DEVELOPMENT AND MECHANICAL BEHAVIOR OF BIODEGRADABLE NANO FILLER POLYMER HYBRID COMPOSITES

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Introduction:
Most commonly used matrix materials are polymeric. The reason for this is twofold. In general the mechanical properties of polymers are inadequate for many structural purposes. In particular their strength and stiffness are low compared to metals and ceramics. Composites are used because overall properties of the composites are superior to those of the individual components for example polymer/ceramic. Composites have a greater modulus than the polymer component but aren’t as brittle as ceramics.

In this project work, an attempt has been made to develop an hybrid bio-degradable nanofiller metal oxide and ceramic oxide as reinforcement and Polyvinyl alcohol (PVOH) as a matrix. Nanofillers are synthesis using solution combustion synthesis method in the laboratory. The fabrication of thin film of bio-degradable hybrid polymer composites is carried out using melt blending process. The composition of reinforcement is varied from 0 wt% to 8 wt% of the composites. The developed thin film is subjected to various test to determine the mechanical properties and physical properties like tensile strength, bio-degradability, density and water absorbtivity according to ASTM standard. The application for the developed materials are also investigated.

Objectives:
The main objectives of the project is listed as follows

- To Synthesis Nano filler material.
- To develop nano filler reinforced hybrid polymer composites.
- To characterize the developed material.
- To Study the mechanical properties of developed material.
- To search the suitable applications for the developed composite material.
- To develop a hybrid polymer of new property.
- To satisfy the requirements of industrial applications.
- To determine the possibilities to minimize the cost of preparation.
Methodology:

In this project work, metal oxides Al\textsubscript{2}O\textsubscript{3} and bio-degradable materials like Rice husk are used as for the reinforcement in micro and nano form, Polyvinyl Alcohol(PVOH) and Starch are used as matrix, the development of the hybrid Nanofiller polymer composite is involved the following steps as shown in Fig.1

![Block diagram for Project methodology](image)

Results and Conclusions:

In this project, The Nano filler polymer hybrid composite thin film has been successfully fabricated. Experiments were conducted in laboratory to determine the properties like water absorbity, Density, Tensile strength and biodegradability for the developed composites. From the above investigation, It is found that density is very high for nano filler as compared to micro filler. From the tensile test, it is clear that the tensile strength is increases as aluminum oxide is used as reinforcement and it is decreased for bio degradable material. It is found that the bio-degradability increases with increase of Starch and Rice husk. The hybrid composite with 6 wt % of reinforcement (PSABN6) has high bio-degradability and also it clear from results that the nano composites shows high degradability than micro composites. From the water absorption test, it has been observed that the percentage of Al\textsubscript{2}O\textsubscript{3} (Nano) is increases water absorbiviy reduced. The similar tendency is observed for hybrid nano composites same, it is also found that as the percentage of Starch increases in composite causes water more absorbiviy.

From the above results the developed composites can be used as food packing material. It can also be used for container for food products and packing materials. It is found that rice husk reinforced natural composites is the best biodegradable composites. Nan filled composites has strong in mechanical properties as compared to micro filled composites.

Scope for Future Work:

The biodegradability can increase by increasing both starch and rice husk. The natural fillers like wood powder, clay can also be used to improve the biodegradability.