Chemical changes in papaya fruit during vacuum frying a focus on sugars reactivities

SERVENT A. (1,2), SOTO M. (3), VIOLLEAU SALMANE E. (1,2), ACHIR N. (1)
1 QualiSud, Univ. Montpellier, Cirad, Institut Agro Montpellier, Univ. Avignon, Univ. La Rnion, Montpellier, France, Montpellier, France
2 CIRAD, UMR QualiSud, F-34398 Montpellier, France , Montpellier, France
3 Centro Nacional de Ciencia y Tecnolog de Alimentos (CITA), Universidad de Costa Rica (UCR), Ciudad Universitaria Rodrigo Facio, cigo postal 11501-2060, San Jos Costa Rica, San Jos Costa Rica

Vacuum frying was proved to be a viable alternative in order to produce stable fried foods with better nutritional and sensory properties. The high temperature, in combination with vacuum and oil immersion, causes physical and biochemical changes. Usually, these modifications are known and foreseeable. For instance, fat absorption and changes in food texture are expected. Likewise, there are chemical changes such as degradation of sugars, vitamins, proteins, and bioactive compounds, colored compounds increase, and starch gelatinization. However, previous published studies reported unusual biochemical changes, at the macro scale, particularly on sucrose increase during frying.

This communication aims to highlight sugars changes during vacuum frying of papaya fruit in order to understand these complex phenomena. A fractionated experimental design (3 temperatures and 3 vacuum levels) was realized using a vacuum frying pilot. Papaya was sliced, randomized, and fried for 6 kinetic points (0-20 min). Lipids, dry matter and sugars were quantified by gravimetry and HPLC respectively. A 4th order kinetic model was used to describe glucose and fructose decrease while sucrose production was modeled by a 1rst order kinetic.

During papaya frying, the high sucrose formation was correlated to simple sugar degradation, confirmed in molecular yield. At 25 kPa, the highest vacuum pressure, and 120 °C glucose and fructose content decreased from 46.4 and 45.8 % nonfat dry weight (DW-NF) to 15.6 and 14.0 % DW-NF after 15 min of frying process, respectively, while sucrose content increased from 0 to 37.0 % DW-NF. Statistical analysis of identified rate constants showed a strong correlation between simple sugar degradation rates and an increase of temperature while final content of sucrose was more correlated to an increase in the frying pressure. This observation suggests a different chemical pathway for the different sugar reactions.

Simple sugars condensation affected by pressure seems to be the most suitable explanation for sucrose production. Simple sugars contribute to this reaction but are also consumed for Maillard or caramelization reactions. Future works are needed to dissociate sugar degradation pathways between different condensation reactions leading to sucrose or caramelization or Maillard reaction products as a function of frying conditions monitoring