MATERIALS WITH IMPROVED ADSORBENT PROPERTIES, FOR RETAINING Cd^{2+} AND Ni^{2+} FROM WASTEWATER

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Abstract
In the most cases, wastewater contains both heavy metals in different concentrations and a number of other organic pollutants. Treating wastewater to remove and, if possible, recover heavy metals is vital for the entire food chain. To achieve this goal, we have designed new materials with improved absorption properties. Thus, we used some recyclable wastes such as power plant ash and eggshell together with zeolites and iron oxides, especially magnetite. The characterization of the new material, designed to retain heavy metals from waste water was done by analytical techniques such as SEM/EDAX, FT-IR, BET, AAS etc.

Introduction
Water is vital to the maintenance of life and the development of most industrial processes, processing and production of goods. Worldwide, intensive efforts are being made to treat wastewater and make water drinkable, especially in areas where the availability of drinking water is a major problem. The lack of advanced or strategic depollution materials and their purchase price, lead to costs that make their use in wastewater treatment processes difficult to access. In accordance with the concept of circular economy, the identification of recyclable materials, waste in general, cheap and reusable, is of particular importance for this field.

Experimental
The materials used are morpho-structurally characterized, then they are mechanically micronized and compacted in a ball mill. The combinations are made in different ratios of two or three precursors, of micrometric dimensions; mixed for homogenization and compacted in the ball mill, obtaining a composite material. It is immersed in the synthetic aqueous solution containing the pollutant whose adsorption we wish to study; the mixture is mechanically stirred at 400 rpm. The optimization of the heavy metal adsorption process on the new designed materials was achieved by studying the influence of the following specific parameters: temperature, pH, contact time and the initial concentration of the pollutant. Atomic adsorption spectroscopy is used to perform analytical determinations and subsequently the efficiency of the pollutant adsorption process is calculated.

Results and discussion
Experimentally, for the recovery of Cd2+ and Ni2+ from wastewater, in a ratio of 1:1:1, the following combinations were used: i) central ash with zeolite and magnetite, ii) central ash with eggshell and magnetite, and iii.) eggshell zeolite and magnetite. Conclusive results were obtained under the following conditions: temperature = 297 K; pH = 7.5; contact time = 240 min; mechanical agitation.

Conclusion
The circular economy is based on extending the life cycle of all products on the market and has the impact of reducing the consumption of natural resources; in this context, some wastes are

recommended to be used in wastewater treatment processes, because they have a good capacity to adsorb heavy metals. Recovery of Cd2+ and Ni2+ from wastewater using new composite materials can be done with up to 96% efficiency. The composite materials thus obtained can be discharged from the pollutant and reused in a number of 10 to 12 cycles. Thus, it can be stated that the transition from the linear economy model to the circular model is an opportunity for a business to develop sustainable innovations.

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