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Retrogradation-annealing Dual Modification of three Rice Starches Resulted in Improved Functionality, Formation of Resistant Starch and Deeper Insight into Starch Polymorphism

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Abstract—*Rice (Oryza sativa, L.) is an ideal model for starch research. Three rice varieties with wide difference in apparent amylose content were subjected to single retro gradation and dual retro gradation-annealing treatments. Retro gradation caused breakdown of starch branches and chains resulting in increased rapidly digestible starch (RDS) fractions. Results for dual modified samples were indicative of conversion of slowly digestible starch (SDS) to resistant starch (RS) during annealing. Absorption of infrared band (FTIR) at 1446 cm-1 was also indicative of this. The newly formed crystallites were thermally more stable than the native polymorphs. Thermo grams from differential scanning calorimetry (DSC) showed a single peak with higher enthalpy of crystallite melting. Amyl pectin in the waxy rice could readily bind lipids forming ordered crystalline polymorphs with lower thermal stability than amylose-lipid complexes. X-ray diffraction (XRD) patterns indicated rise in crystallinity with the formation of a new sharp peak at 2θ = 29.1 in the dual modified samples. This prominent peak indicated yet unexplored facts on starch polymorphism. Also, some crystallites present in single modified samples were lost after dual modification. This was contradictory to the belief that annealing improves crystalline perfection of only the existing polymorphs. Modified starches gave thinner, stickier gels with improved freeze-thaw stability and reduced swelling power. The results suggested the potential applicability of the single and dual modified starches in frozen stored products. The dual modification technique can be suitably used for the synthesis of resistant starch.*

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