Changes in the chemical and mineralogical properties of Mt. Talang volcanic ash in West Sumatra during the initail weathering phase.

ABSTRACT

Eruptions from Talang volcano on 12 April 2005 distributed volcanic ash over portions of the Solok District of West Sumatra, Indonesia. Unleached and leached pristine volcanic ash were collected immediately after the eruption, and the third sample was collected after 2 years. The mineralogy and chemical properties of pristine volcanic ash and volcanic ash deposits that were weathered for 2 years from the 2005 eruption of Mt. Talang, Sumatra, were studied to characterize the volcanic ash, identify the primary minerals present, and determine its chemical properties. Results showed that the volcanic ash contained 30% noncrystalline minerals (or volcanic glass); the remaining ash is composed of crystalline minerals such as labradorite, hypersthene, augite, hornblende, olivine, opaque ferromagnetic minerals, and rock fragments. Notable differences in pH values were observed as the pH tended to become more acidic from the unleached, leached, and weathered volcanic ash, but the ash did not give much response to the sodium fluoride (NaF) test. Total sulfur gradually decreased from 3.28% in unleached ash to 1.93% after 2 years. Available phosphorus (P) in the unleached volcanic ash was 68 mg kg−1, and this value was decreased by 15 % after 2 years of being exposed to the atmosphere, while phosphate retention ranged between 52.8% and 66.8%. Cation exchange capacity (CEC) was low with the value of 10 cmolc kg−1 although base saturation was high, exceeding 75%. The low acid oxalate–extractable silicon (Si), aluminum (Al), and iron (Fe) values of 0.07%, 0.25% and 1.17%, respectively, show the scarcity of secondary amorphous compounds in the ash. Total elemental analysis indicated that no differences were found in total silica oxide (SiO2) content of all samples, with a value about 56%, and this volcanic ash can be classified as basaltic andesite. We observed that removal of chemical elements by leaching was large for calcium oxide (CaO), magnesium oxide (MgO), and sodium oxide (Na2O) as the values decreased in time. Solid-state 29Si and 27Al magic angle spinning (MAS) nuclear magnetic resonance (NMR) studies indicated that Al occurred in both tetrahedral and octahedral forms. Silicon was not present in the tetrahedral layer. An intense peak at −92 ppm was indicative of the presence of aluminosilicates.

Keyword: Basaltic andesite; Crystalline minerals; Noncrystalline minerals; Volcanic ash.