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"Development on the margin"

Removal of Metalaxyl-m by Organically Modified Sediment from Aqueous Solution

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Abstract

Re-use of marginal water such as drainage- and/or waste-water in agricultural field is an alternative solution for developing and emerging countries to overcome limitations in fresh irrigation water. One of the most important problems is that the marginal water has different types and amounts of pollutants with negative effects on the environment. Long term environmentally safe usage of this water is possible after removing these pollutants. This study is focusing on the use of cost effective and environmentally friendly adsorbents to remove organic pollutants from aqueous solutions.

Natural bentonitic clay sediment (bent) instead of standard montmorillonite clay minerals have been proposed in combination with natural organic modifiers, humic acid (HA) and L-Cystinedimethylester (Cystin), and synthetic organic modifiers, Methyltriphenylphos-phonium (MTP) and Hexadecyltrimethyl-ammonium (HDTM), to adsorb the fungicide Metalaxyl-m (MM) from aqueous solution. Metalaxyl-m, (methyl N-(2,6-dimethylphenyl)-N-(methoxyacetyl)-D-alaninate) a systemic fungicide, is used to control a wide range of fungal diseases in many field crops and vegetables and it represents a typical example of organic pollutants in the drainage water.

Changes in clay properties after modification with the organic modifiers have been detected by X-ray diffraction (XRD) and total carbon (TC) analyses. From the XRD pattern, the basal spacing of the bentonitic sediment increased from 14.6 to 15.1, 16.9 and 19.5 Å after the treatment with HA, MTP and HDTM, respectively. Total organic carbon of the modified sediments followed the sequence of HDTM- > MTP- > Cystin- > HA-bent > untreated sediment. Loading the sediments with the organic modifiers improved the adsorbed amount of the MM relative to that obtained by the untreated sediment. Among the treatments, sediment modified with cystin and HDTM had the highest adsorption of MM, reaching the 2.7 and 2.3 fold, respectively, as compared with the untreated sediment. Isotherms of metalaxyl-m adsorption showed that Freundlich equation is the model fitting to the observed data with correlation coefficient (R^2) between 0.960 - 0.997.

Keywords: Clay sediment, metalaxyl-m, organic modifier

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