A new insight into the physicochemical, functional, and macromolecular properties of banana starch

Dufour D.\textsuperscript{1&2}, Gibert O.\textsuperscript{1}, Ricci J.\textsuperscript{1}, Giraldo A.\textsuperscript{1&2}, Sánchez T.\textsuperscript{2}, Guilois S.\textsuperscript{3} Pontoire B.\textsuperscript{3}, Gonzalez A.\textsuperscript{2}, Rolland-Sabaté A.\textsuperscript{3}

1) CIRAD, UMR QUALISUD, F-34398 Montpellier, France
2) CIAT, Cali AA6713, Colombia
3) UR1268 Biopolymères Interactions Assemblages, INRA, F-44300 Nantes, France

The thermal, functional and macromolecular characteristics of 16 unripe varieties of banana starches were investigated, while including the world most cultivated dessert (\textit{dessert}) and cooking genotypes (\textit{cooking}) and some FHIA hybrids. Average granule size diameter of \textit{dessert} and \textit{cooking} varied in the 20.1 to 42.7 µm range with an average size of 33.6 and 31.5 µm, respectively. Some significant differences were observed in the onset temperature, in the gelatinization variation of enthalpy, and in the amylose content of the groups (64.5 vs 66.5°C, 13.8 vs 15.6 J g\textsuperscript{-1}, and 17.7% vs 23.5%) with a variation in the 59.7 to 70.2°C range, in the 8.1 to 18.4 J g\textsuperscript{-1} range and in the 14.8 to 26.6% range, respectively. Pasting temperatures assessed by RVA on 8% (dry w/v) suspensions also highlighted some significant differences between groups with 71.2 and 74.9°C, respectively. \textit{Dessert} genotypes exhibited higher peak viscosity than those of \textit{cooking} ones (1872 vs 1608 cP), whereas an antagonistic trend was observed on the starch solubility at 90°C (7.6% vs 9.4%). Starches showed a mixture of A-type and B-type crystallites, with a higher proportion of B-type allomorph (from 50 to 100%). \textit{Dessert} showed a higher proportion of B-type crystallites (74%) than \textit{cooking} (67%) and FHIA ones (62%). Crystallinity degrees varied from 20 to 40%. Molar mass and size distributions of the constitutive macromolecules were determined using size-exclusion (SEC) and field flow fractionation (A4F) techniques coupled with multi-angle laser light scattering. No significant difference was observed between banana clusters. A4F and SEC results followed the same tendency with molar masses ranging from 9.7*10\textsuperscript{7} to 1.9*10\textsuperscript{8} g.mol\textsuperscript{-1} and from 8.3*10\textsuperscript{7} to 2.3*10\textsuperscript{8} g.mol\textsuperscript{-1}, respectively. Branching parameters and molecular conformation of corresponding amylopectins were evaluated as well. A close relation between cultivar genotypes uses and consumer preferences with the thermal and pasting properties were revealed.