was better described using the second-order model, pointing to chemical adsorption. The Langmuir-Freundlich model best describes the adsorption process, which occurred by a combination of mechanisms, such as electrostatic interactions between the ions involved in the process. The maximum adsorption capacity was 3.99 and 1.67 mg/g for Cuban and Mexican nanocomposites (SSW/Al-Cu and SSB/Al-Cu respectively). The characteristics of waste conditioned the formation of nanoparticles. The reuse of steel slag waste is possible as support materials of different kind of bimetallic nanoparticles.

blancoflores81@hotmail.com
alien.blanco@test.edu.mx