iJRASET
International Journal For Research in
Applied Science and Engineering Technology

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 10 **Issue:** IV **Month of publication:** April 2022

DOI: https://doi.org/10.22214/ijraset.2022.41749

International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.538
Volume 10 Issue IV Apr 2022- Available at www.ijraset.com

Production of Agar-Agar and Sago Based Bioplastic: A Review

Pratik Dilip Patil
Department of Environmental Engineering, Anantrao Pawar Colloge of Engineering and Research, Affiliated to Savitribai Phule Pune University

Abstract**: Plastics made from petrochemicals have long been popular as packing materials because of their excellent barrier qualities, stiffness, tensile strength, and tear strength. Despite their widespread use, plastics have a number of drawbacks, including a poor water vapour transmission rate, non-biodegradability and other issues that contribute to environmental degradation. Newer options came forward regarding usage of the bio-plastics, while keeping in the mind pollution and harm caused to our environment. Bio-plastics are mainly produced from various biological resources such as, potatoes, potato peels, corn, sugarcane, wheat, rice, seaweed-based bioplastic with various agar-agar, seaweed, starch or cellulose based proportions as well as plasticizers and their significant impact on physical-properties, and the bioplastic characteristics. The process used in the production of bioplastics is also investigated. The use of single-use plastic as a replacement in food packaging and other uses is considered. Bioplastic made from seaweed is environmentally beneficial in nature because it degrades fully in soil. Agar-agar and sago-based bioplastics would have a greater chance of overcoming plastic pollution due to their superior mechanical qualities and shorter shelf life spam.
Keywords: Bioplastic, Agar-Agar, Sago, Biodegradable, Petrochemical.

I. INTRODUCTION

Plastics are nothing but the long-chain man-made, polymeric molecules that are low-cost, light in weight, and long-lasting. In the todays world living organism i.e. in the ocean and in the surrounding area, which are affected on a daily basis of owing to increase in the plastic-pollution and there-for the effects are known as the 'Trash - islands,' or 'trash - hills.' These polymers are turned into micro-plastics, which take at least 400 years to break down into minute fragments. The conventional one plastics have a petrochemical origin, making them non-biodegradable and non-renewable. The non-biodegradable and non-renewable nature of the petrochemical plastic has been a severe drawback to their use and resulting in massive municipal garbage and environmental degradation.

As a result, most users are under increasing pressure to reduce non-degradable waste and replace it with biodegradable products.

As a result, the majority of research aimed at improving the structural bonding strength and functional characteristics of starch-based bioplastics has concentrated on integrating chemicals such as plasticizers to ease the problem of brittleness in the materials. Zhang et al. [1], recently stated that bioplastic films produced by treating them with various plasticizers are not cost-effective and lack the requisite material characteristics. Furthermore, Huang et al., found that when starch-based bioplastics treated with plasticizers are stored for an extended period of time, their mechanical properties deteriorate dramatically due to recrystallization.

In today’s time the difficulty of finding an similar and identical balance between the mechanical characteristics, cost, acceptable level of biodegradability and efforts to manufacture the competitive biodegradable materials. Both agar-agar and sago are natural polymers that are abundant and inexpensive to create. They have been considered to be one of the most promising choices for bioplastics production. Agar-Agar and sago-based bioplastics have been the subject of numerous studies aimed at improving their characteristics. Mechanical and thermoforming qualities, gas and water vapour permeability, transparency, and availability among other properties are the most significant in bioplastic materials.

By observing the huge market potential for the bioplastic materials makes it clear that great and vast opportunities lie ahead in future time. There are nevertheless problems that must be overcome in order to increase the competitiveness of bioplastic materials.

This review paper covers some of the recent improvements that are made in improving the performance of bioplastic with the use of agar-agar, and, sago, and many other natural sources through the use of glycerine and vinegar to overcome most of the limits demonstrated by plasticized organic-plastics. Potential application areas for bioplastic materials, as well as prospective markets are highlighted along with their advantages and dis-advantages.

II. CHARACTERISTICS, OF, AGAR-AGAR, AND, SAGO, POWDER

A. Agar-Agar

The primarily structure of the agar-agar is characterised chemically by the continuous repeating unit of Galactose and 3, 6-anhydro-L-galactose with few variations as well as a low ester sulphate of content. Agar's structure is made up of two polysaccharide groups: agarose, which is a neutral polymer, and agar, pectin, which is an oversimplified word for the charged polysaccharide [3-5]. Agarose is responsible for agar's ability of gelling making it extremely valuable in skin care, herbal medicine, and pharmaceutical uses; it also has good film qualities. [6]. Because of its ability to operate as stabilisers, emulsifiers, and thickening agents, agar-agar is widely used in the commercial food processing sector. Both are already utilised in gel-based food products such sweets, jams, and jellies, as well as baked goods. The agar gels are typically tight and lucid, but the addition of carbohydrates improves their strength [7]. It has a low hydroscopic property, which is advantageous in the manufacturing of packaging; also agar films are biologically inert and can easily interact with various bioactive compounds and/or plasticizers to aid in the formation of elastic and soft gels [8-10].

B. Sago, Powder

Sago is practically pure starch, including only a trace of B vitamins and consisting of 88 percent carbohydrate, 0.5 percent protein, and minute amounts of fat. It is a staple food in the southwest Pacific region, where it is used to make soups, cakes, and puddings in meal form. Its principal usage in cooking is as a pudding and sauce thickening elsewhere. It's utilised as a textile stiffener in industry. Biodegradable plastic made from sago starch is an eco-friendly product. This is to reduce the chemical composition of the mixture by replacing the starch, which is a starch that does not contain harmful chemical reactions or reactions when mixed with other biodegradable components. Sago starch is a natural material, so it is harmless. Sago starch contains amylose, which easily binds to other compounds. Sago starch gelatinizes when heated at 70 ° C.

III. APPLICATIONS, OF, BIOPLASTIC

Bioplastics include disposable items such as plates, utensils, cups and foils, packaging, plastics, bottles and paper, fast food coatings, cloths and textiles industry, compost and various types of bags, agricultural mulching films, surgery implant, big industrial packaging, packaging of milk, food service, personal care, pharmaceuticals, medical, leisure, etc. Commonly used However, as a package, it can be used in any application where controversial plastics are used.

IV. ADVANTAGES OF, BIOPLASTIC

Plastics are the main pollutants in the environment used on a daily basis. Therefore, it is necessary to switch to pollution-reducing bioplastics rather than petrochemical-based products. This can solve many environmental problems. Bioplastics have the following unique properties: like they are environmental friendly, compostable and energy efficient biodegradable. The future of biodegradable plastics shows great potential.

Here, are, some, of, the, advantages, of, the, bioplastics:

1) Reduction of carbon, foot, print, [12,7,8].
2) Energy, efficiency, [12,7,8].
3) Partly, based, on, natural, feedstock, [12,7,9].
4) Eco-safety.

However, the problems, might, occur, with, the, use, of, bioplastics., Here, are, some, of, the, disadvantages, of, bioplastics:

a) Relative high, cost, [9,11].
b) Brittleness of bioplastic, [13].
c) Thermal, instability, [12,13].
d) Various, recycling, problems, [9].

V. LIMITATIONS OF BIOPLASTIC

A. Bioplastic, may, require, specific conditions, to, decompose, i.e., natural, breakdown, of, bioplastic, may, not, occur, if, it, is, sent, to, the, landfill, along, with, other, waste.
B. Growing, demand, for, bioplastics, may, create, competition, for, food, sources.
C. The, cost, of, bioplastic, may, not, be, economical, as, compared, to, the, petrochemical, plastic, i.e., non-degradable, plastic.

D. Their, may, be, problems, to, occur, in, recycling, of, the, bioplastic, material.
E. Special, type, of, equipment's, and, tools, may, require, to, develop, this, bioplastic, material, and, various, types, of, thin, bio-films.

VI. FUTURE, MARKET, OF, THE, BIOPLASTIC, PRODUCTION,

By observing the market of bioplastic its global value is estimated at US $ 3.27 billion in 2019, reaching to US $ 6.12 billion by 2023 and a CAGR (Compound Annual Growth Rate) of 15.1. %, From 2020 to 2025. Governments around the world have banned the use of disposable plastics by which, along with growing awareness among people about the harm that plastics can do to tour planet is one of the major trends that are stimulating this market. Non-composted plastics are a global problem today, and the best way to deal with them is to manufacture and use biodegradable materials.

The plastic market can be divided based on significant end-use and regional outlook. Depending on the material, there are the following types: starch-based, PLA-based, polybutylene-adipate-terephthalate (PBAT), polybutylene succinate (PBS), polyhydroxyalkanoate (PHA), etc. Those who including these are poised to dominate the market with starch-based bags. This segment is ready to expand its revenue-based CAGR to 10.4%.

Demand for bioplastics has increased over the last decade due to growing awareness of the use of organic or natural resources for the development of various regulations for environmental protection, conservation, manufacturing the materials and the effective use of natural resources. The growing consumer preference for biodegradable materials, coupled with growing environmental interest, is expected to drive the overall growth of the biodegradable packaging market.

VII. CONCLUSION

From this review, we can conclude that the use of renewable and natural resources in the production of bioplastics is more beneficial than petrochemical plastic products. Petrochemical-based plastics have many drawbacks that is why they cause pollution and produce manufacturing, recycling, poisonous gas, and so on. In addition, eating food from plastic containers can cause cancer because it is widely used in packaging.

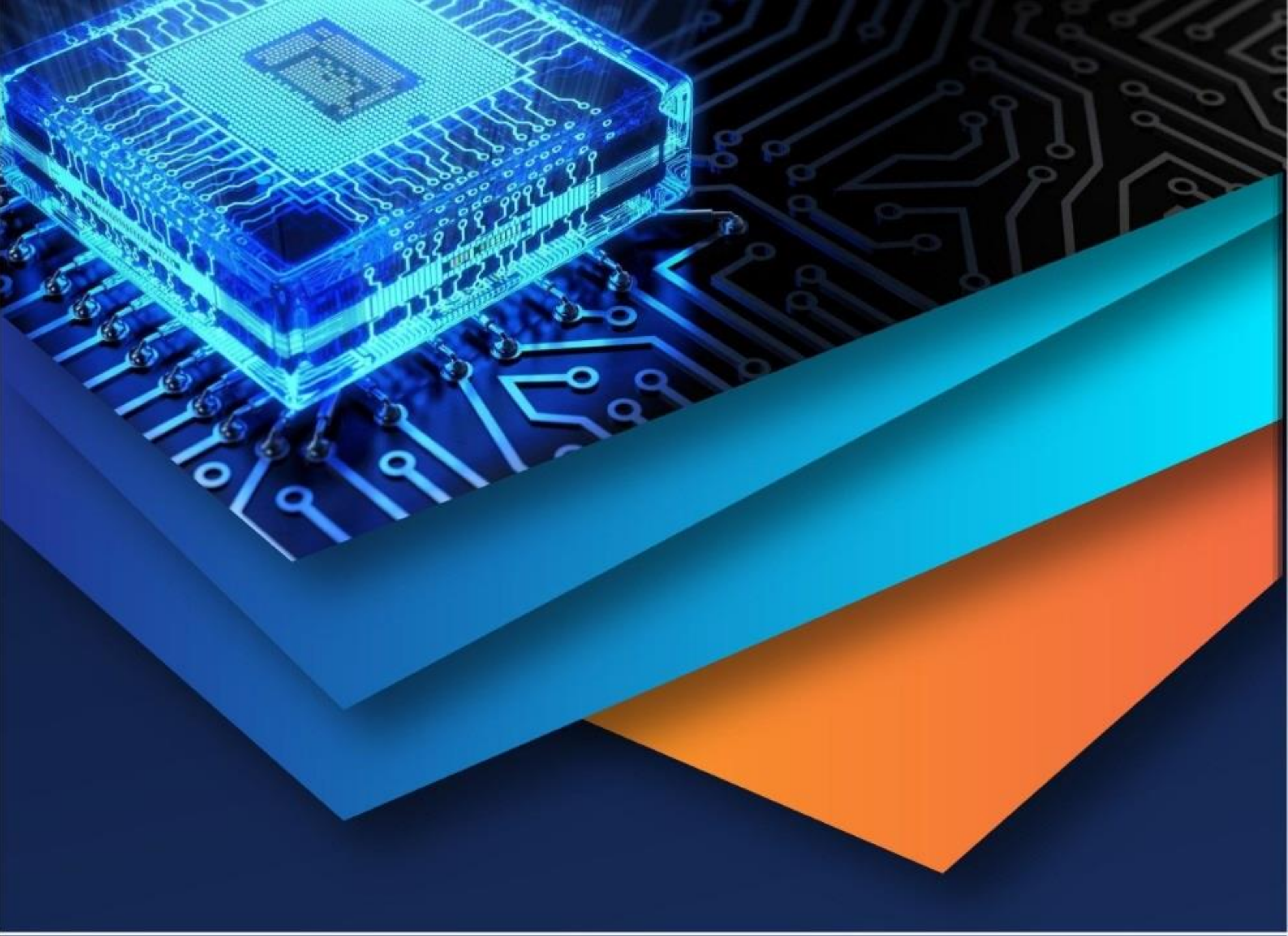
Compared to petrochemical plastics, natural based bioplastics are renewable, biodegradable, environmentally friendly and sustainable, so we need to switch to bioplastics. Therefore, more and deep research and development in the field of bioplastics is urgently needed and should be encouraged.

VIII. ACKNOWLEDGMENT

I, would, like, to, say, my special, thanks, to, respected principal prof. Sunil B. Thakare, and Head of the Department prof. Sagar M. Gawande sir. They, always, gave, me, the, opportunities, to, learn, and, grow., I, feel, fully, fortunate, to, study,, work, and, research at, Department, of, Environmental Engineering, Anantrao Pawar College of Engineering and Research, Pune.,

REFERENCES

[1] Q.H.,Zeng,, A.B., YU,, G.Q, LU, (max),, Dr., Paul,, Clay-based, polymer, nanocomposites:, research, and, commercial, development,, journal, of, nanoscience, and, nanotechnology, 5, (2005), 1574-1592.
[2] Williams,, Peter, W.;, Phillips,, Glyn, O., (2000)., "Chapter, 2:, Agar"., handbook, of, hydrolloids., cambridge:, woodhead., p., 91., isbn, 1-85573-501-6.
[3] Araki,, C., Structure, of, the, Agarose, Constituent, of, Agar-agar., Bull., Chem., Soc., Jpn., 1956,, 29,, 543–544.,
[4] Araki,, C., Some, Recent, Studies, on, the, Polysaccharides, of, Agarophytes;, Pergamon, Press, Ltd.:, Oxford,, UK;, Kyoto, Technical, University:Kyoto,, Japan,, 1966.
[5] Matsuhashi,, T., Agar., Chapter, 1., In, Food, Gels;, Harris,, P.,, Ed.;, Elsevier, Science, Publishers, Ltd.:, Amsterdam,, The, Netherlands;, Nagano, State, Laboratory, of, Food, Technology:, Kurita,, Nagano,, Japan,, 1990;, pp., 1–51.
[6] Rhim,, J.-W., Effect, of, clay, contents, on, mechanical, and, water, vapor, barrier, properties, of, agar-based, nanocomposite, films., Carbohydr., Polym., 2011,, 86,, 691–699.,
[7] Bixler,, H.J.;, Porse,, H., A, decade, of, change, in, the, seaweed, hydrocolloids, industry., J., Appl., Phycol., 2011,, 23,, 321–335.
[8] Mostafavi,, F.S.;, Zaeim,, D., Agar-based, edible, films, for, food, packaging, applications—A, review., Int., J., Biol., Macromol., 2020,, 159,, 1165–1176.
[9] Sousa,, A.M.M.;, Sereno,, A.M.;, Hilliou,, L.;, Gonçalves,, M.P., Biodegradable, agar, extracted, from, Gracilaria, vermiculophylla:, Film, properties, and, application, to, edible, coating., Mater., Sci., Forum, 2010,, 636–637,, 739–744.,
[10] Martínez-Sanz,, M.;, Martínez-Abad,, A.;, López-Rubio,, A., Cost-efficient, bio-based, food, packaging, films, from, unpurified, agar-based, extracts., Food, Packag., Shelf, Life, 2019,, 21,, 100367.
[11] Shivam, P., Recent, Developments, on, biodegradable, polymers, and, their, future, trends., International, Research, Science, Eng., 2016;, 4(1):, 17-26.
[12] Chen, YJ., Bioplastic, and, their, role, in, achieving, global, sustainability., Journal, of, Chemical, and, Pharmaceutical, Research., 2014;, 6(1):, 226-231.
[13] Nafisa, Jabeen, N,, Majid, I,, Nayik, GA., Bioplastics, and, Food, Packaging:, A, Review., Cogent, Food, &, Agriculture., 2015;, 42(1):, 01-06.



10.22214/IJRASET

45.98

IMPACT FACTOR: 7.129

IMPACT FACTOR: 7.429

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY