

Design and development of protective Biogear (hand & Foot) for Pourakarmikas (Garbage pickers) Using Sustainable polymers

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Abstract:

Biodegradable polymers have been developed rapidly in the last years and are widely used today in the fields of pharmacy, clinical biomedicine, cosmetic, medical, packing industries, tissue engineering, agriculture and other areas. The interest in biodegradable polymers has been increasing, mainly due to rising oil prices, which is the basic feedstock of plastic derived from petroleum, and also due to the problem of the removal of waste plastics that accumulate in the environment. Biodegradable polymers have many advantages in contrast to synthetic polymers and can be decomposed in the environment to non-hazardous substances. Biodegradable polymers are classified into two classes based on their synthesis i.e., synthetic and natural polymers. They are derived either from petroleum resources or from biological resources. The following review presents an overview of the different biodegradable polymers and their properties, current scientific research, applications, global production of bio-plastic and replacement of conventional plastic.

Key words: Bio-degradable, polymers, natural origin, bio-plastics, conventional plastic

Introduction:

Synthetic fibres are usually man-made and made up of non-biodegradable polymers and as a result it takes years to decompose and hence with the use of technology, an approach is made to procure synthetic fibres in a sustainable manner.

Recent trends in biodegradable polymers indicate significant developments in terms of novel design strategies and engineering to provide advanced polymers with comparably good performance. However, there are several inadequacies in terms of either technology or cost of production especially in the case of applications in environmental pollution. So, there is a need to have a fresh perspective on the design, properties and functions of these polymers with a view to developing strategies for future developments.

The problem and prospects of approaches adopted to make non-biodegradable synthetic polymers such as polyethylene biodegradable and biodegradable polymers and copolymers made from renewable resources especially poly(lactic acid) based polymers and copolymers which are emerging as the candidate biodegradable materials for the future.

For recent trends and future perspective, polyethylene and poly (lactic acid) are used as polymer for sustainable environment and green energy. Poly(lactic acid) is a biodegradable as well as recyclable polyester made from renewable feed stock. Lactic acid has the raw material which is produced by fermentation of glucose and sucrose and is refined to a high purity. Poly(lactic acid) is a thermoplastic monomer derived from renewable organic sources such as corn starch or sugar cane.

Due to environmental and sustainability issues biodegradable polymers have attracted more and more attention and is emerging as a new trend.

Aim:

To Design and development of protective Biogear for hand and Foot for Pourakarmikas with an Sustainable polymers

Objectives:

To design and develop hand gloves and foot gloves made up of biodegradable polymers and given anti-microbial finish for Pourakarmikas (Garbage pickers)

Methodology:

- To understand biodegradable polymers and emerging trends.
- Hand gloves and Foot gloves.
- Anti-microbial finish.
- To analyse the scope in market.
- Demand and sustainability.

The study begins with, focusing on understanding **biodegradable polymers and emerging trends** in sustainable materials. Which involves the reviewing recent innovations, material properties, and applications relevant to protective wear to ensure in selecting of sustainable materials.

Next, the design and development of **hand gloves and foot gloves** were carried out using these sustainable materials, ensuring they were ergonomic, durable, breathable and suitable for the working conditions of Pourakarmikas.

An **anti-microbial finish** was incorporated into the biogear to enhance hygiene and reduce the risk of infection caused by exposure to waste and contaminants.



Further, a detailed study **to analyse the scope in the market** by surveys and gathering feedback from users to determine acceptance and need; Finally, the project examined **sustainability**, evaluating its benefits, usability, and awareness about such biodegradable protective gear to ensure the product supports both user safety and ecological responsibility.

Product Study:

Biodegradable polymers are sustainable and eco-friendly. Using biodegradable polymers, synthetic fibres are made biodegradable. Hand gloves and foot gloves are made of biodegradable synthetic fabric and anti-microbial finish which is again eco-friendly is given. This product is of one-time use and after every usage, it has to be disposed. It is light in weight and eco-friendly.

With the use of technology it has enabled the microbes to interact with the polymer when it is in the final resting place out of the ocean or soil or landfill and that kind of encourages the microbes, the bacteria and the enzymes to consume it as food and hence making it sustainable.

The target customers for this product are mainly garbage pickers because they are the most affected. This product's applications can be seen in medical field- surgeons, lab chemist, and pathologist; in the field of hotel management – chefs, waiters; in parlours and salons; and so on.

After thorough research, the gloves were developed based on standard sizes both for men and women and it was given anti-microbial finish. They are of one-time use and after optimum usage it is disposed and it is degradable.

Garbage pickers are the one's who are mostly affected by pollutants because they deal with garbage and scraps on a daily basis, and as a result the waste in turn is the hub for various diseases.

This product aims at minimising infections and would serve as a barrier against the same. It would also safeguard them against various viruses and bacterias.

Market Study:

The market study is conducted to know the awareness among the people. By knowing this, it is easy for the manufacturer to make sure the product as a scope in the market. Without doing market analyse, it is difficult to sell a product and make a profit out of it. Since the project aims to know about biodegradable synthetic polymers, an ethnographic study conducted through Google forms to know about the awareness among people on biopolymers, environmental issues and sustainability. Sixty four responses have been received. The results will be discussed further.

Result and Discussion:

The world is currently facing a major plastic pollution crisis, the gigantic amount of plastic waste flowing into oceans and marine areas is likely to almost triple by 2040 and there is an increase of up to 37 million tonnes each year says the UN environment programme. To prevent ecological disaster, the need of the hour is to use and promote sustainable product which don't pollute but help preserve our planet for future generations. The introduction of renewable and recycled energy decreases petrochemical and minerals and eliminates the loss of natural energy. Such bio-fibre based polymer composites also have consumer products and applications.

Demand for biodegradable polymers has been rising as a result of environmental concerns regarding the use of non-renewable materials.

1. The field survey:

The protective biogear was evaluated through a field product survey where actual users Pourakarmikas (municipal sanitation workers). The product was designed to provide protection and comfort while using or conduct in the handling tasks in municipal sanitation work.

The key factors observed like fit and comfort, safety, protection, Breathability, durability and sustainability while using.

The field survey confirmed the effectiveness of the biogear in providing both safety and comfort for Pourakarmikas. Using sustainable polymers not only concerned about sustainable it also a cost-effective synthetic the interaction and the feedback from Pourakarmikas provided valuable insights for refining in further.

Challenges identified included:

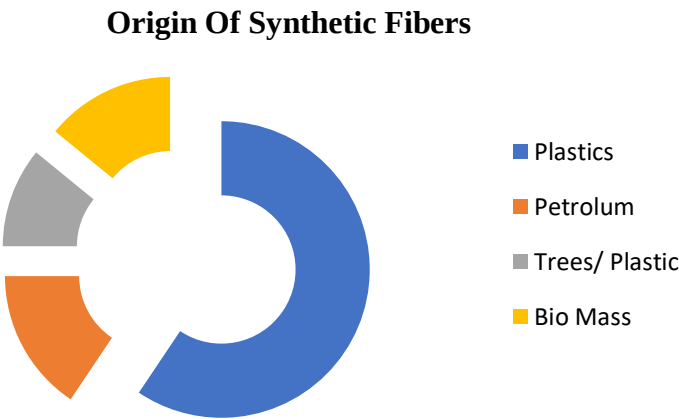
- The need for improved grip in gloves when handling wet waste.
- Reinforcement in foot cover soles for extended durability.
- Standardized sizing for various hand and foot dimensions.

The study reinforces the potential of sustainable design in occupational safety gear. Further iterations of the product can focus on multi functionality, better water resistance, and inclusion of antimicrobial finishes.



2. **Ethnographic study was conducted to 64 Responses in order find out the awareness of biodegradable synthetic fibres and its sustainability.**

1. **What is the origin of synthetic fibers?**



2. Are you aware of the negative impact that environment is facing by the use of man-made synthetic Fibers.

Awareness of Environmental Impact of Synthetic Fibers



3. Are you aware of biodegradable synthetic fibers?

Awareness of Biodegradable Synthetic Fibers



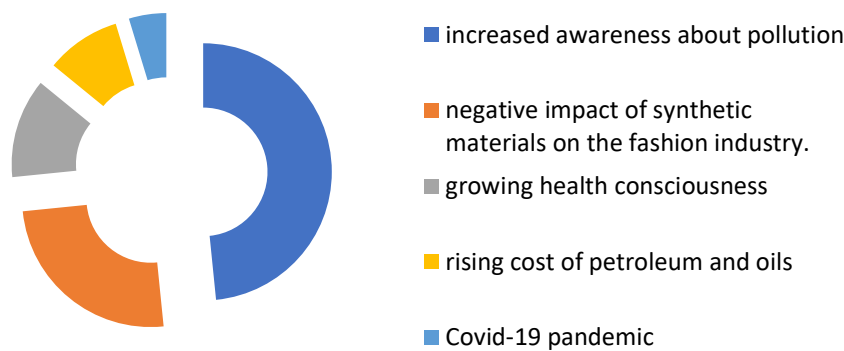
4. Are you aware of the products available in market that states it is made up of biodegradable synthetic fibers? If yes, which are those?

Market Awareness of Biodegradable Synthetic /Synthetic polymers Fiber Products

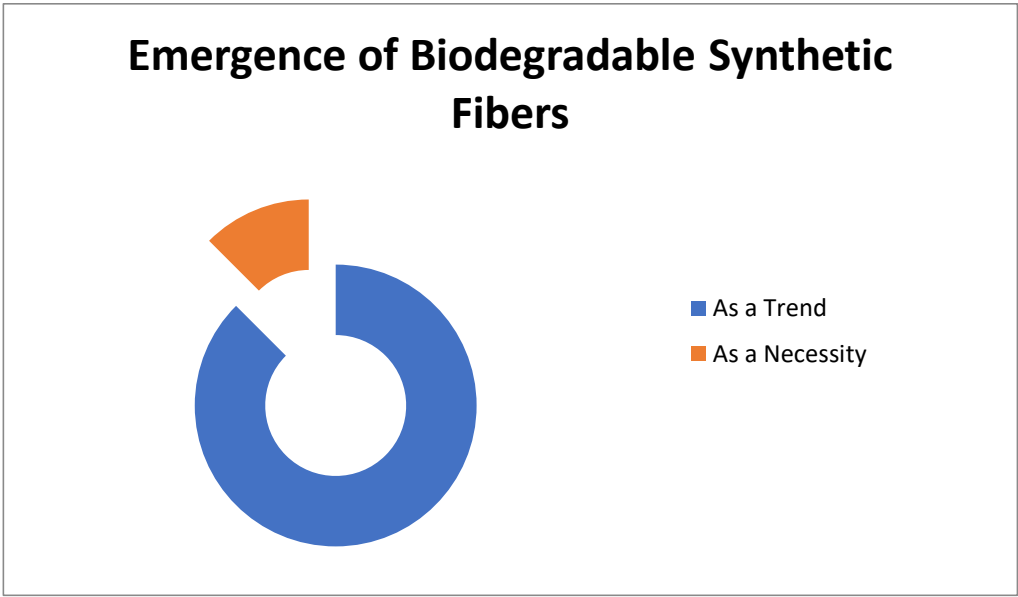


5. Are you aware of the products available in market that states it is made up of biodegradable synthetic fibers? If yes, which are those?

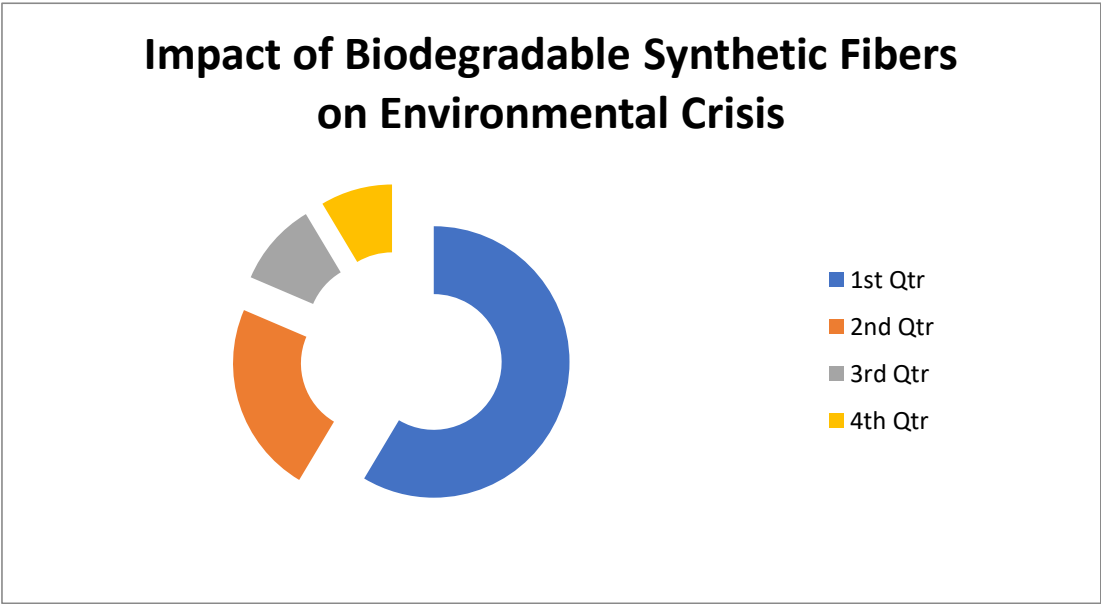
factors that led to the need for biodegradable synthetic fibers



6. Why were biodegradeabe synthetic fibers emerged ?



7. Do Biodegradable synthetic fibers really cut down on the environment crisis?



Based on the above questionnaire, we can conclude that with the increase in environmental issues, people have become more conscious and aware about biodegradability and sustainability. People are now trying to opt for biodegradable synthetic fibres as they are now aware that synthetic fibres harm nature as well as human health in long term. The concept of biodegradable polymers came into limelight after the pandemic Covid-19.

Discussion: From the above field survey and ethnographic study it helped in the assessing the effectiveness of protective biogear among Pourakarmikas.

- A field survey was conducted to assess the effectiveness of protective biogear among Pourakarmikas.
- An ethnographic study with 64 responses revealed limited awareness about biodegradable synthetic fibres and their sustainability, highlighting the need for education and promotion of eco-friendly protective gear in waste management sectors.

Limitations and Drawbacks:

- It is limited to one use only.
- It can emerge as a trend only if people are conscious about environment and themselves.

Future Recommendation:

- The fashion industry has a bad rap for unsustainable practices, and hence it can be assumed that this trend can sustain in fashion market.
- If people adapt to sustainable fashion, the use of biodegradable polymers will act as stepping stone towards sustainability.
- Comparatively reduced pollutants and hence environmental crisis can be addressed.

Conclusion:

If, on one side scientific research shows that the textile industry is among the production sectors that contribute most to the pollution of our planet, on the other side it must be admitted that there are many innovation textile solutions developed to ensure their protection. The result of technological progress, sustainable manufacturing processes approach to fashion.

More than the origin, the chemical structure of the biopolymer is a key factor that determines its biodegradability. Indeed, the future outlook for development in the field of biopolymer materials is promising; the future of each polymer is dependent on its competitiveness but also the social ability to pay for it. Biodegradable polymers made from renewable resources can retain all the benefits of petroleum-based polymers without the negative environmental impact. The discovery and implementation of polymers made from natural resources is an enormous leap into the future for different branches of industry. In order to successfully replace biodegradable polymers with current plastics, cooperation is needed not only with industry and academics, but also with various disciplines such as chemistry, engineering, material science, biogeochemistry and climate science. This will require a plenty of time and a key multidisciplinary development will be needed.

From street fashion to technical clothing, the rule that moves these revolutionary projects is to create a production that is increasingly attentive to the nature and health of consumers without sacrificing aesthetics

and performance techniques of a dress. This is especially the case of synthetic fabrics, which have the greatest impact on the creation of harmful waste and scraps.

Words like sustainability, circular fashion, up-cycling and recycling may have entered the fashion vocabulary, but the real challenge is to find fibres that have a low environmental impact and non-polluting processes.

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