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Development of New Nanomaterials and Nanocomposites for Environmental Protection

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Extended Abstract

Development of new materials for environmental protection represents a prime research area all-over the world, as the need for clean water is continuously increasing. Among the different methods for decontamination of polluted water, adsorption represents one of the easier methods to scale-up, with minimum energy consumption or other associated costs. The present work aims to describe the progress in the development of inorganic materials [1 -3] and organic/inorganic nanocomposites [4] towards the adsorption of inorganic pollutants, achieved by our group. The developed materials have as main component the apatitic materials, which were proven to have superior adsorption capacity towards different types of both organic and inorganic pollutants [4, 5].

In the same time, the materials developed were tested in pilot scale installations, in order to validate the applications of the materials in real life conditions, which revealed the main draw-back regarding the large-scale application of this type of materials, respectively the formulation of stable forms to be used in large columns experiments.

Several types of materials were proposed and evaluated for environmental protection applications. The composite material formed from an organic phase, namely pectin obtained from vegetable wastes, and an inorganic phase formed from apatitic material of hydroxyapatite type in which calcium has been displaced by magnesium, was evaluated for the adsorption of heavy metals from aqueous solutions (the results suggesting an amount of adsorbed pollutant/gram of adsorbent (qe) of more than 500 mg/g for lead adsorption and of more than 350 mg/g for cadmium adsorption, under optimized conditions). Pure hydroxyapatite was also evaluated for the application in pilot scale installations. In order to use the apatite material in continuous-flow experiments, it is necessary to condition it in granular form. Several ways of obtaining these granules were considered, and the use of polyvinyl alcohol as a binder was finally selected, due to its safety in use with regard to human health and the environment. The experiments performed revealed an amount of adsorbed pollutant/gram of adsorbent (qe) of more than 30 mg/g for arsenic adsorption.

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