Potential of soil, sludge and sediment for mineral carbonation process in Selinsing Gold Mine, Malaysia

ABSTRACT

Soil, sludge and sediment that are rich in alkaline earth silicates play significant roles as passive agents for removing carbon dioxide through mineral carbonation process. This study was conducted to characterize the mineralogical component and chemical composition of gold mining wastes and to identify the availability of natural silicate minerals as a feedstock for the mineral carbonation process. Particle-size distribution analysis was performed, and pH of the soil, sludge, and sediment were determined, whereas the mineralogical component and chemical composition of the samples were also analyzed. Results demonstrated that the presence of sepiolite and chlorite-serpentine in the stockpile and mine tailings can sequester carbon dioxide into magnesium carbonates, while the presence of stilpnomelane in the stockpile can be sequestered into iron carbonate. The presence of large amounts of small-size particles (silt fraction) in sludge (78.23%) at the mine tailings was identified to have higher surface area to absorb carbon dioxide. pH conditions of sludge (pH 7.9) and sediment (pH 8.3) from the mine tailings were favorable to enhance carbonate precipitation. Therefore, gold mine wastes have shown the potential for passive sequestration of carbon dioxide, thus, providing more insights into the enhancement of mineral carbonation process and the potential of natural silicate minerals.

Keyword: Soil mineralogy; Waste materials; Divalent cation; Mineral carbonation process; Feedstock; Gold mine