

Vertical Variations and Mobility of Heavy Metals in Sediment of Oto, Saitama

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Subsurface sedimentary environment and groundwater may pollute by leachable heavy metal in sediment after water sediment interaction. Total 20 sediment samples at 1 m interval were investigated from a boring core of Oto area, Saitama from 1 m to 21 m depth to determine water soluble fraction of Arsenic (As), Lead (Pb), Cadmium (Cd) and Selenium (Se) using an extraction method. From 1 m depth to 4 m depth, high organic matter content silty clay exists. At 4 m depth there is a peat layer is underlain by 3 m thick tuffaceous clay layer which is known as Kanto loam. A sandy to gravelly shallow aquifer exist from depth of 8 m to 12 m. A thick layer of marine sediment from depth of 14 m to 18 m is embedded with transitional sediment above and below. Physical parameters such as pH, Electrical Conductivity (EC) and Organic matter content were determined. Total chemistry of Iron (Fe) , Manganese (Mn) and Sulphur (S) were determined by X-ray Fluorescence and mineralogy were determined by X-ray Diffractometer. After systematic extraction procedure leachate were analysed to determine As, Cd, Pb and Se content in each sediment by Inductively Coupled Plasma Mass Spectrometer (ICP-MS) and Fe, Mn and Al were determined by Inductively Coupled Plasma Atomic Emission Spectrometer (ICP-AES). The pH of water soluble fraction showed low pH value 3.3 in peat , 3.6-4.7 in high organic matter content silty clay from 1 m to 4 m depth and 3.8 to 4.9 in marine sediment. The EC value showed the reverse scale in marine sediment and peat which is much higher than other sediment. The EC value extends up to 111.0 m S/ m in peat and 61 to 130 m S/ m in marine sediment leachate. Organic matter content were determined using Ignition loss method where sediment at 1 m depth showed very high content which is 47.68 % , 12.65 % in peat and 3.4 to 7.7 % in marine sediment. Water soluble fraction showed the mobility trend which is Se > Cd > As > Pb. Water soluble fraction of As, Se and Pb for all sediment has not been exceeded the ground water standard by WHO, however the content of Cd showed higher value which is ranged 2.2 to 9.6 ppb in marine sediment and 3.1 to 4.3 ppb in peat and peat adjacent silty clay. Se concentration showed similar mobility characteristics with Cd where, leachable fractions are higher in marine, peat and peat adjacent sediment. With low pH and high salinity, Cd and Se showed higher mobility than As and Pb. Peat and marine sediments showed high mobility characteristics for Cd and Se, so these sediment layer should be considered as environmental pollution threat for environmental risk assessment and management.

Keywords: Heavy metal, Water soluble fraction, Peat, Marine sediment