

Title Structure-functionality changes of starch following rough rice storage
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Abstract

The storage of rough rice is accompanied by some functional, chemical, and biological changes that are collectively termed as aging. Despite the many studies on the subject, the exact mechanism of aging is still not clear. Rice functionality has long been ascribed to starch, as it constitutes about 90% of milled rice on a dry weight basis. Hence, the influence of starch fine structures on the aging phenomenon needs to be properly elucidated. This work examined the structural features of starch during rough rice storage to gain valuable insights on the mechanisms behind the changes in rice functionality upon aging. Specifically, the effects of storage temperature and duration were investigated. Dried rough rice samples (Bengal and Cypress) were stored at 4, 21, and 38 °C in temperature-controlled chambers and periodically removed and analyzed after 1, 3, 5, 7 and 9 months. Flour (powdered head rice) and starch (extracted from head rice by alkali steeping) were evaluated for pasting and thermal properties. Starches were characterized for molecular size distribution by high-performance size-exclusion chromatography and amylopectin chain-length distribution by high-performance anion-exchange chromatography with pulse amperometric detection. Significant changes on fine structure were observed primarily on the 38 °C lots (accelerated aging batch), and to some extent on the 21 °C lots. The decreased amylase-amylopectin ratio, shortened amylopectin average chain length, and the shift in chain-length distribution to shorter branch chains were implicative of molecular-level starch degradation. Present findings indicated that rice aging is accompanied by the wearing away of starch molecules. However, aging is not solely attributed to starch. The trends in pasting and thermal properties of flour and starch samples were incongruent, indicating that non-starch rice kernel constituents (e.g. protein, lipid, and non-starch polysaccharides) and their interaction with starch and starch degradation products may also be important.