Effect of Acidic Functional Groups on Organic Acid Sorption by
Several Andisols and Oxisols from Methanol/Water System

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The existing sorption models of organic acids to variable charged soils in water-cosolvent mixture are not suitable for describing the functional groups effect. Organic acids sorption by variable charge soils was measured as a function of apparent pH and methanol volume fraction. Benzoic acid and 2,4-Dichlorophenoxyacetic acid (2,4-D) bearing carboxyl group and 2,4-Dichlorophenol (2,4-DCP) and 2,4,6-Trichlorophenol (2,4,6-TCP) bearing hydroxy group were chosen as organic acids. 2 Andisols, 2 Alfisols, and 2 Oxisols were used as sorbents. The sorption ($K_a$) of 2,4-DCP and 2,4,6-TCP by variable charge soils decreased with the addition of methanol (i.e., increasing $E$). However, the same sorption trend was not apparent for 2,4-D and benzoic acid both of which carry a carboxyl group (Figure 1). Positive relationship between $\log K_a$ vs. $E$ observed for 2,4-D and benzoic acid is most likely due to carboxyl group in 2,4-D and benzoic acid, whose effect was not incorporated in cosolvency model. The functional group effect is highly likely due to the complexation reactions between carboxyl group and charged soil surface in cosolvent-water system. Further study of the solubility of organic acids in the solution extracted from the soil through methanol volume fraction is needed to reveal the interaction between organic acid and mixed solution on soil. In addition, The efforts are required to explain the interaction between functional group of organic acids and the soil surface and to develop techniques for direct probing of the complex on the soil surface.

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Figure 1. Effect of functional groups on organic acid sorption by variable charge soils as a function of methanol volume fraction ($E$)