Extraction and characterization of protein-polysaccharide complex in cashew apple bagasse: A new insight for cashew apple bagasse extract valorization in the food industry

Madinatou Zié[1], Nicolas Jacquet[1], Alabi Taofic[2], Christophe Blecker[1]

[1] Department of Food Science and Formulation, Gembloux Agro-Bio Tech, University of Liege, Gembloux, Belgium.[2] Department of Biochemistry-G, University of Pelefero Gon Coulibaly, Côte d'Ivoire.

Introduction

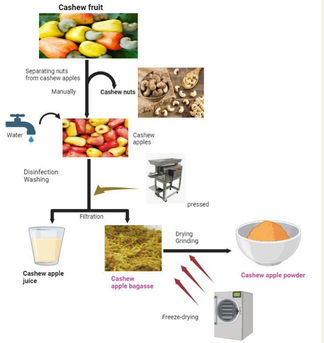
-The cashew tree (*Anacardium occidentale* L.) is native to tropical America and is widely available in several countries in South Asia, Africa, and Central America as an economically important agricultural crop.

-*A* fruit with two edible parts including the cashew nut and the cashew apple (CA)

-The largest sources of residues produced by the cashew agronomic industry

-The cashew apple bagasse (CAB), a by-product underutilized of this fruit after juice extraction contains nutrient compounds such as ascorbic acid, antioxidant and proteins (9-16%) that could be valorized

Methodology



Cashew apple bagasse obtention method

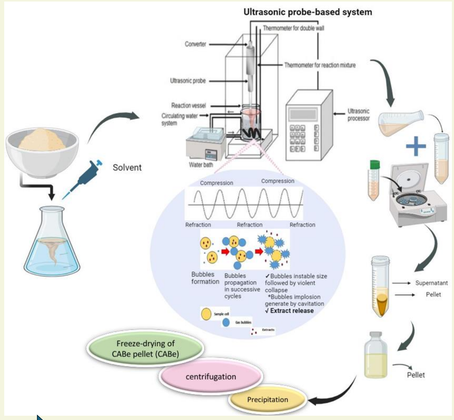
-Optimization with response surface methodology (RSM) using design expert software version 10

-High-intensity ultrasonication was employed to enhance CAB protein extraction under optimal conditions obtained from the experimental design

-Sugar composition (GC FID)

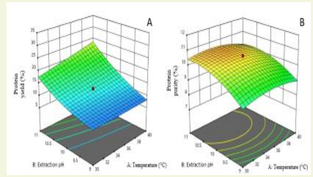
-Structural Characterization (HPSEC)

-Surface properties (tensiometer)

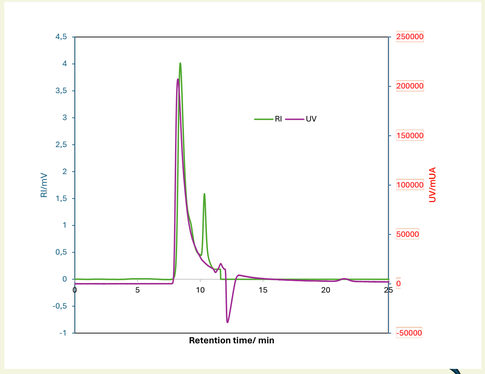


Procedure to obtain protein-polysaccharide complex (CABe)

Key results



RSM design and ultrasound-assisted extraction (UAE) were used to obtained a CAB extract (CABe) with a high concentration of protein



-The HPSEC profile of CABe shows two main fractions. The first elutes from 8-10 min, and the second elutes from 10-11 min

-The UV (280 nm) signals found in both fraction 1 and fraction 2, are attributed to the presence of aromatic amino acids

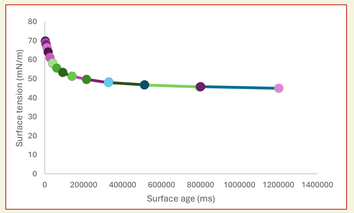
-The proteinaceous moiety indicates a polysaccharide-protein complex

-The major fraction (peak 1) might correspond to the arabinogalactan-protein fraction

-The second fraction should be the glycoprotein population

Components	g/100g dry solids
Dry matter	91.82 ± 0.65
Crude protein	22.10 ± 0.04
Ash	5.90 ± 0.30
Galactose	17.45 ± 3.73
Arabinose	11.85 ± 1.98
Glucose	9,79 ± 2.55
Rhamnose	1.24 ± 0.16
Mannose	0.77 ± 0.15
Xylose	0.69 ± 0.19
Galacturonic Acid	0.70± 0.06

The complex is primarily composed of protein, galactose, arabinose, and glucose



-The molecules were gradually absorbed at the interface, reaching an equilibrium SFT value of approximately 45 mN/m for CABe and 57.4 mN/m for Arabic gum

-The favorable interaction between the protein and polysaccharide fractions of CABe

-The rapid diffusion and adsorption capacity of molecules at the interface => low surface tension

Conclusion

- ✓ For the first time, we have made a natural protein-polysaccharide complex derived from cashew apple
- ✓ Surface tension analyzes highlighted the good functional properties of CABe
- ✓ New insights into the structure and functionality of CABe provided valuable knowledge for potential applications involving this hydrocolloid complex
- ✓ CABe with the highest percent of its protein is important for a higher emulsion stabilizing capacity
- ✓ In comparison to gum Arabic, the functional properties and compositional analysis suggest that CABe acts like this hydrocolloids which, thanks to its technological characteristics, is widely used in the food, pharmaceutical, printing, textile and cosmetic industries as a stabilizer, emulsifier, film former, thickener, flocculant and surface finishing agent

References

Castellani, O., Guibert, D., Al-Assaf, S., Axelos, M., Phillips, G. O., & Anton, M. (2010). Hydrocolloids with emulsifying capacity. Part 1 - Emulsifying properties and interfacial characteristics of conventional (Acacia senegal (L.) Willd. var. senegal) and matured (Acacia (sen) SUPER GUM™) Acacia senegal

de Paula, R. C. M., & Rodrigues, J. F. (1995). Composition and rheological properties of cashew tree gum, the exudate polysaccharide from Anacardium occidentale L.

Idris, O. H. M., Williams, P. A., & Phillips, G. O. (1998). Characterisation of gum from Acacia senegal trees of different age and location using multidetection gel permeation chromatography.

Lin, J., Wang, Z., Meng, H., & Guo, X. (2021). Genipin crosslinked gum arabic: Synthesis, characterization, and emulsification properties.