Eggshell waste valorization into $CaO/CaCO_3$ solid base catalysts

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One of the main challenges of circular economy is the reuse of waste into value-added products. In this context, the big amounts of food waste generated globally become a great renewable resource for recycling and transformation, increasing sustainability of the supply chain. In particular, 7.2 million tons of hen eggshell waste are annually produced, which are converted into a source of environmental pollution. However, eggshell is a biodegradable residue composed in more than a 90% by $CaCO_3$ and thus can be exploited as catalyst, adsorbent, composite, functional material, among other uses. The aim of present work is the valorization of eggshell waste to obtain $CaO/CaCO_3$ materials with application as heterogeneous catalysts.

Domestic hen eggshells were firstly washed with tap water to eliminate impurities and then the inner membrane was manually removed. Afterward, the eggshells were dried in oven at 80 °C for 24 h under air. Dried eggshells were calcined in muffle at different temperatures, times and heating speeds to achieve diverse compositions. Crystalline structures achieved were characterized by X-ray diffraction (XRD), while textural properties were obtained by N_2 adsorption-desorption (BET method). Thermogravimetric analyses (TGA) were used to study the thermal stability of obtained samples. Physicochemical changes and properties observed were correlated with the treatments applied, evidencing the transformation from $CaCO_3$ to CaO. Considering this preliminary results, prepared solids could be useful as base catalysts in different heterogeneous reactions.

Keywords: Food waste valorization; eggshell; calcium carbonate; calcium oxide; solid base catalysts