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DEVELOPMENT OF BIODEGRADABLE AND THERMOSTABLE POLYSACCHARIDE FILM (SCREENING STUDIES) FROM MARINE ALGAE

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Abstract: This study is to produce an eco-friendly, nontoxic and easily biodegradable plastic film from the naturally available source that is seaweeds abundantly found all over the world. The alginate extracted from the Sargassum sp., a brown macroalgae is used to make bioplastic film as an alternative to the conventional plastics. Due to its high degradability and non-toxicity this could be used to replace the application of single use plastics. As seaweeds exhibit antimicrobial activity, they could enhance the effective production of bioplastic film which could be used for food packaging. Seaweeds can be used to make bioplastics as an alternative since they are numerous and can be cultivated in a wide range of environmental conditions. They are also less expensive than natural sources such as plants and other biomass. As a result, it is more quickly degraded, there will be no health or environmental problems. This study demonstrates bioplastic's ability to reduce the use of synthetic plastics. Sargassum is a seaweed that belongs to the Phaeophyceae class of brown algae, from which alginate is extracted and used for the processing of bioplastics. The study's major objective is to reach out to the biodegradable plastics sector as a viable alternative to non-biodegradable plastics. The biodegradable film was produced and further studies need to be done for the properties of seaweed.
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Index Terms: **Eco friendly, conventional plastic, non-toxicity, antimicrobial, Food packaging**.

INTRODUCTION

Plastics are carbon-based polymers obtained from the sources such as petroleum or natural gas. With the use of plastic life has become very comfortable but the use of plastic also causes many environmental issues all over the world. The removal of these conventional plastics is very difficult. Incineration of these plastics release a toxic chemical called dioxins which leads to cause global warming and environmental pollution that affects human health and causes endocrine disorders, cancer, suppression of the immune system, and various side effects. Despite the fact that plastics are recycled, the majority of plastics are not recycled. Plastic is mostly used for product packaging, which results in an increase in plastic trash every day [4].

Therefore, in this research, we aim to develop plastics derived from the natural polysaccharides of brown seaweed. Biodegradable plastic can be a solution to limit the amount of plastic produced in order to avoid plastic pollution which is difficult to disintegrate. Seaweeds can be used to make bioplastics as an alternative since they are numerous and can be cultivated in a wide range of environmental conditions. They are also less expensive than natural sources such as plants and other biomass [2].

There are many types of brown seaweeds exists which vary in its size and overall morphology. Seaweeds are employed as one of the possibilities for the manufacture of bioplastics due to their high biomass. In the packaging sector, seaweed is frequently utilized as a bioplastic.

Alginate is a polysaccharide obtained from brown seaweed which is a flexible material used as a film. Bioplastic is more quickly degraded; there will be no health or environmental problems. Because seaweeds have medical characteristics, bioplastics made from them may have antibacterial and antioxidant effects [3].

These alginate molecules provide both versatility and stability to the bioplastic. This alginate from brown seaweed (*Sargassum sp*) contains unique pharmaceutical properties such as antioxidant, antifungal, anti-inflammatory and antibacterial activities [3]. The long-term goal is to develop more environmentally friendly, cost-effective, and toxic-free bioplastics that will match the quality of many conventional polymers already in use. The goal of the current study is to create and analyse a bioplastic derived from alginate from seaweed (*Sargassum.sp*) as an alternative for traditional plastics.

MATERIALS AND METHODS

2.1 Collection of seaweeds

The marine algae (*Sargassum sp.*) were collected Rameswaram, Ramnadu district, Tamilnadu, India which is located along the Southeast coast of India.

2.2 Preparation of seaweed powder

The collected seaweed is then washed thoroughly to remove the dirt and other unwanted particles and then shade dried for 3 days. The dried seaweed is ground into fine powder for the analysis of secondary metabolites. The powdered sample were then stored in refrigerator (fig 1). They were then screened qualitatively for the evaluation of their phytochemcial compounds.

Fig. 1 Fine powdered seaweed

2.3 Phytochemical analysis

The different solvent extracts of the chosen marine algae (*Sargassum sp.*) were analysed for confirming the presence and absence of the active phytochemicals.

2.3.1 Test for Flavonoids

A few drops of 1% NH3 solution was added to the various solvent extracts of the marine algae in a test tube.

2.3.2 Test for Anthraquinones

For 1ml of algae extracts few drops of 10% ammonia solution was added.

2.3.3 Test for Carbohydrates

Mix 2ml of algae extract with 1ml of molisch's reagent and then few drops of conc. sulphuric acid was added.

2.3.4 Test for Proteins

Ninhydrin test:

For 2ml of the algae extract of various solvents, add 1-2ml of ninhydrin solution to it and boil the mixture.

2.3.5 Test for Quinones

For 1ml of extract, 1ml of concentrated sulphuric acid was added.

2.4 Seaweed alginate extraction

The *Sargassum sp.* seaweed is sun dried and 20g of the dried is taken for the extraction process. The seaweed is soaked in 300 ml of 3% $CaCl_2$ solution overnight. After soaking, the seaweed is washed thrice in distilled water. Then the seaweed is made to soak in 300ml of 3% HCl solution for 1 hour. After an hour, again the seaweed is washed thrice using distilled water. In 200 ml of Na_2CO_3 solution the seaweed is soaked for 1 hour (Fig. 7). Followed by this, seaweed is washed with distilled water. The treated seaweed is left to soak in distilled water overnight. The solution is centrifuged to collect the supernatant containing alginate.

Fig. 7 seaweed in Na_2CO_3 solution for 1 hour

RESULT AND DISCUSSION

The preliminary screening for the presence of phytochemical has been done for various solvent extracts of marine algae (*Sargassum sp.*). The tests have confirmed the presence of various phytochemicals in different solvents such as water, ethanol, acetone, chloroform and methanol. The tests have confirmed the presence of good amount of secondary metabolites in this seaweed which could lead to the development of non toxic film for food packaging industries.

3.1 Test for Flavonoids

A yellow coloration was observed for the presence of flavonoids (fig. 2).

Fig. 2 appearance of yellow colour

3.2 Test for Anthraquinones

Appearance of pink colour precipitate indicates the presence of anthraquinones (fig. 3).

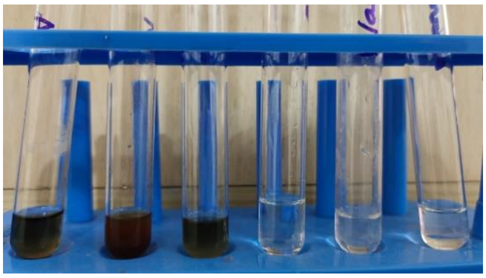

Fig. 3 appearance of pink colour precipitate in water

3.3 Test for Carbohydrates

Purple or reddish colour indicates the presence of carbohydrates (fig. 4).

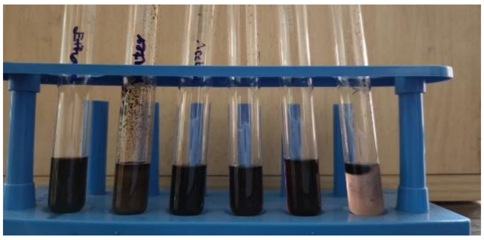

Fig. 4 appearance of purple colour

3.4 Test for Proteins

In ninhydrin test**,** if there is the appearance of deep blue or purple colour then the presence of protein is confirmed (fig. 5).

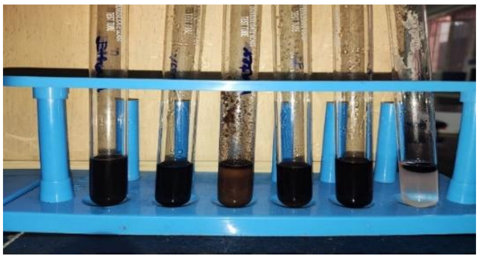

Fig. 5 appearance of purple and deep red colour

3.5 Test for Quinones

Formation of red colour indicates presence of quinines (fig. 6).

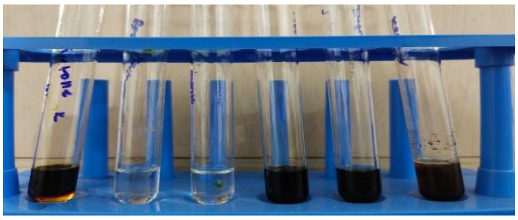

Fig. 6 appearance of red colour

Table 1 depicts the phytochemical analysis of various solvent extracts of the seaweed *Sargassum sp.*

S.no	Phytochemicals	Water	Ethanol	Acetone	Chloroform	Methanol	Blank
1	Flavonoids	-	+	+	-	-	-
2	Antraquinones	+	-	-	-	-	-
3	Carbohydrate	-	+	+	+	+	-
4	Protein	-	+	+	+	+	-
5	Quinone	+	-	+	+	+	-

"-" shows absence and "+" shows the presence of the following phytochemicals

3.6 Seaweed alginate extraction

The obtained supernatant is treated with 75% ethanol to precipitate the sodium alginate (fig. 8). The precipitated alginate is kept in hot air oven overnight at 45ºC to form the sodium alginate film (fig. 9).

Fig. 8 Supernatant containing ethanol precipitated sodium alginate precipitate

Fig. 9 Sodium alginate seaweed film

REFERENCE:

[1] Carina, D., Sharma, S., Jaiswal, A.K. and Jaiswal, S., 2021. Seaweeds polysaccharides in active food packaging: A review of recent progress. *Trends in Food Science & Technology*, *110*, pp.559-572.
[2] Gade, R., Tulasi, M.S. and Bhai, V.A., 2013. Seaweeds: a novel biomaterial. *International Journal of Pharmacy and Pharmaceutical Sciences*, *5*(2), pp.975-1491.
[3] Khalil, H.P.S., Lai, T.K., Tye, Y.Y., Rizal, S., Chong, E.W.N., Yap, S.W., Hamzah, A.A., Fazita, M.R. and Paridah, M.T., 2018. A review of extractions of seaweed hydrocolloids: Properties and applications. *Express Polymer Letters*, *12*(4).
[4] Rajendran, N., Puppala, S., Sneha Raj, M., Ruth Angeeleena, B. and Rajam, C., 2012. Seaweeds can be a new source for bioplastics. *J. Pharm. Res*, *5*(3), pp.1476-1479.