

Roselawatee Toae 2011: Development of Granular Cold Water Soluble Starches from Native and Crosslinked Rice Starches Having Different Amylose Contents. Master of Science (Biotechnology), Major Field: Biotechnology, Department of Biotechnology. Thesis Advisor: Associate Professor Klanarong Sriroth, D.E. 140 pages.

Granular cold water soluble (GCWS) rice starches were prepared by an alcoholic-alkaline treatment using three rice starches with different amylose contents (39.13, 24.02 and 9.21%, as determined by a spectrophotometric method for High amylose - HA; Medium amylose - MA and Low amylose - LA rice starches, respectively). To prepare GCWS starches, rice starches were suspended in an aqueous ethanol (1:20 by weight) and mixed with 3M sodium hydroxide (NaOH) solution at different ratios of 1.0-4.0 by weight and temperature (25 and 30 °C). The GCWS rice starches with the maximal cold water solubility (greater than 95%) could be prepared by using different conditions, depending on starch types. The GCWS of HA and MA rice starches having higher onset gelatinization temperatures than the LA rice starch (the onset temperatures as determined by a Differential Scanning Calorimeter were 70.27, 63.66 and 59.36 °C for HA, MA and LA rice starches, respectively) were prepared by using 40% ethanol. In contrast, the preparation of GCWS from LA rice starch had to be performed under the restricted condition of water content, using 95% ethanol, otherwise starch was completely dispersed and did not maintain the granular shape. The amounts by weight ratios of alkali for preparing the GCWS of HA, MA and LA rice starches were 2.0, 2.5 and 3.0, respectively at 25 °C for HA and MA and at 30 °C for LA rice starches. Relatively to native starches, GCWS rice starches contained higher ash and slightly higher amylose contents. No birefringence was observed in GCWS starch granules of which were melted and agglomerated together. Instead of an A-type X-ray pattern found in native rice starches, the GCWS high and medium amylose rice starches exhibited a V-type X-ray pattern while amorphous pattern was observed for GCWS low amylose rice starch. When dissolved in water, the GCWS starches demonstrated similar swelling power, solubility and volume fraction of dispersed phase comparable to cooked paste (at 95 °C, 15 min) of native starches. The thermal analysis by Differential Scanning Calorimeter confirm instant solubility of GCWS rice starches as only small or no enthalpy values could be quantified. The retrogradation of GCWS rice starches were similar to cooked starches. When determined by a Rapid Visco Analyzer, the paste viscosity of GCWS starches was equivalent or higher than peak viscosity of cooked pastes of native starches. The Brookfield analysis of GCWS rice starches exhibited similar paste properties as cooked paste of native starches, i.e. having shear thinning and thixotropic behavior. Dual modification by cross-linking and granular cold water solubility of high and low amylose rice starches were also successfully developed by using the weight ratio of starch and ethanol of 1:20 (40 and 95% ethanol for HA and LA rice starches, respectively) with 12 and 3.5 of 3M NaOH at 25 °C, respectively. Once dispersed in cold water, cross-linked GCWS rice starches provided instantly viscous paste being stable with constant shear over 30 min.

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Thesis Advisor's signature