

Development of Biodegradable Packaging Material Using Garlic Peels (*Allium sativum*)

A. Reni¹, R. K. Pramodithaa², S. Saieni^{3*}, S. Soundarya⁴, S. Suprajaa⁵, M. M. Tamilmani⁶

¹Associate Professor, Department of Food Processing and Preservation Technology, Avinashilingam Institute for Home Science and Higher Education for Women, Coimbatore, India

^{2,3,4,5,6}Scholar, Department of Food Processing and Preservation Technology, Avinashilingam Institute for Home Science and Higher Education for Women, Coimbatore, India

Abstract: Biodegradable packaging is produced using biopolymers which are molecules often found in living organisms like cellulose and proteins. The motive of the project is to convert household biodegradable waste (garlic) into biodegradable packs. This packaging method is done to reduce the environmental impact. The waste rate of the garlic peel is about 16-20% seed stock weight (1). Approximately 2.3-2.9 million tons of garlic peels were generated as waste worldwide. The peels are composed of cellulose (41-50%) hemi cellulose (16-26%) and lignin (26-30%) (3) which acts as effective packaging property. This is done to develop a biodegradable packaging using garlic peels and to find an eco-friendly alternative to reduce the current impact of plastic and over use of papers in packaging industries.

Keywords: biodegradable, garlic peels, eco-friendly packaging, biodegradable bag.

1. Introduction

In this developing world we are indeed responsible for innovating new ideas and also finding solution to preserve our natural resources by other alternative replacements which could promote a better environment. Packaging industries are the one which uses lot of plastics and paper for making strong packaging materials. Though plastic have certain toxic substances it's usage has become unavoidable in the industries. So to minimize this we can shift to "Sustainable packaging". Sustainable packaging is one of the modern packaging method mainly done to reduce the environmental impact. This will transform the fruit and vegetable peels (2) waste in a productive way, which will develop and enhance new solution in the packaging field to promote better environment. The expected outcome is a biodegradable bag. This would be the better substitute for plastic bags, because our vision is to create a biodegradable bag which will be an alternative for a timely issue that is the usage of plastic bags. When compared to the plastic bags this will be easily disposable and with no negative environmental impact. The cloth bags or pure paper bags which uses fewer fresh resources from nature and more of what it considered to be waste. We would obtain a biodegradable bag where we can expect pollution free usage there would be reduction of amount of waste produced and carbon dioxide

levels and there would be less consumption of energy during manufacture.

2. Materials and Methods

The materials required for the making of packaging material using bio peels of *Allium sativum* (Garlic) are listed below,

- Garlic peels
- Cardboard boxes
- Sodium hydroxide
- Starch
- Soda ash
- Soxhlet extractor percolator boiler
- Round bottom flask
- Erlenmeyer flask
- Spatula
- Milligram weighing scale
- Fourdrinier machine
- Blender
- Steam
- Moisture scanner sensors
- Slitter rewinding machines

The methods used to prepare a biodegradable packaging material from garlic peel includes the following;

- Preparation of garlic peel pulp
- Preparation of head pulp
- Development of biodegradable packaging

A. Preparation of garlic peel pulp

The garlic peels are collected from various food industries which are generated as waste. The cloves and the stalks are removed. The peels were cleaned then cooked with soda ash and then blended to obtain pulp.

B. Preparation of head pulp

The paper and paper boards are collected and sorted and then they are pulped.

C. Development of biodegradable packaging material

This garlic pulp is mixed with the head pulp obtained from

*Corresponding author: saienibas@gmail.com

cardboard boxes with required amount of starch solution. The pulp mixture is pressed, dried and rolled into papers which can be made into pouches or bags based on customer needs.

D. Testing methods

Various samples are made and their strength were tested to get a good quality packaging material. Burst strength test is one of the paper strength test and this testing method is used here to determine the strength of the various samples of packaging material.

The process followed to make a biodegradable packaging material using garlic peels is shown in the figure.

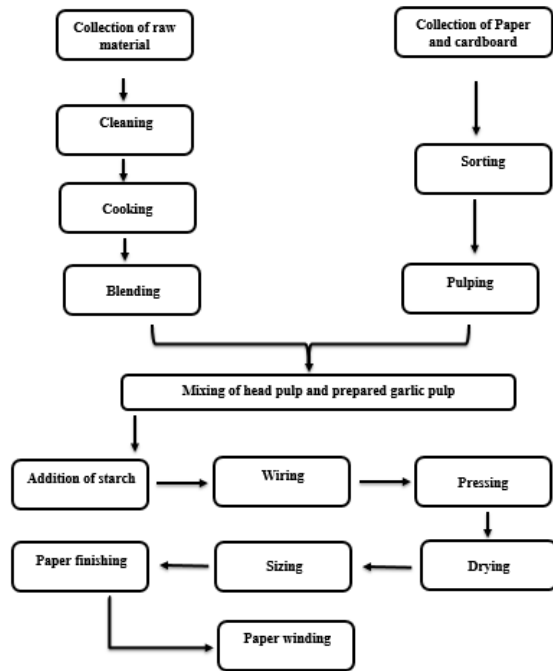


Fig. 1. Flowchart for development of biodegradable packaging material using garlic peels

3. Results and Discussions

Bursting strength testing machine is used to test strength of the different kinds of paper and paperboard(Figure2). The operating system of the tester is very easy. It is very important and widely used measurement (4). It is defined as the required minimum amount of hydrostatic pressure to rupture the paper or paperboard (maximum resistance (in kPa) of a specimen). Samples with different proportion of pulp and starch were made (Figure 3) and test are done to check the strength. The results of burst test are shown in Table 1.



Fig. 2. Burst strength tester

A. Samples

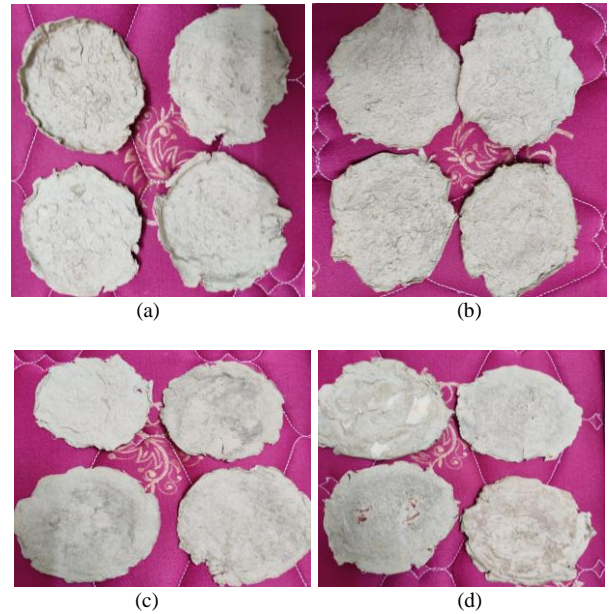


Fig. 3. Samples (a) Pulp Without Starch, (b) Pulp with Starch (c) 10% percent sample + 90 percent head pulp, (d) 20% percent sample + 80 percent head pulp

Table 1
Results of burst test

Variety	Weight	Burst Factor
Sample 1 (Pulp Without Starch)	1.24	14
Sample 2 (Pulp With Starch)	1.12	15
Sample 3 10% percent sample + 90 percent head pulp	1.08	16
Sample 4 20% percent sample + 80 percent head pulp	1.02	17

From the above results it is obvious that, Addition of starch to sample the paper strength gets increased. Hence, we conclude that proper optimization of starch will improve the paper strength and quality.

4. Conclusion

Nowadays, Smart and active packaging materials fabricated from natural materials have considerable potential in the food industry to improve the quality and safety of foods, as well as to extend their shelf-life and reduce waste. Natural pigments can be incorporated into these materials as indicators of changes in freshness, quality, or safety by undergoing color changes in response to specific alterations in pH, gas levels, or temperature. The main advantage of smart biodegradable packaging materials is that the freshness and safety of a product can be monitored in real-time without having to open the package. Hence it can be concluded that, the biodegradable packs made out of garlic peels were tested and can be made into carry bags or pouches as per our needs. It can be used as an eco-friendly alternative to reduce the current impact of plastics and overuse of paper in packaging industries. This packs can be recycled and reused. This will be a new solution in the packaging field to promote better environment.

Acknowledgement

We would like to thank our university, School of Engineering, Avinashilingam Institute for Home Science and Higher Education for Women, Coimbatore for having provided us with the required facilities for our project and for achieving the goals of the project. We would like to extend our gratitude to our guide Dr.(Mrs). A. RENI., M.Tech., PhD., Associate professor for her constant support and guidance. Finally, I would like to take this opportunity to thank our family and friends for their support throughout this work. I also sincerely acknowledge and thank those who gave us directly or indirectly their support for the completion of this work.

References

- [1] Natalie La Volpe. (2018) Good Reasons to Save Those Onion and Garlic Skins. Farmer's Almanac. <https://www.farmersalmanac.com/uses-onion-garlic-skins-30580>
- [2] Kallel, F., & Ellouz Chaabouni, S. (2017). Perspective of garlic processing wastes as low-cost substrates for production of high-added value products: A review, *Environmental Progress & Sustainable Energy*, 36(6), 1765-1777.
- [3] Pathak, P. D., Mandavgane, S. A., Puranik, N. M., Jambhulkar, S. J., & Kulkarni, B. D. (2018). Valorization of potato peel: a biorefinery approach. *Critical Reviews in Biotechnology*, 38(2), 218-230.
- [4] Nagarao, S. D. (2014). Characterization of garlic skin and its evaluation as biomaterial (Doctoral dissertation).
- [5] Paper Testing, <https://cppri.res.in/paper-testing>