

Utilization of Eggshell Waste as a Calcium Source and Investigation of Its Physicochemical Properties

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The food industry generates a large amount of eggshell waste, offering an opportunity for converting eggshells to eggshell powder. It helps to minimize the generated waste and increase the effective utilization of eggshell powder as an alternative source for commercially available food-grade calcium carbonate (CACC). This study aims to investigate the physicochemical properties of two types of eggshell powder samples: eggshell powder with eggshell membrane (WM) and eggshell powder without eggshell membrane (NM) and to select the most significant sample for CACC. A sieve analysis was conducted for WM and NM samples separately. Based on the sieve size, three samples from both WM and NM samples (WM-40 μm , WM-100 μm , WM-150 μm , NM-40 μm , NM-100 μm , and NM-150 μm) were taken and compared with the CACC for purity and particle size. The physicochemical properties of the most significant sample were analyzed. Based on the cumulative passing percentages, 50% of the particles of WM were less than 150 μm , while it was less than 100 μm in NM. The percentage of particles passed through the 40 μm sieve size was higher in NM than in WM resulting in a 14% over 11.2%. Purities of WM-40 μm , WM-100 μm , WM-150 μm , NM-40 μm , NM-100 μm , and NM-150 μm in terms of calcium carbonate were $97.67\pm 1.53\%$, $97.33\pm 0.58\%$, $96.33\pm 0.58\%$, $98.67\pm 0.58\%$, $98.00\pm 1.00\%$, and $97.67\pm 1.15\%$ respectively. NM-40 μm was selected as the most significant sample based on the purity, particle size, and yield. The moisture content, bulk density, whiteness index, and mean particle size of NM-40 μm were $1.56\pm 0.04\%$, 0.80 ± 0.02 g/ml, 95.48 ± 0.76 , and 16.8 μm respectively which were not significantly different ($p>0.05$) from CACC. Based on physicochemical properties, NM-40 μm can be used as an alternative to CACC.

Keywords: Eggshells, Calcium Carbonate, Purity, Particle Size