The Use of Eggshell Waste as a Bio-Adsorbant of Phosphates for Water and Soil Quality

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Phosphate run-off into natural waterways from agricultural fertilisers and animal manures can cause eutrophication. Agricultural operations are large consumers of non-renewable fertilisers and large producers of biowaste materials. These issues come at great economic/environmental cost. This study's aim was to offset these issues by identifying potential biowaste adsorbents, examining their effectiveness in decreasing orthophosphate concentration in aqueous solutions, and their direct application to run-off areas as adsorbents and soil conditioners. Biowaste materials were selected based on their abundance, availability, cost, renewability and biodegradable properties, namely eggshell, citrus peel, setaria grass, wool, cardboard, sawdust, banana and potato. Tests conducted in simulated superphosphate run-off rainwater over 24 hours, indicated that cardboard (42%) and eggshell (62%) both decreased orthophosphate levels. Further testing on eggshell waste, (6 hourly intervals and in manure/rainwater run-off simulation), showed average orthophosphate reductions of 59% and 55%, indicating effective adsorption. Costs and benefits were investigated comparing the use of eggshell waste for the dual purpose of phosphate adsorption and soil conditioning. A mathematical model and website were developed to calculate cost savings and application rates of eggshell. History has shown that global change is achieved through action on a local scale. The website provides farmers with a free, accessible tool to help counteract their environmental footprint and create global change. This study concluded that the economic and environmental benefits of agricultural use of biowaste products, like eggshell, as an adsorbent and soil conditioner, appear to have been undervalued and underutilised.

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