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Biodegradable Water Bottle

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Abstract: ***Plastics are important in many branches of industry, particularly in the packaging industry. However, it has an undesirable influence on the environment and causes problem with the deposition of waste and consumption. According to the sustainable seas trust, if we continue dumping as we have been by 2050, there will be more than 700 million tons of plastic in the ocean, outstripping the weight of fish. Therefore there is a tendency to replace the plastics with biodegradable plastics. So as to reduce the dumping effect. This project aims to search biomaterials, having rich content in starch, from which polymer can be made. Initially corn starch, potato starch, wheat starch and tapioca starch was tried, fruitful result was not obtained from polymerisation as expected. The main focus is towards the fabrication of water bottle using biopolymers. After plenty of starch, it was decided to choose PLA(Poly Lactic Acid) as raw material from which water bottle to be made. Water bottle with a specific dimension is modelled in CATIA, and then converted to STL file; subsequently a prototype is made using 3D printing technology. A paradigm shift from the petroleum based polymers to Bio-polymers going to happen in near future.***
Keywords: Synthetic Polymers, Biodegradable polymers, Starch, PLA (poly lactic acid), 3D printing

I. INTRODUCTION

Nowadays, the plastic products are mandatory in our day to day life. The major impact of using a plastic product is health disorders. Many of the food products are packed using the conventional petroleum based plastic products like bags, bottles, cans, straws, etc. As plastics are dumped into the ground and it takes 1000 years to decompose it. It occupies plenty of spaces in the sea area. When the plastics are dumped into the sea ,it causes harmful effects to sea animals. People when consumes fishes and their sea foods causes cancer to them. Some of the researcher says that there are 100 million marine species[1] are killed every year. If plastics are continuously dumped into the sea,it increases the sea level and causes the earthquakes,tsunami,etc.it is the need of hour to find alternative solution to develop a bioplastic.Mostly water consumed the more spaces in our environment. So biodegradable water bottle play a crucial role in saving environment.

Agnieskasuzman[4] and his team elaborated an overview of biodegradable polymers for food packaging is done. They strongly believe, the decomposition depends on degradation environment.

Mdenamulhoque [5] et al focuses on synthesis and characteristics of sago starch mixed LDPE biodegradable polymer. They studied about the mechanical property(elongation at break and young's modulus)of the starch. They combined the low density polymer with starch in the variation of 10%,30%,50%,and 70%. Then how the trimethylolpropanetriacrylate (TMPTA) AND ELECTRON BEAM (EB) irradiation was cross-linked and influences the mechanical and thermal properties of the mechanical and thermal properties of the polymer was investigated.

Malathi A.N [6] provides information on performance of biodegradable polymer and mainly concentrated on biodegradable polymers from biomass products.

Nikita chokis [7] focuses on polylactic acid and FI-IR(Fourier transform infrared) technique was confirmed by LA and PLA .DSC(Differential scanning calorimetry) is used to analysis the thermal behavior .

II. MATERIAL AND METHODS

Poly (lactic acid) (PLA), so far, is the most extensively researched and utilized biodegradable aliphatic polyester in human history. Due to its merits, PLA is a leading biomaterial for numerous applications in medicine as well as in industry replacing conventional petrochemical-based polymers. The main purpose of this review is to elaborate the mechanical and physical properties that affect its stability, process ability, degradation, PLA-other polymers immiscibility, aging and recyclability, and therefore its potential suitability to fulfill specific application requirements**.** This review also summarizes variations in these properties during PLA processing (i.e. thermal degradation and recyclability), biodegradation, packaging and sterilization, and aging (i.e. weathering and hydrothermal). Incorporating better understanding of the role of these properties with available improvement strategies is the key for successful utilization of PLA and its copolymers/composites/blends to maximize their fit with worldwide application needs. PLA

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4032D is available in pellet form. Drying prior to processing is essential. In the molten state,the polymers are stable, provided that the extrusion and drying procedures are followed.

Normally the PET bottles can be manufactured by using two manufacturing process. The same method is used to make PLA bottles. The two methods is

1) Injection moulding

2) Blow moulding

The preform (parison) can be first manufactured in the Injection moulding and next that preform can be set in the blow moulding machine and give the compressed air and converted into the required shape.



Fig 2 Normal bottle

III. WORKING PRINCIPLE

The working method of biodegradation is already proved, so we didn't test any biodegradability. In 1990 PLA material is introduced and proved it is biodegradable ,but no one can manufactured the water bottle we are the first one introduced the water bottle.PLA is presently used in packaging (films, thermoformed containers, and short shelf life bottles). Cargill Dow LLC obtains fibers by conventional melt-spinning processes for clothing and other uses. PLA products have a silky feel, durability, and good moisture-management properties (moisture is quickly wicked away from the body, keeping the wearer dry and comfortable).

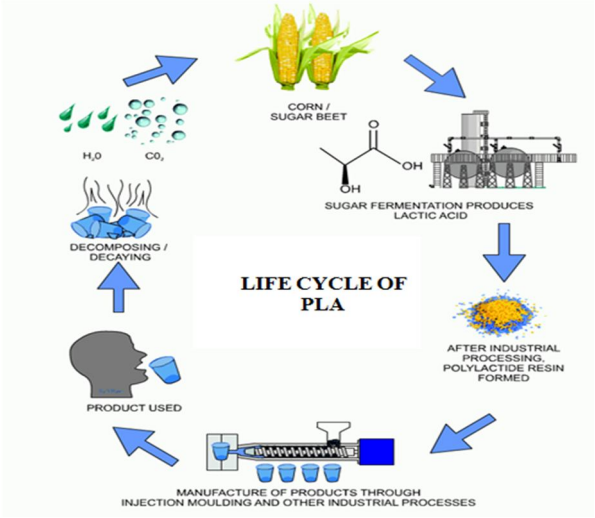


Fig 3 Life cycle of PLA

IV. DESIGN DIAGRAM



Fig 4Designed PLA bottle

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V. DEVELOPMENT OF PROTOTYPE

We developed the prototype by using the 3D printing technology. Normally 3D printing technology is used to develop the prototype .First we designed in the CATIA after it can be converted to the stl file and manufactured in the 3D printing.



VI. ADVANTAGES

A. It reduce carbon footprint
B. It provide energy savings in production
C. Avoids petroleum based raw materials
D. It Reduces dumping effect
E. It do not contain additives that are harmful to health
F. It do not change the flavor or scent of the food contained
G. It provide the Clean environment
H. It helps to increase the agriculture in our country
I. It reduces mortality rate of sea animals
J. It helps to reduce the petroleum prices

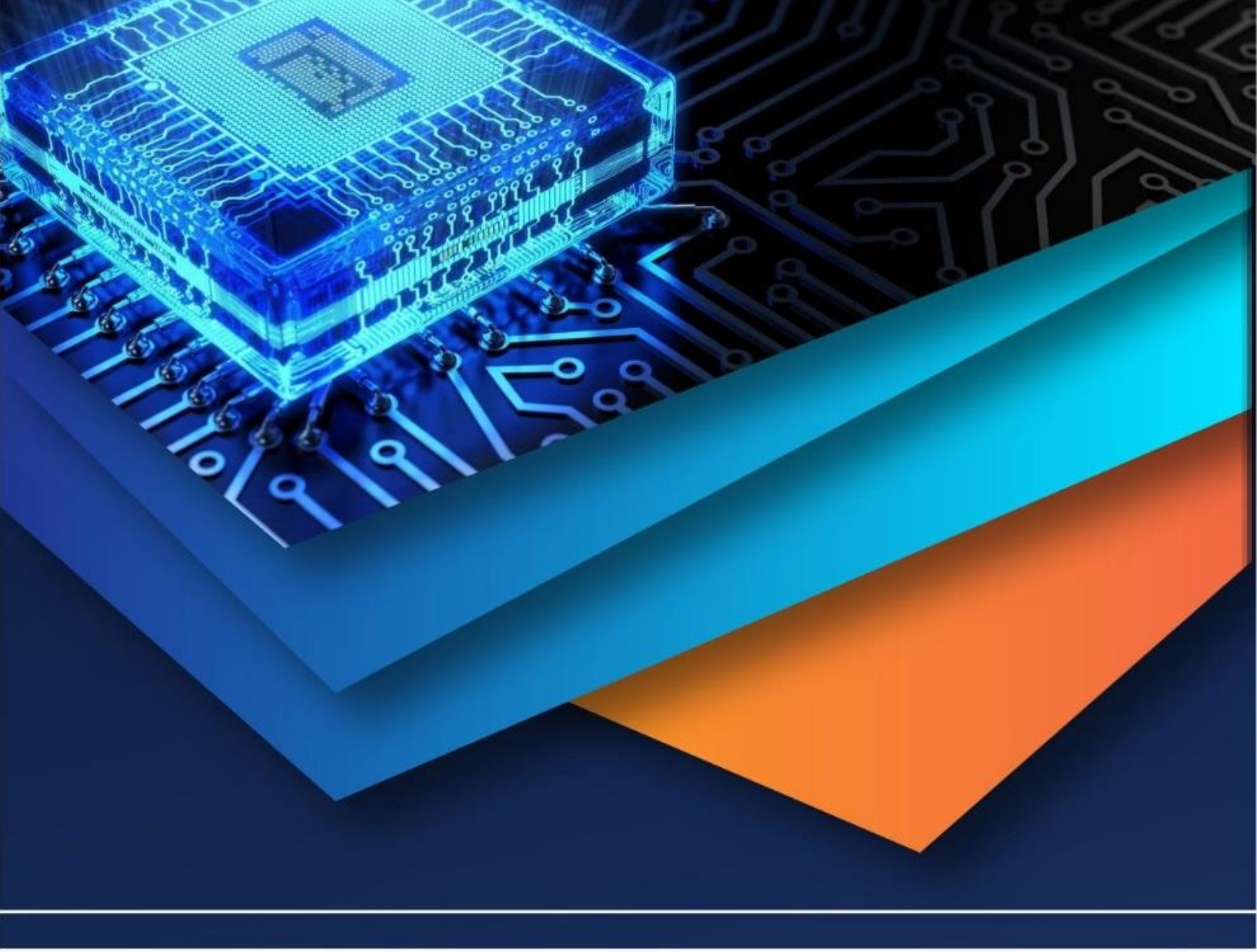
VII. CONCLUSION

Finally it is concluded that this project helps to reduce the usage of plastic bottles. The application of PLA polymer can completely decompose the water bottle in turn saves environment. This would increase the agricultural growth in our country. People can feel free to use the bio plastic water bottle as it can't cause any health effects while consumption. It is safe able one. Nowadays we are facing more trouble in the petroleum price; it can be solved because the plastics are made from the petroleum products. If we move to the bio water bottles or products, automatically the price is reduced. The motto of this project is to avoid plastic bottles and use the bio-plastic bottles.

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