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Evaluation of different methods for modifying starch obtained from *Manihot esculenta* MU51 (Cassava MU51) to develop an effective food thickener

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Cassava is a low-cost crop cultivated in tropical countries for food and as a rich source of starch that is amenable to value addition. Native cassava starch, however, is undesirable for many industrial applications because of its poor structural properties. In order to improve these properties, native starches are often modified. Modification can improve these limitations by tailoring them to a specific industrial need. This study aimed to evaluate various starch modification methods used to modify cassava starch obtained from the cassava MU51 variety in order to produce an effective food thickening agent for the food industry. The MU 51 variety is readily available and has a high starch content relative to other local varieties. Native cassava starch extracted from cassava MU51 tubers was acetylated to three distinct degrees of substitution: 0.08, 0.12, and 0.17. Cassava starch was subjected to acid treatment to prepare acid-modified starch, while physical treatment of raw starch produced pre-gelatinised starch. Both native and modified starch samples were then analysed for total starch content, amylose content by colorimetry, viscosity by a viscometer, solubility, and swelling power by the Leach method. Viscosity is the major parameter for determining the thickening property of starch, followed by amylose content, swelling power, solubility, and total starch content. The results showed that acetylated starch with a 0.17 degree of substitution exhibited the highest viscosity (1.42 Pa at 15% w/v) compared with other modified samples, indicating its strong potential as a thickening agent. Other acetylated starch samples also showed higher viscosities than native starch at 5%, 10%, and 15% w/v concentrations. Pre-gelatinised starch had the highest amylose content (19.83%), compared to native starch and the other modified starch samples. Swelling power increased with temperature for all the native and modified starch types. An acetylated sample with a 0.17 degree of substitution demonstrated the highest solubility (51.8%) at 80 °C, outperforming native starch (40.0%). Solubility of acid-modified samples increased with temperature up to 80 °C and decreased at 90 °C, whereas pre-gelatinised starch solubility increased up to 90 °C without a decrease at 80 °C. In terms of total starch content, native starch had the highest amount (75.78 µg/mL), with pre-gelatinised, acetylated, and acid-modified samples showing progressively lower values. These results highlight that while total starch content is important, viscosity, amylose content, and solubility are the key factors influencing thickening performance. The ANOVA results indicated that there is a significant difference ($p < 0.001$) between the native and modified samples. The modified starch samples were compared with a commercially available sample, with the acetylated starch at a 0.17 degree of substitution exhibiting the closest performance, and by comparison, this sample emerged as the most suitable for use as an effective food thickening agent. Therefore, the acetylation method is better than the other two methods that can be used to modify MU51 cassava starch as a food thickener.

Keywords: Acetylated, Acid modified, Pre-gelatinised, Solubility, Thickening

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