A STUDY ON THE FUNCTIONAL PROPERTIES OF TARO STARCHES FROM TONGA

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ABSTRACT

This study compared the functional properties of three taro starches extracted from selected cultivars, one from each of the three most commonly grown taro genera in Tonga. The selected cultivars were *Alocasia macrorrhiza* var '*Fohenga*', *Colocasia esculenta* var '*Lau'ila*', and *Xanthosoma saggitifolium* var '*Mahele'uli*'. Cassava starch, a commercial product from Thailand, was studied together with the taro starches for comparison purposes.

Freshly harvested taro corms/cormels were peeled, washed, ground into pulp. The taro pulp was washed with excess water and filtered with a cheese cloth. The solid pulp was discarded, and the water-starch mixture (starch milk) was collected in a settling tank. The starch was held for 10-24 hours to allow the starch to settle, and then the supernatant liquid was discarded. The *Xanthosoma* starch was successfully isolated using this method. For the *Alocasia* and *Colocasia*, the starch could not be isolated from the starch milk due to the presence of a mucilaginous material, and it was separated using a bowl centrifuge. The starches were dried, in a hot-air drier and then purified to remove trace of protein, fat, and fibre.

All the taro starch granules were similarly polygonal in shape but the granule sizes were different. The *Xanthosoma* starch granule size (5-30μm) was similar to that of cassava starch granules (5-35μm). The granule sizes of *Alocasia* (0.5-3μm) and *Colocasia* (0.5-6μm) were very small, smaller than rice starch granules. The amylose contents, determined using an iodometric blue value colorimetry method, were 12.1, 13.6, 19.8, and 27.4% for *Alocasia, Colocasia*, cassava, and *Xanthosoma* starches respectively.

The gelatinization temperatures for the starches were determined using sensory evaluation, hot stage microscopy, Brabender Amylograph, and Differential Scanning Calorimetry (DSC) methods. The gelatinization temperatures were approximately 69, 70, 75 and 80°C for cassava, *Alocasia, Xanthosoma* and *Colocasia* starches respectively. The gelatinization temperature ranges for *Xanthosoma* and *Colocasia*

were similar to that of cassava starch, but *Alocasia* starch showed relatively wider temperature range. The viscosity of the *Xanthosoma* gelatinized starch paste was much higher than the other starches but showed greater breakdown on heating.

The strengths of the starch gels were determined by measuring the rheological modulus G* of the gels using a Bohlin Rheometer, and the penetration strength test using an Instron. Both tests showed that the *Xanthosoma* starch produced a much stronger and higher viscosity gel than all of the cassava, *Alocasia* and *Colocasia* starches which produced gels with similar strength. The relative order of gel clarity from qualitative sensory evaluation, from highest to poorest clarity, was cassava, *Xanthosoma, Colocasia*, then *Alocasia*.

The storage stability of the starch gels was evaluated by studying the crystallisation using DSC, and measuring the syneresis occurring during storage at 5 and 22°C. The *Xanthosoma* starch gel was extremely susceptible to crystallisation and syneresis during storage, compared with cassava, *Colocasia*, and *Alocasia* gels which had similar stabilities on storage. The freeze-thaw stability of the starch gels was studied by subjecting the starch gels to repeated freeze-thaw cycles. The *Xanthosoma* starch gel was extremely unstable with freeze-thaw treatment. The *Alocasia* and *Colocasia* starch gels were similar to cassava starch gel which was more stable with freeze-thaw treatment.

The *Xanthosoma* starch, because of extremely high viscosity and gel strength, could be use in food products that need high viscous texture but require no further storage. The *Colocasia* and *Alocasia* starches, because of high digestibility due to very small granule sizes can be used in baby food formulations, which are either heat treated or frozen.

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