Study of Cation Exchange Properties of Selected Sri Lankan Coastal Soils with Sea Water

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Introduction

Ion exchange is a naturally occurring process that depends on several physical and chemical factors. In general, geology and climatic condition of an area are the major factors among them. Geology and climate are the controlling parameters to develop different soil types in a given area. Also, texture and other physical properties such as pH and oxidation reduction potential (ORP) effectively control the ion exchange properties in the soil.

In Sri Lanka larger area of the island is covered with crystalline rocks of Precambrian age and has distinguish four major basement units (Cooray, 1984). Considering climate of the island the dry, wet and intermediate climatic zones are defined on the basis of rainfall. In other words climatic zones of Sri Lanka are divided based on the annual rainfall of the island based on detail observations made by Agriculture Departmentof SriLanka. WetZone is demarcating inthesouthwesternregion of the countryincluding western part of thecentralhillcountry, DryZone predominantly covering north, north-east and eastern sectors of th ecountry. Intermediate Zone identified between the Wet and Dry zones. Moreover, for the separation of aforesaidmajor climatic zones,landuse, forestry,rainfallandsoilshavebeenwidelyused (Herath and Pathirana, 1983).

Due to different geological settings and diverse climatic variations of Sri Lanka various soil types are formed. Since its special geographical locality there is a higher possibility to contaminate soils with sea water. Such possibilities are accounts Tsunami, Tidal effects and inland river sand mining. Therefore there is a possibility to contaminate sea water with pure natural soils.

Therefore main objectives of the study is to find the ion exchange properties of natural soils in Sri Lanka with sea water. Results will able to investigate ion exchange capacity with respect to physico-chemical properties of different soils such as pH, Oxidation reduction potential and conductivity.

Methodology

A field survey was carried out along the coastal region of the country and selected soil samples were collected. Physical properties of the soil were studied before laboratory analyses. Sample were dried using standard oven at the UvaWellassa University to remove the water content. Subsequently, organic matter content were analyzed using muffle furness under 450 C standard temperature. Major cations were measured using Varian Atomic Absorption Spectrometer (AA 240).

Results and Discussion

Results indicated that cation exchange capacity of wet and dry zone soils have a similar pattern (Figure 1). In general, wet zone cation exchange capacity varies from 1.0 to 3.0 mg/g and dry zone cation exchange values range from 0.5 to 3.0 mg/g. However, intermediate zone shows

somewhat lower variation than wet and dry zones (from 1.5 to 2.0 mg/g). Cation exchange capacities of the studied soils show negative relationship with soil pH. However, slightly positive relationship with the oxidation reduction potential is indicated. Moreover, a negative relationship with soil ionic conductivity and a significant positive relationship with soil organic matter levels are shown.

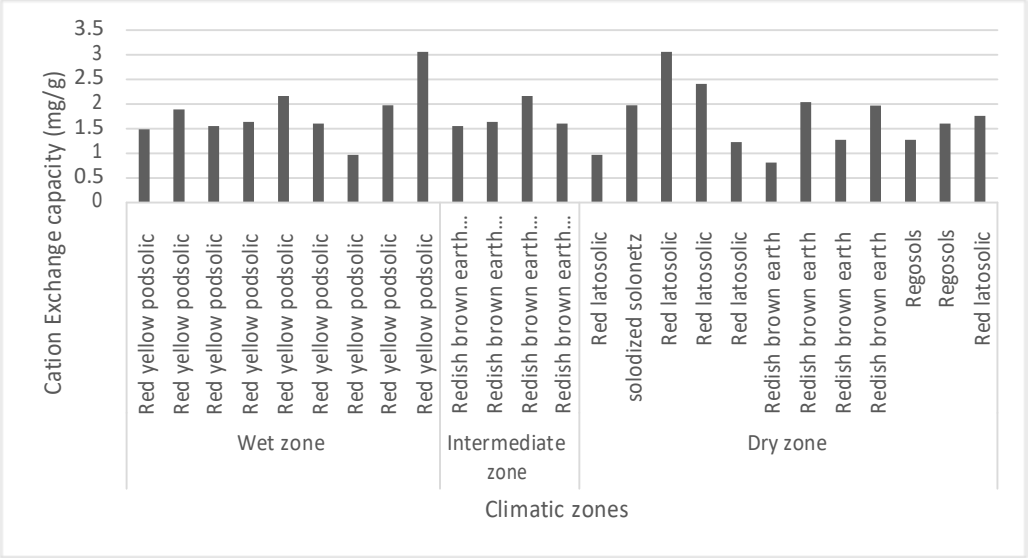

Figure 1. Cation exchangeability in selected soils of different climatic zones.

Conclusions

Despite climatic variations of wet and dry zones, the geological settings of the country made the soils in those regions to have high ion contents. Thereby, cation exchange capacities are higher in both regions. Results concluded that more cations prefer to exchange with H^+ in the studied soils. However, Ca^{+2} significantly prefer than the other measured ions. Further, results indicate that Na^+ and Mg^{+2} exchange with oxidizable cations in the soils and K and Ca^{+2} exchange with freely available cations. However, soil contains with more free surface sites newly introduced cations seem to be bonded with them and higher the exchange capacity. Organic matter content in the soils also significantly contributed for the cation exchange process and it increases with the increasing organic matter contents in the soils.

References

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