

The physico-chemical and mineralogical characterization of Mg-rich synthetic gypsum produced in a rare earth refining plant

ABSTRACT

The physical, chemical and mineralogical characterization of the constituents of magnesium-rich synthetic gypsum produced in a rare earth-refining plant located in Gebeng, Pahang, Malaysia was conducted through elemental chemical analysis, scanning electron microscopy with Energy Dispersive X-ray (EDX)-analyzer, thermal analysis, X-ray fluorescence and X-ray diffraction. The crystalline nature of the by-product was studied using FTIR spectroscopy. Elemental analysis confirmed the presence of Ca and Mg, which are essential macronutrients required by plants and this Ca alongside the high pH (9.17) of MRSG may confer on the material a high acid neutralization capacity. From the result, it was observed that the studied by-product is a heterogeneous crystalline material comprising of gypsum ($\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$) and other major components such as calcium (magnesium) compounds (hydroxide, oxide, silicates, and carbonate) and sulfur. These aggregates may contribute to give an acid neutralization capacity to MRSG. The XRD study of MRSG indicated a high content of gypsum (45.4%), shown by the d-spacing of 7.609 Å (2-theta 11.63) in the diffractogram. The infrared absorption spectra of MRSG indicate close similarities to mined gypsum. The results of the characterization indicated that MRSG has valuable properties that can promote its use in amending soil fertility constraints on nutrient-deficient tropical acid soils.

Keyword: Industrial by-product; Physico-chemical characterization; FTIR; Thermal analysis; X-ray fluorescence; FESEM-EDX; Acid soil amelioration