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Fourier Transform Infrared (FTIR) Spectroscopic Analysis of Soil Organic Matter in an Alluvial Type Gem Deposit in Pelmadulla, Sri Lanka

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Abstract

Organic matter is one of the most important and fundamental constituent in soil, which usually present in transported sediments. Therefore a wide spectrum of physically and chemically different organic matter can be expected in alluvial type sedimentary gem deposits. Composition of soil organic matter is very important, because it is tightly link with environmental issues such as mine gas poisoning, carbon budget and bioavailability of toxic elements in the soils.

This study was conducted to identify the composition, distribution and impacts of the soil organic matter in the sedimentary profile of an alluvial gem deposit in Pelmadulla, Sri Lanka. Seventy seven soil samples were collected along the sedimentary profile in three different locations using auger drilling method. Chemical bonding structure of the each soil sample was analyzed in the mid IR region of FTIR spectroscopy. Total organic matter (TOM) and the total organic carbon (TOC) contents of the of each soil sample were measured using loss on ignition and the Walkley-Black wet oxidation methods respectively. In addition, selected basic physical and chemical parameters of the soil such as pH, oxidation-reduction potential, moisture content, and elution conductivity were also tested.

Results indicate pH is in slightly acidic in nature and soil elution conductivity is higher in the peat layer of the bottom alluvial deposit. FTIR spectroscopic analysis proved the presence of several organic functional groups/bonds such as saturated aliphatic (2950-2970 cm^{-1}, 2860-2880 cm^{-1}), unsaturated aliphatic (2915-2935 cm^{-1}, 2845-2865 cm^{-1}), alcoholic (3200-3645 cm^{-1}), carbonyl (1680-1820 cm^{-1}), aryl (1450-1615 cm^{-1}), disulfides (570-705 cm^{-1}) and ether (2815-2850 cm^{-1}). Some of those functional groups such as carbonyl and disulfide in organic matter may cause for the poisonous gas emissions. The ratio of TOC/TOM is slightly higher in the top and the bottom of the alluvial deposit. This indicates the high-carbon organic matters are present in the top and the bottom most layers. Conversely, carbon content of the middle layers in the deposit is less due to the intermediate level of organic matter degradation. In addition, middle region of the alluvial deposit is consisting of sandy nature, which reflects the dry climatic formation in the past thus the organic matter content is low. High soil elution conductivity in the bottom of the deposit indicates that the soluble ions were leached to the bottom and accumulate in the peat layer.

Keywords: FTIR spectroscopy, Soil organic matter, Alluvial gem deposits, Geochemistry