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# Synthesis and Characterization of Starch Films from Green Banana Peel for the Food Packaging Industry

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## INTRODUCTION & AIM

The use of plastic in the food industry has caused adverse environmental impacts due to the generation of solid waste [1]. As an alternative, biodegradable films have been made from plant and food waste [2].

However, some disadvantages they may present are their low mechanical properties and flexibility. For this reason, several formulations of starch extracted from banana peel residues mixed with glycerin were synthesized and characterized to determine the most suitable mixture that meets the desirable properties for this application.

In addition, an optimization study of the solutions was carried out to maximize the functional properties in the food packaging application [4].

## METHOD

In this study, starch was extracted from green banana peels using two different methods: using only the aerenchyma and using the whole peel [3]. For biofilms, three different formulations were made varying the amount of starch and glycerin for flour treated with and without sodium bisulfite.

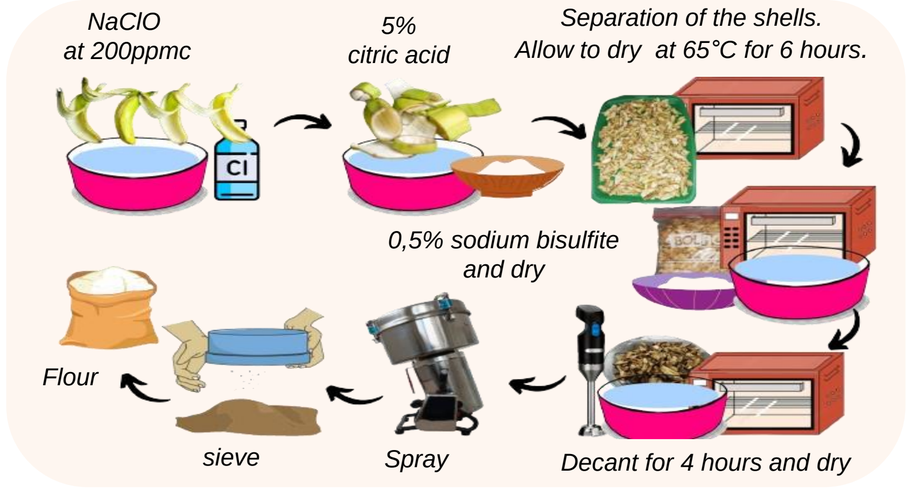


***Figure 1. Starch extraction***

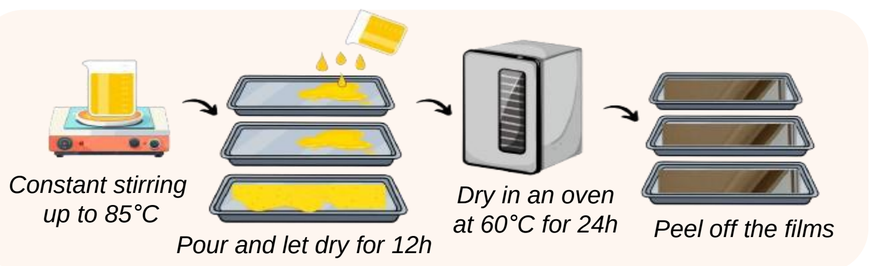


***Figure 2a. Preparation of green banana starch / glycerin films***

| Sample | Starch banana (g) | Glycerin (g) | Metabisulfite treatment | % p/p |
|---|---|---|---|---|
| Formulation 1 | 3 | 0.6 | Applicable | 20 |
| Formulation 2 | 3 | 0.6 | Not applicable | 20 |
| Formulation 3 | 4 | 0.8 | Applicable | 20 |
| Formulation 4 | 4 | 0.8 | Not applicable | 20 |
| Formulation 5 | 5 | 1 | Applicable | 20 |
| Formulation 6 | 5 | 1 | Not applicable | 20 |
| Formulation 7 | 4 | 0.6 | Not applicable | 15 |
| Formulation 8 | 4 | 0.8 | Not applicable | 20 |
| Formulation 9 | 4 | 1 | Not applicable | 25 |

***Table 1. Formulations used to obtain starch films from green banana peels and glycerin***

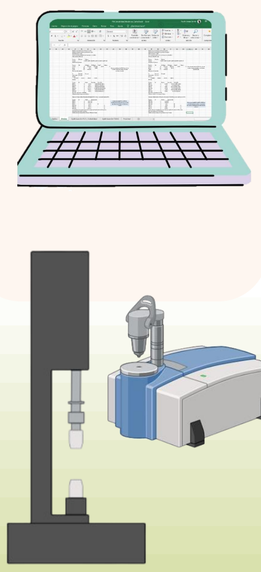

***Figure 2b. Physicochemical and mechanical characterization of films***

## RESULTS & DISCUSSION

Nine formulations (F1-F9) of biodegradable starch/glycerol films were prepared and analyzed.

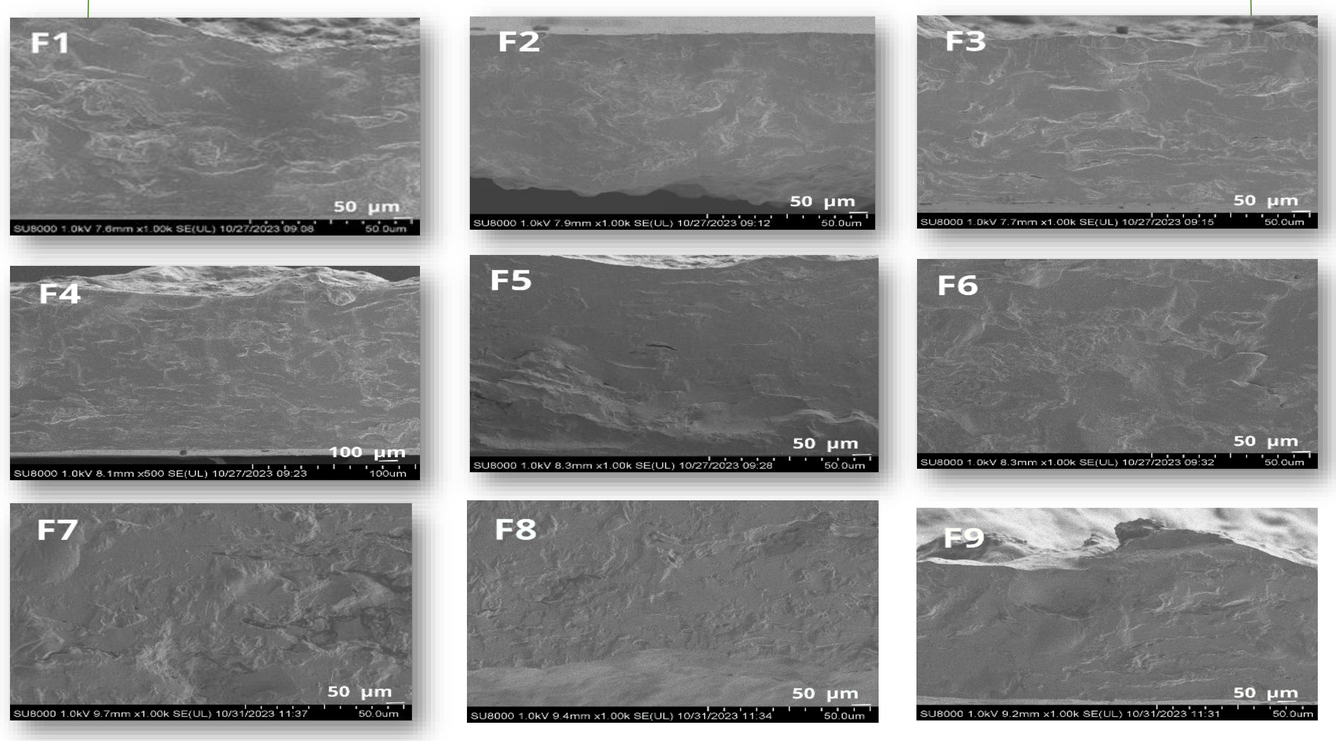


***Figure 3. SEM micrographs of starch/glycerol films.***

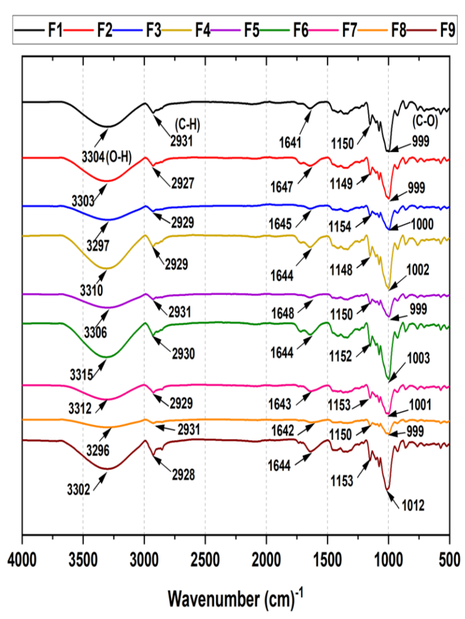


***Figure 4. FT-IR espectra.***

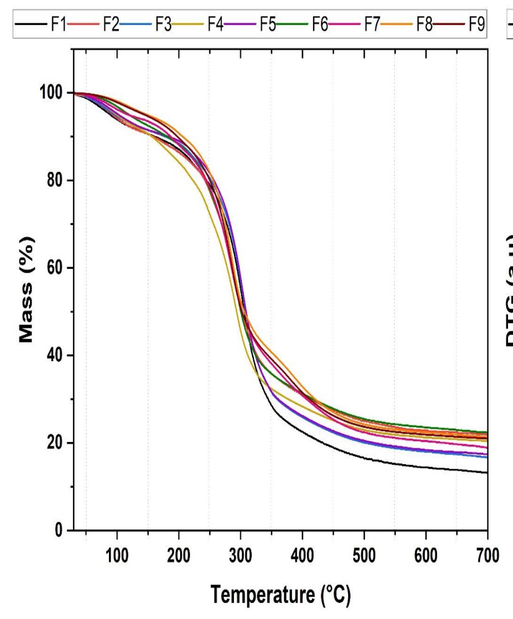


***Figure 5. TGA termogram.***

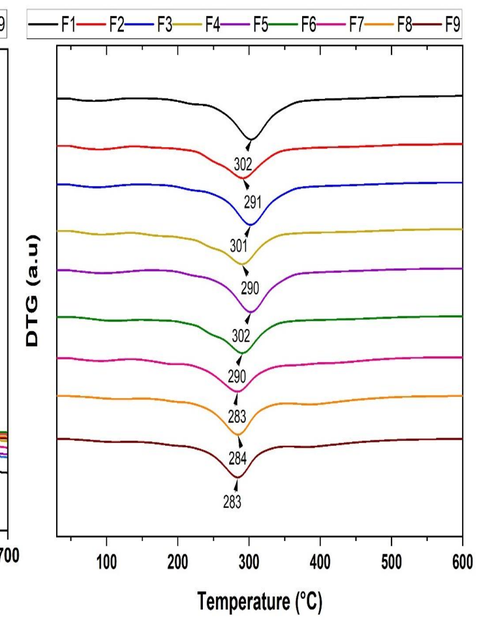


***Figure 6.DTG termogram.***

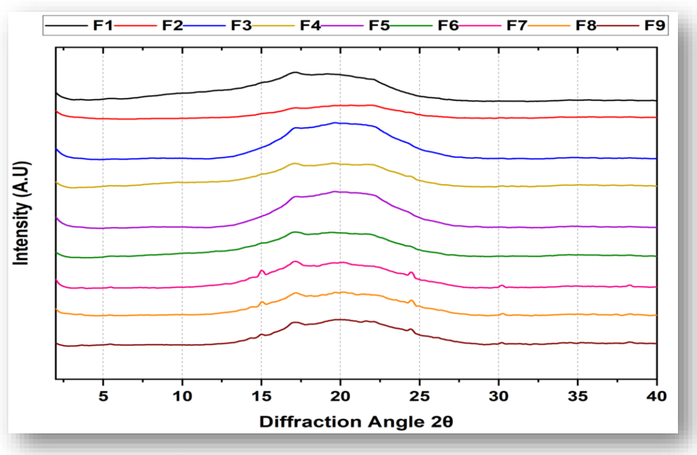


***Figure 7. DRX espectra.***

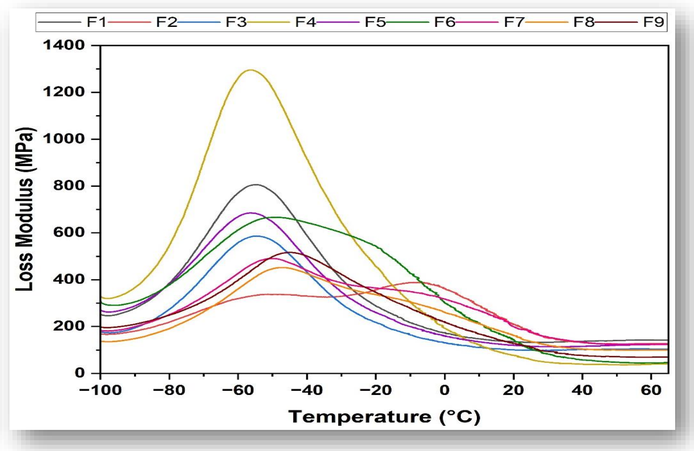


***Figure 8. LOSS MODULUS espectra.***

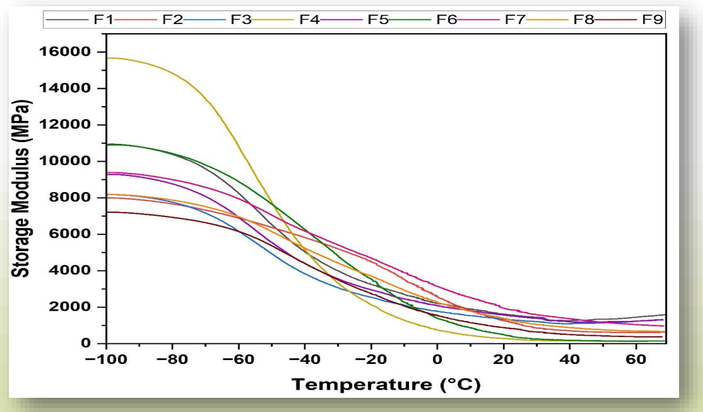


***Figure 9. STORAGE MODULUS espectra.***

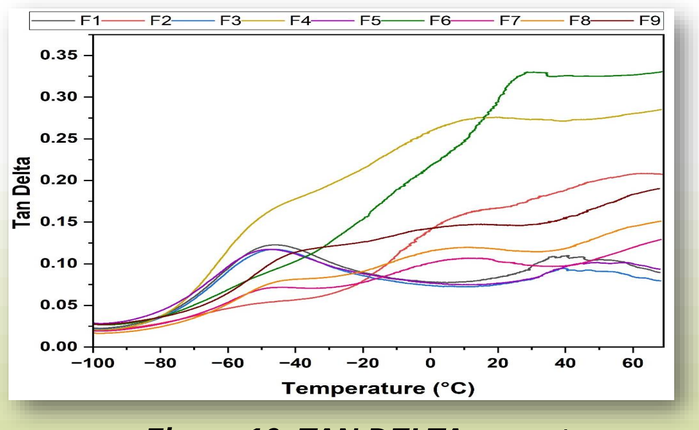


***Figure 10. TAN DELTA espectra.***

## CONCLUSION

The mechanical, solubility and vapor permeability properties of the films were optimized to identify the most suitable formulation for food packaging. F3 was determined to be the most appropriate formulation due to its higher mechanical properties and lower vapor permeability and solubility compared to a commercial polyethylene film.

## REFERENCES