Evaluation of industrial potential of novel cassava starches with low and high amylose contents in comparison with other commercial starch sources

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The industrial starch market is undergoing major expansion, but certain specific industrial uses cannot be satisfied by native starches and, therefore, chemical or physical modification is necessary. These modifications are often harmful to the environment and generate additional costs. Mutations in the cassava starch biosynthesis pathways were recently discovered at CIAT, Cali, Colombia. CIRAD, in partnership with CIAT, carried out a study on the physicochemical and functional properties of these starches, which could result in interesting industrial applications and create new market for cassava starch.

Among the new cassava starch types, two new mutant cassava starches with extreme amylose contents (0% and 31%) have been recently reported. These mutants are drastically different from normal cassava starch whose amylose content typically ranges between 15-25%. The new mutants were compared with normal cassava starches and commercial versions of amylose-free or normal potato, rice 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. On the contrary, the higher-amylose mutations induced by gamma rays radiation in cassava deeply modified the branching pattern of amylopectin as well as other starch characteristics and properties. These modifications resulted in changes in starch granule ultrastructure (e.g. decreased starch crystallinity), a weak organized structure, and increased susceptibility to mild acid and enzymatical raw starch hydrolysis (fastest and most efficient hydrolysis of all studied native starches). This mutation could offer interesting advantages for the production of bioethanol. Gels from normal root and tuber starches (potato, cassava) after refrigeration and freeze/thaw had lower syneresis than cereal starches (maize, rice). Gels from waxy starches (except for potato) did not present any syneresis after 5 weeks of storage at 4°C. Waxy cassava starch was the only one not showing any syneresis after 5 weeks of storage at -20°C.

The distinctive properties of the new cassava starches suggest new opportunities and commercial applications for tropical sources of starch.

Supporting information:

Journal of Agricultural and Food Chemistry (2007), 55(18): 7469-7476. http://dx.doi.org/10.1021/jf800603p
Journal of Agricultural and Food Chemistry (2008), 56(16): 7215-7222. http://dx.doi.org/10.1021/jf800603p
Journal of Agricultural and Food Chemistry (2010), 58(8): 5093-5099. http://dx.doi.org/10.1021/jf1001606
Food hydrocolloids (2012), 27(1): 161-174. http://dx.doi.org/10.1016/j.foodhyd.2011.07.008