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PHYSICO-CHEMICAL CHANGES IN BAUXITE RESIDUE FOLLOWING APPLICATION OF SPENT MUSHROOM COMPOST AND GYPSUM

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ABSTRACT

Physical properties exhibited by unvegetated mine wastes pose limitations to vegetation establishment and growth. In an attempt to promote vegetation cover on bauxite residue, a field trial was established to determine the effect of spent mushroom compost (SMC) and gypsum amendment on enhancing the physical properties of the residue. SMC was incorporated at rates of 0, 60, 80 and 120 t ha^{-1} with gypsum at 0, 40 and 90 t ha^{-1} and *Holcus lanatus* sown at a rate of 80 kg ha^{-1}.

The addition of SMC and gypsum was beneficial in improving the physical properties of the residue and promoting growth. Principally increasing organic content of the residue decreased bulk density and particle density whilst improving substrate porosity. Residue pH, EC and sodicity of the residue were also affected by the amendments, which positively impacted on microaggregate stability and preventing clay dispersion. Pearson correlations demonstrate that the most significant parameters in determining clay dispersion potential are the pH and the exchangeable sodium percentage (ESP) of the residue.

KEY WORDS: bauxite residue; clay dispersion; gypsum; microaggregate; Holcus lanatus; revegetation; sodic; spent mushroom compost

INTRODUCTION

Restoration of vegetation cover on mine residues (tailings) can fulfil the objectives of stabilization, pollution control and visual improvement (Wong, 2003). For bauxite residue, texture plays an important role in revegetation success. The fraction of coarse-textured material in the refinery residue (residue sand) to fine-textured red mud is dependant on the ore and the operational parameters of the Bayer process (Wehr *et al*., 2006). The coarse fraction of the residues can present fewer difficulties than the fine fraction in establishing vegetation (Meecham and Bell, 1977). Wong and Ho (1994) cited 'the predominance of the fine fraction' as a major constraint limiting red mud reclamation efforts. Courtney and Timpson (2005) found that an increase in sand content in amended fine fraction residue improved substrate conditions and reduced plant sodium content.

Inherent properties of bauxite residues present similar chemical and physical conditions to alkaline-sodic soil such as high pH, hardsetting, low permeability and water logging (Harris and Rengasamy, 2004). The lack of structural stability in sodic soils promotes seal and crust formation at the soil surface, resulting in erosion (Rengasamy and Sumner, 1998). Furthermore, structural problems created by physical processes such as dispersion of clay minerals and specific conditions such as surface crusting and hardsetting may affect water and air movement, plant-available water-holding capacity, root penetration, seedling emergence and tillage and sowing operations (Qadir and Schubert, 2002).

Gypsum is the most commonly used amendment for sodic soil and its use in amending bauxite residue is well documented. However, its use in bauxite residue amendment has generally been interpreted for its effect on chemical properties and nutrient availability, overlooking its effect on residue physical properties.

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