Sirithorn Lertphanich 2013: Structural and Physico-chemical Properties of Various Starches and Their Roles as Gelling Improvers in Blends with Acid-thinned Cassava Starch. Doctor of Philosophy (Biotechnology), Major Field: Biotechnology, Department of Biotechnology. Thesis Advisor: Associate Professor Klanarong Sriroth, D.Ing. 147 pages.

The objective of this study were to characterize structural and functional properties of underutilized starches including yam bean, taro, ensete, water caltrop, chickpea and mungbean and compare with cassava starch in order to evaluate their potential uses as cassava gel improvers by blending technique. All extracted starches were pure (protein and ash < 0.5% dwb). Taro starch had the smallest granules (2 μm) while ensete granules were the largest (42 μm). Only ensete starch had the B-type polymorph, while mungbean and chickpea starches were C-type and the rest were A-type. The amylose contents varied from 7.91% in taro starch to 35.59% in chickpea starch. Chickpea had the highest proportion (11.88%) of long branch chains (DP$\geq$37), and lowest proportion (19.35%) of short branch chain (DP 6-12). Diverse thermal, pasting, rheological properties and degree of enzyme hydrolysis were observed. Based on paste viscosity as determined by a Rapid Visco Analyzer (RVA), only water caltrop, mungbean and chickpea had positive values of setback from peak, implying high tendency of gelation. Chickpea had the lowest gelatinization temperature and the highest gelatinization range, whereas cassava starch showed the lowest enthalphy and transition temperature for retrograded starch. The dynamic rheological analysis also revealed high storage modulus (G') values upon cooling for water caltrop, mungbean and chickpea starches, while cassava, yam bean and taro had low G' values. By Principal Component Analysis (PCA) on gelation properties, starches were classified into two groups which are good gelling starches, i.e. chickpea, mungbean, ensete and water caltrop and inferior gelling starches, i.e. cassava, yam bean and taro. The acid modification by hydrochloric acid (1-6% dsb) for 1-7 hr at 45°C was then introduced to improve gelation properties of cassava starch. Hot paste of acid-thinned cassava starches had lower viscosity (viscosity = 4 to 341 cP at 10%dsb, 90°C) but higher water fluidity (WF = 8 to 82), while cold paste had high final viscosity by RVA (94–541 RVU) and gel hardness of acid-thinned cassava starch was much higher (8–152 g) than native cassava starch (15 g); the property changes were dependent on modification conditions. By blending acid-thinned cassava starch with good gelling starches, i.e. mungbean and chickpea (25, 50 and 75%), the texture of the blends were improved, the extent was influenced by degree of acid thinning and the amount of good gelling starches.

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