World Academy of Science, Engineering and Technology
International Journal of Environmental and Ecological Engineering
Vol:13, No:4, 2019

Valorization of Banana Peels for Mercury Removal in Environmental Realist Conditions

Authors : E. Fabre, C. Vale, E. Pereira, C. M. Silva

Abstract : Introduction: Mercury is one of the most troublesome toxic metals responsible for the contamination of the aquatic systems due to its accumulation and bioamplification along the food chain. The 2030 agenda for sustainable development of United Nations promotes the improving of water quality by reducing water pollution and foments an enhance in wastewater treatment, encouraging their recycling and safe water reuse globally. Sorption processes are widely used in wastewater treatments due to their many advantages such as high efficiency and low operational costs. In these processes the target contaminant is removed from the solution by a solid sorbent. The more selective and low cost is the biosorbent the more attractive becomes the process. Agricultural wastes are especially attractive approaches for sorption. They are largely available, have no commercial value and require little or no processing. In this work, banana peels were tested for mercury removal from low concentrated solutions. In order to investigate the applicability of this solid, six water matrices were used increasing the complexity from natural waters to a real wastewater. Studies of kinetics and equilibrium were also performed using the most known models to evaluate the viability of the process In line with the concept of circular economy, this study adds value to this by-product as well as contributes to liquid waste management. Experimental: The solutions were prepared with Hg(II) initial concentration of 50 µg L-1 in natural waters, at 22 ± 1 ºC, pH 6, magnetically stirring at 650 rpm and biosorbent mass of 0.5 g L-1. NaCl was added to obtain the salt solutions, seawater was collected from the Portuguese coast and the real wastewater was kindly provided by ISQ - Instituto de Soldadura e qualidade (Welding and Quality Institute) and diluted until the same concentration of 50 µg L-1. Banana peels were previously freeze-drying, milled, sieved and the particles < 1 mm were used. Results: Banana peels removed more than 90% of Hg(II) from all the synthetic solutions studied. In these cases, the enhance in the complexity of the water type promoted a higher mercury removal. In salt waters, the biosorbent showed removals of 96%, 95% and 98 % for 3, 15 and 30 g L-1 of NaCl, respectively. The residual concentration of Hg(II) in solution achieved the level of drinking water regulation (1 µg L-1). For real matrices, the lower Hg(II) elimination (93 % for seawater and 81 % for the real wastewaters), can be explained by the competition between the Hg(II) ions and the other elements present in these solutions for the sorption sites. Regarding the equilibrium study, the experimental data are better described by the Freundlich isotherm (R ^ 2=0.991). The Elovich equation provided the best fit to the kinetic points. Conclusions: The results exhibited the great ability of the banana peels to remove mercury. The environmental realist conditions studied in this work, highlight their potential usage as biosorbents in water remediation processes.

Keywords : banana peels, mercury removal, sorption, water treatment
Conference Title : ICECM 2019 : International Conference on Environment, Chemistry and Management
Conference Location : New York, USA
Conference Dates : April 22-23, 2019