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STUDIES ON THE FATE AND BEHAVIOUR OF SOME CONTAMINANTS IN SOILS AS A PREREQUISITE IN BIOREMEDIATION

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Abstract

Soils could be relevant receptors for contaminants as they possess the ability to bind various chemicals. Nowadays, there is an increasing concern regarding the introduction of substances, biological organisms or energy into the soil, resulting in a change of the soil quality, which is expected to affect the normal use of the soil, as well as public health and the living environment. Heavy metals and mineral oils are among the most common harmful contaminants, but the persistent organic pollutants and their degradation compounds continue to emerge in the soil.

The paper deals with the fate of two types of contaminants: heavy metals and dyes, in some agricultural and urban soils with various characteristics. Sorption, desorption and bioavailability experiments were performed using six types of soils.

The description of some sorption and migration phenomena for heavy metals (Cadmium and Chromium), and two dyes (Orange II and Congo Red) revealed that the extent of sorption onto soils depends on many factors, such as the type and concentration of the adsorbate, contact time, agitation speed, temperature, pH, or the surface chemistry of the adsorbent. The results indicate that soils with different physico-chemical properties have different effects on the adsorption of most contaminants, especially at higher concentration levels. As expected, differences in contaminant behaviour were observed, but their mobility was strongly pH dependent, while some soil constituents, such as clay and organic matter contents, influence the sorption capacity of the sorbent and sorption equilibrium. The presence of soil minerals also influences the sorption properties of soils by reducing sorption affinity through blocking organic matter sorption sites or by causing conformational changes in its structure. Some kinetic and thermodynamic models fitted the experimental data with good accuracy. Toxicity and phytotoxicity tests showed that important fractions of the contaminants could be bioavailable in certain conditions.

The results contribute to the development of scientific databases which address these issues and the demands of decision makers and the public to understand the impact of chemicals on human health and the environment and to select the most feasible bioremediation alternatives.

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