Title : **Producing Calcium Carbonate via CO_2 Sequestration in Chemical Treatment Solutions from Recycled Stone**

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ABSTRACT

This research investigates the production of calcium carbonate from stone waste using a pH-swing method involving acid and base treatments. Calcium ions are leached from solid stone waste using two acid solutions: hydrochloric acid (HCl) and acetic acid (CH_3COOH). The carbonation process is then initiated by bubbling carbon dioxide gas through the solution, under pH control, in sodium hydroxide (NaOH) and ammonium hydroxide (NH_4OH) solutions. The as-synthesized calcium carbonate samples were characterized to determine their crystal structures, morphologies, and elemental compositions using X-ray diffraction (XRD), scanning electron microscopy (SEM), and energy-dispersive X-ray spectroscopy (EDS), respectively. The XRD patterns confirmed the high crystallinity of both calcite and aragonite calcium carbonate phases. Moreover, SEM analysis revealed spherical and cubic morphologies of the fine samples. EDS analysis further confirmed the presence of Ca, C, and O, which are consistent with the XRD and SEM results. Under the HCl and NH_4OH conditions, about 90% yield of calcium carbonate is produced, and 4.7 g of CO_2 is permanently stored per 5 g of solid stone waste using this method. These findings highlight the potential of the pH-swing carbonation process for effective CO_2 sequestration and the valorization of stone waste, contributing to advancements in sustainable waste management strategies and carbon capture technologies.

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