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SURFACTANT-ASSISTED SYNTHESIS OF NANOSIZED PRECIPITATED CALCIUM CARBONATE AND MAGNESIUM HYDROXIDE FROM MARBLE

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Precipitated Calcium Carbonate (PCC) and magnesium hydroxide (Mg(OH)₂) are products in high demand, and are widely used in Sri Lanka. Therefore, the country spends large sums of money for these products despite there being a high possibility to synthesize them using extensively distributed marbles. However, the production of PCC and Mg(OH)₂ has not yet been achieved. This study describes a novel technique to synthesize nanoparticles of PCC and Mg(OH)₂ simultaneously from Sri Lankan marbles. This is a timely requirement to enhance the utility of Sri Lankan marbles and to reduce the cost of importing these products.

Marble samples collected from selected locations were crushed, ground and <100 µm fraction was heated at 1000 °C for 4 h to produce calcined dolomite (CaO.MgO). 5 g of calcined dolomite was dissolved in 100 mL of 0.5 M sucrose solution and stirred for an hour. The solution was filtered under suction to separate the precipitated MgO with impurities from soluble calcium sucrate. 0.5 mL of triton X 100 was mixed with calcium sucrate and then 100 mL of 0.5 M Na₂CO₃ solution was added dropwise to the mixture to synthesize PCC nanoparticles. The function of triton X 100, a nonionic surfactant was to keep resulting products in nanoscale by preventing particle aggregation. The separated MgO component was dissolved in 1.0 M HCl solution and filtered to obtain 25.0 mL of 1.0 M MgCl₂ solution with pH of 6.0. Triton X 100 (0.5 mL) was mixed with 50 mL of 1.0 M NaOH. 25 mL of MgCl₂ solution was added dropwise to the reaction mixture while stirring to synthesize Mg(OH)₂ nanoparticles. The final powders of PCC and Mg(OH)₂ products were dried.

X-ray Diffraction (XRD) analysis confirmed the presence of calcite in PCC and brucite in Mg(OH)₂. The estimated average particle sizes of PCC and Mg(OH)₂ products by means of Debye–Scherrer formula were 45.1 nm and 11.8 nm respectively. The products were further characterized by using Fourier transform infrared spectroscopy (FTIR) and Thermo Gravimetric Analysis (TGA). Weight percentage of Ca in the Mg(OH)₂ product was 1.1% and weight percentage of Mg in PCC was 0.6%.

These results confirm that both PCC and Mg(OH)₂ nanoparticles can be synthesized using Sri Lankan dolomitic marbles with sufficient quality to meet with commercial requirements.

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