

Behavior of Aluminum in Some Andisols, Korea, and its Mineralogical and Environmental Implication

Yungoo Song¹, Gyoo Ho Lee², Hi-Soo Moon², Edward Paterson³, and Ji-Won Moon²
¹Korea Environmental Research Inc., Research Division, Woojin Bld., 1022-1 Bangbae-Dong, Seocho-Ku, Seoul 137-063, Korea
²Department of Earth System Sciences, Yonsei University, 134 Shinchon-Dong, Seodaemun-Ku, Seoul 120-749, Korea
³The Macaulay Land Use Research Institute, Craigiebuckler, Aberdeen AB9 2QJ, U.K.

Dissolved Aluminum from the soil solid phases has been a major environmental concern due to the ecological importance of potentially phytotoxic Al on terrestrial and aquatic organisms. We examined the solubility of Al in some Andisols, Cheju Island, which are characterized by the high porosity (60%), the extremely low base saturation percentage (<3%), the substantial amounts of Al-humus complexes in the A horizon, and of short-range ordered minerals, such as imogolite and allophane, and gibbsite in the B horizon. Equilibrium batch experiment reacting with 1 mM NaCl solution in the different pH ranges for 14 days, shows that all suspensions were oversaturated with respect to gibbsite ($\text{Al}(\text{OH})_3$) and imogolite ($\text{Al}_2\text{SiO}_3(\text{OH})_4$), while undersaturated with amorphous $\text{Al}(\text{OH})_3$ and proto-imogolite. The IAP_{gibbsite} and IAP_{imogolite} values of the suspensions increase distinctly with the increase of depth. Continuously reacted suspensions with each soil horizon for half hour were also oversaturated with gibbsite and imogolite, but not with amorphous $\text{Al}(\text{OH})_3$. The

IAP_{gibbsite} and IAP_{imogolite} values of the suspensions reached to those of the equilibrium results in the B horizon. These results indicate that the Al solubility is controlled by the rapid reactions with readily dissolved Al from Al-humus complexes in the A horizon and mainly amorphous Al(OH)₃ in the B horizon. These suggest that the readily dissolved Al fraction should be rapidly active and result in the Al toxicity by acid deposition. In addition, the rapid irreversible removal of the most soluble Al fraction may eventually result in reduced acid neutralization, and rapid soil acidification of the Cheju soils.