AGAR BASED BIODEGRADABLE PLASTIC

KASALI HASNAIN IKBAL[1], SHAIKH AMIR AINUL ABDEEN[2], SHAHID RAZA ASGAR ALI[3], SHAIKH SAHIL[4], RUPESH KHARBE[5]

"DEPARTMENT OF MECHANICAL ENGINEERING"[12345]

"RIZVI COLLEGE OF ENGINEERING" (RCOE)[12345], MUMBAI UNIVERSITY, MUMBAI, INDIA.

CORRESPONDING AUTHOR (PROJECT GUIDE)[5]

ABSTRACT:

In today's world due to depletion of resources massive research are done on sustainable energy.

Bioplastic synthesized from organic substances are degradable in nature. It can solve the petro-plastic epidemic issues and prove to ensure future by prominent research work as well as increasing environmental concern. Though in India the bio-degradable plastic is still in beginning stage. Presently, it is facing the various challenges such as strength, feasibility, synthesis cost. On the other hand, users are less aware about concept and potentiality of bio-degradable plastic. Focus of our topic is to provide better alternative having tensile strength very similar to plastic. We performed several experiments to find plastic alternative, after doing many experiment on our product it was very important to check how feasible our product is, as very less experimental data regarding agar based bio-degradable plastic is available hence our work will provide necessary data to other professionals who are working to obtain plastic alterative.

KEY WORDS:

Agar, Biodegradable Plastic, Plastic, Tensile Strength, Environmental Pollution.

INTRODUCTION:

Designers in 20th century were inspired by the elastic properties of plastic and than due to its availability at low cost caused sudden boost in production of plastic. but use of fossil based synthetic polymers across globe has caused many environment issues including environment pollution. bioplastics has been classified broadly in 2 categories:

1.bio-based plastics-Bio means that the product is derived from biomass(plants).

2.bio-degradable plastics- these are product which disintegrate into organic matter and gases like co_2 etc over period of time.

Our research is focus towards searching for biodegradable plastics having tensile strength similar to plastic.

LITERATURE REVIEW:

This study tries to find the alternate plastic material having tensile strength similar to plastic using agar powder and glycerin which are bio-degradable in nature. Agar is a biopolymer derived from red seaweed, two main species of which are Gelidium and Gracilaria. Agar derived from Gelidium species are preferred due to their higher gelling strength. Glycerin is also used in mixture to provides elasticity in component. It is sticky and contribute to strength. In this research experiments were conducted to optimize variables and obtain adaptable agar-based films and composition-dependent changes of the films were determined. Several experiments were done on trial & error basis to develop an organic material which behaves similar to plastic. Experiments were conducted by combining ingredients and water from heating mixture at medium heat for 20- 25 minutes. After heating mixture became thick paste it was poured on the baking sheet and left for 1-2 days to dry.

TESTING PROCEDURES:

The following steps were followed to determine tensile strength of the samples.

Step 1: We first check for any defects using visual analysis. If has no defects (perforation, tears), then it can be used for testing.

Step 2: After the sample is approved for testing, A dumbbell shape element as per ASTM D638 standard is sliced out from sample.

(as shown in Figure1)

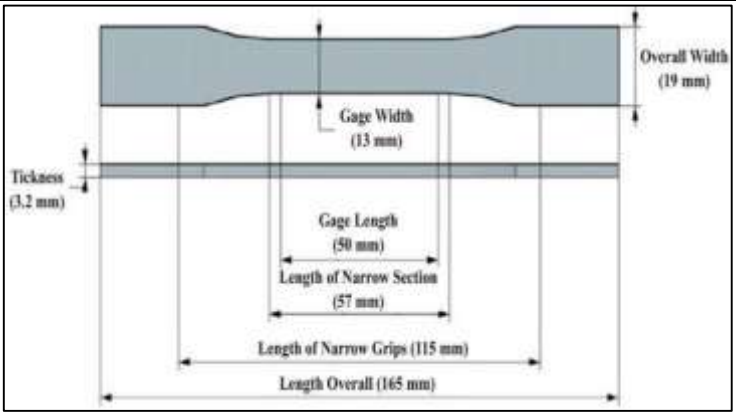

figure 1: dumbbell shape element as per astm d638

Step 3: The standard slice of sample is gripped between two clamps and the clamping position for every sample is kept constant. (As shown in figure2)

Step 4: Once the sample has been clamped, weights are added in step of 50 grams each. A small time gap of 20 second is provided between addition of weight to allow sample to stretch uniformally.

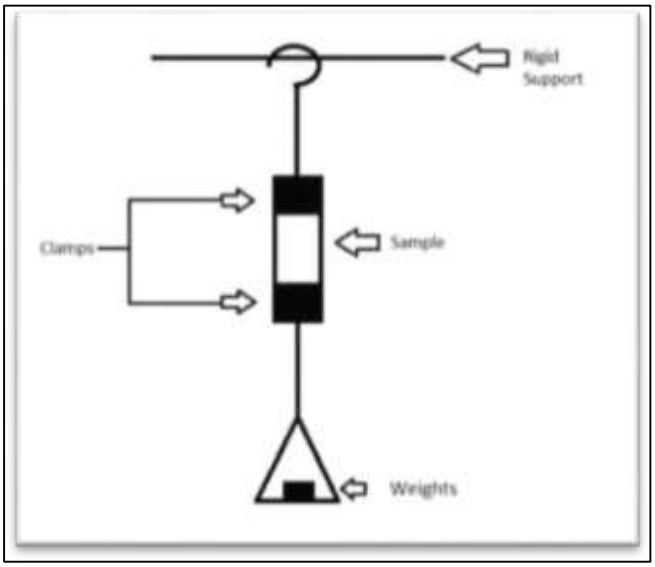

figure 2: testing overview

Step 5: Following formula is used for calculation of tensile strength. Tensile strength (MPa) = weight(N)/cross sectional area (mm^2).

OBSERVATION TABLE:

table 1: determining tensile strength

Sample No.	Agar(g)	Water(mL)	Glycerin(mL)	Tensile Strength(MPa)
1	10	60	3	2.3
2	10	60	5	2.13
3	10	60	7	0.87
4	5	60	5	0.388
5	15	60	5	3.7

ANALYSIS:

1.variation of tensile strength with variation of the quantity of agar.

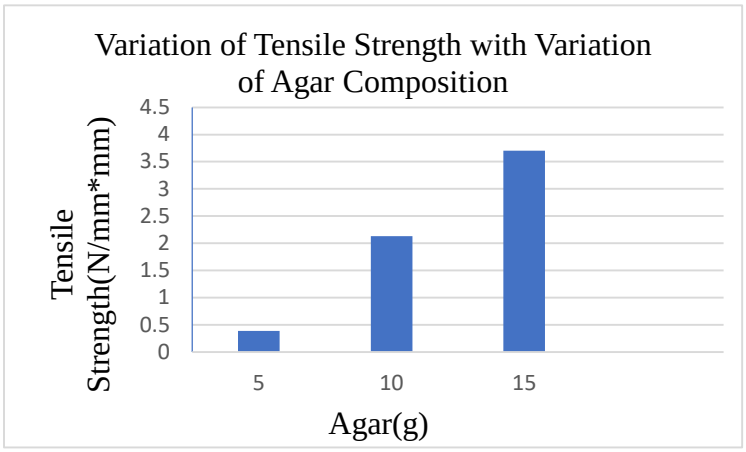

Chart1:variation of tensile strength with variation of agar composition

2. variation of tensile strength & flexibility with variation of glycerin composition.

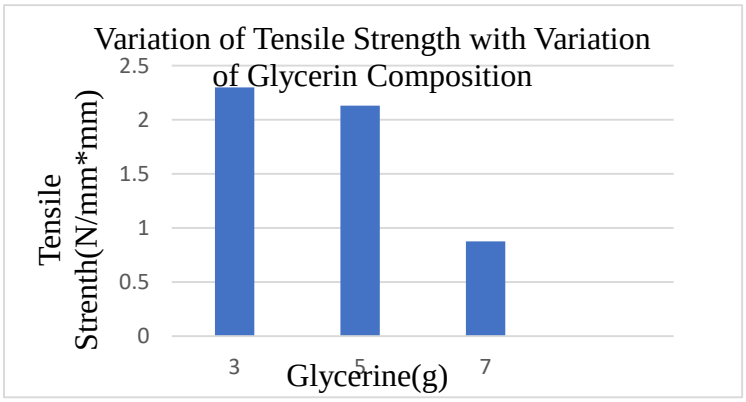

chart 2:variation of tensile strength with variation of glycerin components

RESULTS:

1.variation of tensile strength with variation of quantity of agar.

From Chart 1 it is clear that sample with 5gram agar is weaker in tension than for 10gram agar, tensile strength increases by 448% and for 15gram agar tensile strength further increases by 73.7%.

Thus, we can say that with increasing agar content, tensile strength of polymer increases, however rate of increment of tensile strength decreases.

2.variation of tensile strength & flexibility with variation of glycerin composition.

From chart 2 it is clear that with the increasing quantity of glycerin, it losses the tensile strength but from the observation of product it is visible that Large content of glycerin presence in sample increase the flexibility, which can be used for different purposes.

ADVANTAGES:

1.It reduces the carbon footprint in the environment, it will also save energy during production because of easy production process.

2.since non-renewable sources are not consumed, there is a significant reduction in pollution. No health damaging additives are contained, like Phthalates and Bisphenol-A. It does not alter the flavor and smell of food they store.

3.Further, more preparation is easy, inexpensive and does not require sophisticated equipment. All these features make them a suitable medium for practices, prototyping, design research and suitable products.

CONCLUSION:

The maximum tensile strength obtained during this research is 3.7MPA which is very less comparatively with PE,PP,PVC,PC plastics. but tensile strength and flexibility of agar based biodegradable plastic indicate that it could be an attractive material for DIY material development[1] such as-

1.food products- for packaging,cutlery,mats

2.baby products- for toys like building block,stuffed toys etc.

3.textiles-for clothing like jackets,shoes,sandals etc.

FUTURE SCOPE:

Further research can be carried out for improving the quality of product.

Material like Bagasse, coir can also be utilized as an additive for further improving strength.

This paper focused primarily on tensile strength measurement. Other standard tests like izod impact test, charpy test, etc. can also be conducted.

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