Brazilian Journal of Experimental Design, Data Analysis and Inferential Statistics

Federal University of Rio de Janeiro

BJEDIS, Rio de Janeiro, BJEDIS 2 YEARS, v. 01 (1), 2023

DOI: https://doi.org/10.55747/bjedis.v1i1.62173

ISSN: 2763-6925

Technical Notes | Received 20/11/2023. Revised 25/11/2023. Accepted 30/11/2023. Published 29/12/2023.

Synthesis of Cassava Starch Biofilm with the Addition of Extract of *Couroupita guianensis* fruit by Casting Method

Sérgio Thode Filho[1], Daniele Silvéria Brandão e Silva[2], Andreina Catarina V. da C. M. Torres[3], Raynara Kelly da Silva dos Santos[1], Rafael Nascimento Amaro[1] , Fernando Gomes de Souza Jr[2.3*]

[1]Instituto Federal de Educação, Ciência e Tecnologia do Rio de Janeiro campus Duque de Caxias, Brazil. Laboratório Multidisciplinar de Gerenciamento de Resíduos (LMGR/IFRJ-CDUC).
[2]COPPE/UFRJ – Programa de Engenharia da Nanotecnologia. Instituto Alberto Luiz Coimbra de Pós-Graduação e Pesquisa de Engenharia Universidade Federal do Rio de Janeiro, Brasil.
[3]IMA/UFRJ – Instituto de Macromoléculas Professora Eloisa Mano, Universidade Federal do Rio de Janeiro, Brasil.

Abstract: Brazil is now the world's fourth-largest banana producer in the world with an annual production of 6.953,747 tons per year. In Brazil, the banana (*Musa* spp.) stands out, not only because it is the most widespread, but also because it is the most consumed by all social classes. Cassava is a renewable, almost unlimited resource and one of the most abundant substances in nature. It is one of the most important starchy root crops of the tropics used for food and industrial purposes. The present study evaluated the use of biofilms based on cassava starch in maintaining the quality and shelf life of the 'Prata' banana at room temperature. The filmogenic solution was created using the casting technique, with adaptations. Additionally, 2.6% cassava starch (m/v) + 2 g of gelatin + 100 mL of the aqueous extract were used. Additionally, the biofilm was applied in the film-forming solution for 1 minute and suspended for further drying at room temperature. After this process, were evaluated the loss of fresh mass, and total soluble solids. The present study revealed the efficiency of biofilm coating with and without gelatin to reduce the rate of enzymatic browning and increase the shelf life of bananas. It was possible to verify a smaller reduction in fresh weight loss in the treatments. Besides, no significant difference was observed in the addition of gelatin to the parameters evaluated in the fruit.

Keywords: Enzymatic Browning, Shelf Life, Biofilms, Food Security.

Adherence to the BJEDIS' scope: This paper presents Tukey's test to analyze all the variables obtained in addition to using regressions to determine the behavior of fresh mass loss as a function of the two biofilms during 12 days of the experiment.

*Address correspondence to this author at the Biopolymers & Sensors Lab. / Macromolecules Institute / Universidade Federal do Rio de Janeiro, Rio de Janeiro, Brazil; Tel/Fax: +55-21-3938-7766; E-mail fgsj@ufrj.br

1. PRESENTATION

Brazil is now the world's fourth-largest banana (*Musa* spp.) producer in the world with an annual production of 6,953,747 tons per year. Among the countless varieties of fruit produced in the world, the banana stands out, not only because it is the most widespread, but also because it is the most consumed by all social classes. The banana, the world's most widely produced and commercialized fruit, is grown in all tropical regions of the world, being strongly present in local businesses and subsistence crops serving as an important source of nutrients for the poorest populations.

Couroupita guianensis Aubl. is a fruit from the Lecythidaceae family with phytogeographical dominance and predominant occurrence in the Northern region of Brazil. Despite this, it grows very well in dry land appreciates heat, and humidity, and tolerates waterlogging, which allows it to adapt to other tropical regions such as the Center-West and Southeast of Brazil, including the Ilha do Governador da Campus. UFRJ. *C. guianensis,* despite having great aesthetic and ornamental uses, is widely used for medicinal purposes. Its anti-fungal, anti-inflammatory, antibiotic, and analgesic properties are widely used in the North of Brazil in the form of infusions and teas, obtained through its leaves, flowers, and bark, to treat inflammatory processes, tumors, severe pain, and hypertension. Recent studies on the chemical and cytochemical composition of *C. guianensis* indicate the presence of many compounds that are already studied experimentally, such as α-amyrin and β-amyrin, their triterpene mixture α, β-amyrin is used in studies of the action of these compounds on Central Nervous System to verify possible sedative, anxiolytic and antidepressant activity. The effect of the extract was tested on different formations of biofilm activity in different organisms, with different concentrations. The extract appears to be more efficient in inhibitory activity at lower concentrations.

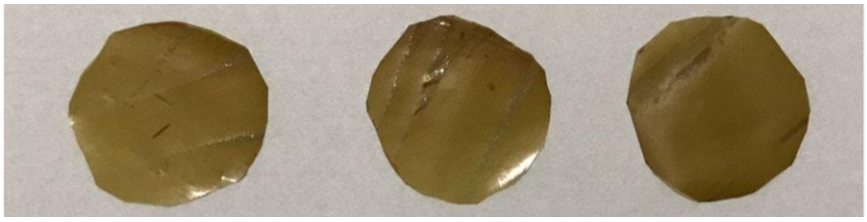
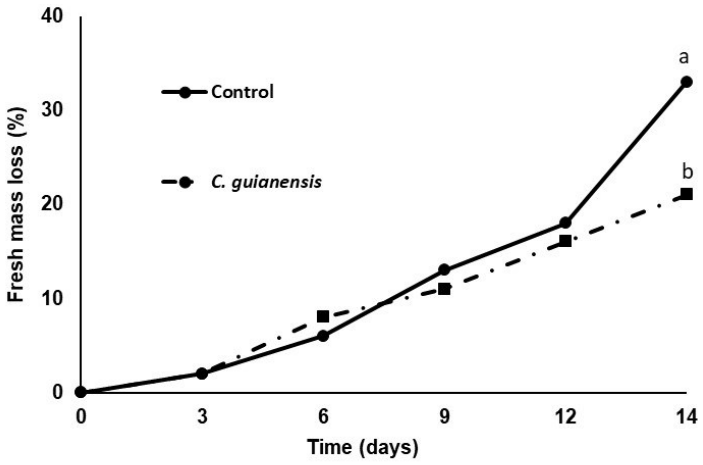


Figure 1. The visual aspect of cassava starch biofilms with aqueous extract of *C. guianensis*



Graph 1. Fresh mass loss as a function of the two biofilms during twelve days of storage. (●) Control group; (■) *C. guianensis* (2,6% starch cassava (m/v) + 2 g of gelatin + 100 mL of extract). Means values followed by the same lower-case letter do not differ statistically by Tukey's test at 5% probability test.

The biofilms synthesized by the casting technique presented a good visual aspect, transparency, homogeneity, and flexibility (Graph 1). We observed that the samples treated with biofilm showed a better appearance and were the ones that had the least loss of water during the analysis period (Figure 1). On the other hand, the group without coating showed a different color at the end. The application of biofilm was efficient in reducing the fruit's contact with oxygen in the air, delaying the enzymatic browning, forming a barrier to water loss, reducing exudation, and guaranteeing better quality fruits for a longer time. The °Brix ranged from 20.1 to 22.2 °Brix. The decrease in pH during ripening is expected to be associated with the accumulation of sugar and acid constituents during the ripening of fruits. As soluble sugars are precursors of organic acids, with a predominance in bananas, of malic acid, their accumulation decreases pH during ripening. During the ripening of the fruit, the conversion of starch into sugars occurs, providing an increase in soluble sodium content. The soluble solids in bananas range from 19.72 to 22.36 °Brix for the ripe fruit. Several factors are related to the content of soluble solids, among them, the state of ripeness, edaphoclimatic conditions in which the fruit was produced, and conditions of artificial ripening and storage. However, the values found are within the acceptable range for ripe fruit and in good condition for consumption.

2. CONCLUSION

This study revealed the efficiency of biofilm coating with and without gelatin to reduce the rate of enzymatic browning and increase the shelf life of bananas. It was possible to verify a smaller reduction in fresh weight loss in the treatments. Besides, no significant difference was observed in the addition of gelatin to the parameters evaluated in the fruit.

CONFLICT OF INTEREST

There is no conflict of interest.

ACKNOWLEDGMENTS

This work was supported by Agência Nacional de Petróleo (PRH 16.1), Conselho Nacional de Desenvolvimento Científico e Tecnológico (CNPq BRICS-STI-5440090/2022-9 and PQ-2022302508/2022-8), Coordenação de Aperfeiçoamento de Pessoal de Nível Superior (CAPES - Finance Code 001), Fundação Carlos Chagas Filho de Amparo à Pesquisa do Estado do Rio de Janeiro (FAPERJ E-26/210.800/2021(Energy), E-26/211.122/2021 (COVID), E-26/210.511/2021 (ConBraPA2022), e-26/201.154/2021 (CNE) and E-S26/210.080/2023 (Thematic)), and Pró-Reitoria de Pesquisa, Pós-Graduação e Inovação (PROPPI).

REFERENCES

1 Eknath, A. A., & Shivchandraji, L. K. Betaamyrin palmitate-isolation from Couroupita guianensis Aubl. leaves. *Indian Drugs*, *39*(4), 213-216. 2002.

2 Souza, C. O., Silva, L. T., Silva, J. R., López, J. A., Veiga-Santos, P., & Druzian, J. I. Mango and acerola pulps as antioxidant additives in cassava starch bio-based film. *Journal of Agricultural and Food Chemistry*, *59*(6), 2248-2254. 2011.

3 Thode Filho, S., Jorge, E. N. D. L. F., da Fonseca Nicomedes, K., Sampaio, F. P., Ongaratto, R. S., & de Souza Júnior, F. G. Adição de biopreservadores na síntese de biofilme de amido de mandioca para conservação de banana 'prata'. **Revista Alimentos: Ciência, Tecnologia e Meio Ambiente**, *2*(8), 40-50. 2021.

