
Glyphosate-Hydrotalcite Interaction as Influenced by pH

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Abstract: Adsorption and the mechanism of adsorption of the herbicide glyphosate [N-(phosphonomethyl) glycine] by hydrotalcite (HT) and by hydrotalcite calcined at 500° C (HT500) was studied. The values of the Freundlich K constant of the adsorption isotherms and the distribution coefficients, K_d, depend on the pH of the adsorption system and vary between 55.54– 9603 (K) and 36.82– 6252 (K_d) for HT and between 10,106– 23,242 (K) and 17,801– 26,558 (K_d) for HT500. X-ray diffraction and infrared spectroscopy studies showed that glyphosate is not adsorbed into the interlayer of HT. The adsorption mechanisms are (1) electrostatic attraction between the surface of HT, charged positively below pH 12 according to its point of zero charge and the glyphosate anion, and (2) ligand exchange between the P-OH and/or C=O groups of the herbicide and the Al and Mg atoms of the HT surface. The occurrence of one or both mechanisms depends on the pH of the adsorption system. These adsorption mechanisms and the amphoteric nature of glyphosate account for the variation in K and K_d values with respect to pH. Previous studies on adsorption of different organic anions by HT have only considered the mechanism of anion exchange as important.

Key Words: Adsorption • Adsorption Mechanism • Calcined Hydrotalcite • Glyphosate • Hydrotalcite • pH

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