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Research Article

Study of Edible Potato Starch as Novel Packaging Materials

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Abstract

Potato starch was utilized to process value added packaging materials made from discarded plastic waste. The quantity for both starch and plastic waste varied and breaking strength for the developed materials were recorded. Discarded plastic waste utilization to minimize toxicity concerns is a waste to wealth approach that produces scalable applications.

Keywords: Edible; Potato Starch; Novel Packaging; Materials

Introduction

Edible starch has been used widely for past many decades owing to the numerous tailor made properties they possess along with their high nutritional content. Among the class of natural polymers, starch is considered as one of the most desired and abundant one. During Photosynthesis, plants store their chemical energy in the form of starch. It has a long history in the field of adhesives for past many decades [1]. Starch is found abundantly in the seeds, fruits, wheat, rice, corn, potatoes and tubers. For example wheat starch plays diverse and multi-functional roles which include mountings of paintings and calligraphy [2]. It is known to form visco-elastic dough by virtue of insertion of mechanical energy or addition of water [3]. Edible starch are studied to show very good mechanical properties on account of the amylopectin in them. Formation of hydrogen bonds between the starch molecules is a key factor due to which they acquire gluing properties. In the proposed study, potato starch solution was added onto the plastic waste to develop a packaging material which is a mixture of plastic waste and wheat starch. Potato starch is of great use in research due to its properties enriched in the formation of numerous value added and sustainable products that are commercializable.

This work is an initiative to utilize the plastic wastes and develop a useful product out of it, to meet several basic requirements for packaging products. Tons of plastic bottles and more materials that are thrown on daily basis in the tourist spot and all the market areas can be utilized to develop value added products, which in turn will clean the environment.

Materials and Methods

Fabrication procedure of Potato starch based packaging material

5g Potato starch was dissolved in 100ml distilled water in a 500ml beaker. The reaction mixture was homogenized completely using a magnetic stirrer until the formation of a thick paste. Afterwards, plastic waste was measured in different quantities to obtain several different mixtures. Both powdered form and shredded form of plastic waste was used in the study to optimize the strength. The ratio of wheat starch to plastic waste (for both powdered and shredded plastic) was 50:50 and 70:30 for different mixtures. It was moulded and dried in an incubator at 65 °C temperature for 3 days. After curing, it was subjected to mechanical study. Universal Testing Machine was used to obtain the failure shear stress of the fabricated material in MPa. The values reported that the plas-

tic waste mixed with potato starch can be a possible candidate for packaging materials. Futher, several futuristic applications are also possible by improving the water holding capacity of the material. Modifications of potato starch for enhancing the performance can be done through chemical, enzymatic and physical methods. Figure 1 to figure 5 represents the developed materials and their testing methods.

Grades	Concentration of Potato Starch (g)	Quantity of Plastic waste (Shredded form) (g)	Quantity of Plastic waste (Powdered form)(g)	Breaking Strength (MPa)
A	5	5	0	1.3
B	5	1.5	0	2.4
C	5	0	5	2.2
D	5	0	1.5	3.4

Table1: Fabrication details and Breaking strength of the potato starch based product.

Figure 1: Grinded plastic waste mixed with potato starch solution.

Figure 2: Shredded plastic waste mixed with potato starch solution.

Figure 3: Study of breaking strength of the samples using the Universal Testing Machine.

Figure 4: Study of breaking strength of potato starch solution mixed with Grinded plastic.

Figure 5: Breaking of the product.

Figure 6: Breaking strength testing of shredded plastic mixture.

Results and Discussions

Discarded plastic waste were utilized to be produced into valued packagings and layered materials. The quantity of the plastic waste was varied to obtain best results. Potato starch solution mixed with plastic waste exhibited 3.4MPa breaking strength ensuring the scalability of the developed product. The powdered plastic waste showed higher breaking strength than the discarded one, implying superior bonding to the starch molecules.

Conclusion

The developed materials have scalable potential to be utilized as packaging materials since these are less chemically toxic and inherently compatible materials. Discarded plastics can be utilized to process valuable materials for desired applications. This in turn will clean the environmental plastic waste and minimize the pollution.

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