Reusing industrial by-products to enhance phosphorus removal in waste stabilization ponds: laboratory approach

Marianna Garfì*, Jaume Puigagut

GEMMA. Department of Hydraulic, Maritime and Environmental Engineering, Universitat Politécnica de Catalunya-BarcelonaTech, c/ Jordi Girona 1-3, Building D1, E-08034, Barcelona, Spain, Tel. +34 934016412; Fax: +34 934017357; email: marianna.garfì@upc.edu (M. Garfì), Tel. +34 934010898; email: jaume.puigagut@upc.edu (J. Puigagut)

Received 19 February 2014; Accepted 13 October 2014

ABSTRACT

Waste stabilization ponds (WSP), in spite of being a suitable technology for wastewater treatment, present low phosphorus removal. This study aimed at evaluating the net increase on phosphorus removal efficiency in microcosm WSP in which sludge was conditioned with an adsorbent (industrial by-product) having a high phosphorus retention capacity. In order to determine the best candidate to condition the sludge, four different industrial by-products (granular bentonite; fly ashes from a municipal solid waste incineration plant; and two types of fly ashes from power plants) were tested for their phosphorus adsorption capacity. Experimental results were fitted to Langmuir and Freundlich models. All adsorbents showed a high phosphorus adsorption capacity. Maximum phosphorous adsorption capacity estimated from Langmuir equations ranged between 34.7 and 74.0 mgP/g adsorbent, being fly ashes from a power plant and granular bentonite the adsorbents with the highest and lowest adsorption capacity, respectively. Microcosms WSP were set up and the sludge conditioned with fly ashes from a municipal solid waste incineration plant. Results showed that phosphorus removal efficiency increased up to 90% by adding 5% of adsorbent (in terms of weight of adsorbent to weight of sludge). Main conclusion is that of industrial by-products may be a low-cost solution for enhancing phosphorus removal in WSP.

Keywords: Bentonite; Fly ashes; Isotherm; Waste stabilization ponds; Phosphorus

*Corresponding author.

1944-3994/1944-3986 © 2014 Balaban Desalination Publications. All rights reserved.