



Adsorption of diuron and its degradation products from aqueous solution by surfactant-modified pillared clays

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Abstract

Adsorption of the herbicide diuron and its three degradation products: 3-(3,4-dichlorophenyl)-1-methylurea, 1-(3,4-dichlorophenyl) urea and 2,4-dichloroanilin on three organo–inorgano-clay minerals, was investigated. These surfactant-modified pillared clays (SMPC) were prepared by intercalation of polycations of aluminum(III), iron(III) or titanium(IV) into the interlamellar space of a montmorillonite, followed by co-adsorption of cetyl trimethylammonium bromide. The adsorption capacity of these new microporous solids was considerably enhanced especially with Ti- or Fe-SMPC. The adsorption isotherms of diuron and its derivatives at different pH were performed on each SMPC. These isotherms are typically S-type curves and suggested a hydrophobic adsorption mechanism. A comparative study of adsorption of the four compounds on each SMPC adsorbent shows the high adsorption capacity of diuron in comparison with its degradation products. This new generation of adsorbents could thus be considered as powerful competitors to activated carbon for the water treatment of industrial effluents in acidic medium.

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1. Introduction

Herbicides and their decomposition products constitute an important class of pollutants for soil, surface and ground waters. Their fate is governed principally by interactions with soil components and in particular with clay minerals and organic fraction. Several studies, particularly in chemistry and agronomy, have investigated the adsorption of these kinds of pollutants by clays, humic substances and sediments. Diuron belongs to the phenyl-

lurea class of herbicides, which was the first class of herbicides developed after the World War II. For example they are used as pre- or post-emergence herbicides to control annual grasses and broad-leaved weeds in cereals.

The importance of interactions between herbicides and solid phases of soils, soil water, and air within and above soil depends on a variety of factors. Generally, the environmental fate of herbicides depends on the chemical transformations, degradation (such as microbial, chemical, or photodegradation) and transport. Transformation determines what herbicides are degraded in the environment, and how much of pesticides and its metabolites (degradation products) are present in the environment, where and for how long. Transport determines where and how herbicides move in the

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