Novel cassava starches with low and high amylose contents: structural and macromolecular characterization in comparison with other commercial sources

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Cassava (*Manihot esculenta* Crantz) is one of the most important sources of commercial production of starch along with potato, maize and wheat particularly for tropical and subtropical regions of the world. It is the third most important source of calories in tropics, after rice and maize. Natural mutation, and induced ones in cassava starch have recently been reported leading to new starches with low and high-amylose contents (0 and 30-31 %). These mutants are drastically different from normal cassava starch whose amylose content typically ranges between 15-25 %. The aims of this study were to have an overview of the structural variability among the recently discovered cassava mutants comparatively to normal and amylose-free potato and maize starches. The macromolecular features, the crystallinity, the granule sizes, and the thermal properties of these new mutants were compared with five normal cassava starches (ranging from 16.8 to 21.5 % amylose) and commercial versions of amylose-free or normal potato and maize starch. The structure of cassava amylopectin was not modified by the waxy mutation and waxy cassava starch exhibited properties similar to the ones of waxy maize starch. Waxy cassava and maize amylopectins show similar molar masses and radii of gyration (from 408×10^6 g mol^{-1} to 520×10^6 g mol^{-1}; and from 277 to 285 nm, respectively). Waxy potato amylopectin exhibit lower molar mass and size. Inversely, the higher-amylose mutations induced by gamma rays radiation in cassava, modified deeply the branching pattern of amylopectin as well as the starch characteristics and properties: molar masses and radii of gyration decreased, while branching degree increased. These modifications resulted in changes in starch granule ultrastructure (lowered starch crystallinity), a weak organized structure, and increased susceptibility to mild acid hydrolysis. The distinctive properties of the new cassava starches demonstrated in this article suggest new opportunities and commercial applications for these tropical sources of starch.

Key words: Amylose; waxy; genetic variation; structural characterization; cassava.