Napon Pongpairoj 2007: Relationship between Fine Structure of High Amylose Rice Starch and Mechanical Properties of Their Films. Master of Science (Food Science), Major Field: Food Science, Department of Food Science and Technology. Thesis Advisor: Assistant Professor Namfone Lumdubwong, Ph.D. 86 pages.

The objectives of the study were to investigate fine structure, chemical, and physico-chemical properties of Thai high amylose rice starches (HAM-RS), and mechanical properties of their films. Rice starches were isolated from seven varieties of Thai HAM rice flour, with similar amylose (AM) contents (between 30 -34 %, $p > 0.05$). The number average molecular weight ($\overline{Mn}$) of the starches range from 3.80×10^5 to 8.54×10^5 Daltons and from 3.07×10^6 to 3.68×10^6 Daltons, when determined by the modified method of Park and Johnson and the equation of Park, respectively. $\overline{Mn}$ of AM of the rice starches displayed 9.06×10^4 to 1.68×10^5 Daltons, whereas $\overline{Mn}$ of amylopectin (AP) of the samples displayed 4.34×10^6 to 5.18×10^6 Daltons. The percent of beta-amylolysis (%β-amylolysis) of Thai rice samples was approximately 58 – 69 %. The debranched starches contained average degree of polymerization ($\overline{DPn}$) 22.9 – 25.4. Debranched starch of Pathumthani 60 displayed a bi-modal distribution, whereas Prajeenburi 1 and Suphan Buri 90 showed a quarter-modal distribution. Other debranched samples had a tri-modal distribution. The Thai HAM-RS contained the whole range of peak gelatinization temperatures (low, medium and high Tp). When the HAM-RS films plasticized with 50 % glycerol were casted, the tensile strength was 1.4 – 2.9 MPa. And the percent of elongation and Young's modulus were 35 – 55 %, and 20 – 70 MPa. Both high correlations were observed between a short chain fraction (DP 6 – 12, A) of debranched starches and their gelatinization temperatures (GT) ($r = -0.79$) and between the A and their enthalpies (ΔH) ($r = -0.80$). In contrast, a long chain fraction (DP 37 – 53, B_3) were positively correlated with GT, and ΔH ($r = -0.60$ and 0.70). The A fraction was also negatively correlated with the values of paste breakdown ($r = -0.70$) and setback ($r = -0.50$). A positive correlation was found between the A and elongation of starch films ($r = 0.60$); but the opposite correlation was reported for the A and the values of tensile strength ($r = -0.50$) and Young's modulus ($r = -0.60$). Both GT and ΔH of the starches were negatively correlated with % of the film elongation ($r = -0.79$, and $r = -0.80$). Also, the elongation of the samples was positively correlated with the trough values ($r = 0.57$), but negatively correlated with the values of paste breakdown ($r = -0.77$) and setback ($r = -0.67$) of the pasting curves. It is suggested that HAM-RS films with high % elongation were possibly produced from rice starches containing a high proportion of A and low GT, and the elongation property of the film was probably predicted using RVA profiles of the starches.

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