

GREEN REVOLUTION

TURNING PUMPKIN PEELS AND NEWSPAPERS INTO ECO-FRIENDLY PACKAGING

In an era where environmental consciousness is more crucial than ever, the pervasive use of non-biodegradable petrochemical plastics poses a significant threat to our planet's ecosystems. These plastics, notorious for their longevity in the environment, contribute to a growing crisis of pollution, choking our oceans and landscapes with indestructible waste. Against this backdrop, the search for sustainable alternatives has led to a groundbreaking innovation: biodegradable polymers. These eco-friendly alternatives promise a future where materials decompose back into the earth, leaving minimal environmental footprint. Dr. Tirth Harikrishna Thaker and his team have embarked on an ambitious project that stands at the intersection of waste management and material science. Their research aims to transform Cucurbita (pumpkin) peels and waste newspaper sheets from discarded by-products into biodegradable packaging films. This initiative not only addresses the critical need for sustainable packaging solutions but also champions the principle of turning waste into valuable resources, marking a significant step towards an eco-friendly future.

Background and Motivation

The environmental toll of conventional plastic waste is a global challenge of staggering proportions. These plastics, derived from non-renewable petrochemical resources, not only deplete valuable natural assets but also persist in ecosystems for centuries, polluting land, waterways and oceans. The urgency to find sustainable alternatives has never been greater. In this quest for eco-friendly solutions, agricultural by-products and waste materials emerge as untapped treasures. Among these, pumpkin peels, a by-product of the Cucurbita processing industry, hold significant promise due to their rich pectin content. Pectin, a natural polymer, offers a viable foundation

for developing biodegradable plastics. Harnessing the potential of such organic waste not only contributes to reducing environmental pollution but also aligns with the circular economy principles, turning what was once considered waste into valuable, sustainable resources.

Objectives and Goals

The project spearheaded by Dr. Thaker and his team is driven by a clear set of objectives aimed at mitigating the environmental impact of traditional plastics. The primary goal is to synthesize biodegradable polymers using pumpkin peels and waste newspaper sheets, thereby converting potential pollutants into eco-friendly materials. These innovative biopolymers are designed to decompose into harmless substances, significantly reducing the environmental footprint. A key focus is on their application in food packaging, where they can offer a sustainable alternative to conventional packaging materials. By developing these biodegradable packaging solutions, the project not only addresses the urgent need for environmental sustainability but also pioneers the use of organic waste in creating valuable products, underscoring the potential of circular economy principles in tackling pollution and promoting eco-friendly practices in the industry.



Methodology/Approach

The methodology adopted by Dr. Thaker's team in crafting biodegradable films is a testament to innovation in sustainable material science. The process begins with the preparation of pumpkin peel powder, a by-product rich in pectin, which serves as a key ingredient in the biopolymer matrix. This powder is meticulously combined with other biopolymers, including corn starch and glycerine, to enhance the film's structural integrity and flexibility.

The synthesis process involves dissolving these components in an appropriate amount of distilled water, creating a homogenous mixture. This mixture is then gently heated below the boiling point of water for 1-1.5 hours to ensure thorough integration of the materials. Once achieved, the blend is poured onto a Teflon-coated glass plate, spread uniformly to form a thin layer, and left to dry at room temperature.

The choice of materials being pumpkin peels and waste newspapers highlights the project's commitment to utilizing organic waste, while the incorporation of starch and glycerine ensures the film's biodegradability. This methodical approach not only recycles waste into valuable resources but also paves the way for producing eco-friendly packaging solutions that leave minimal environmental impact once they complete their lifecycle.

Results and Analysis

The research led by Dr. Thaker yielded compelling results, underscoring the efficacy of the synthesized biodegradable films. Water absorption tests revealed that all films exhibited significant uptake, with the pumpkin peel variant absorbing 48.38% of its weight, indicating a high degree of hydrophilicity, an essential property for biodegradation. Biodegradability tests further affirmed the films' eco-friendly attributes; when buried in soil, the films demonstrated considerable decomposition over several days, showcasing their potential to break down into environmentally benign components.

Fourier Transform Infrared Spectroscopy (FTIR) analysis played a pivotal role in elucidating the chemical structure of the films. The spectra confirmed the successful integration of pumpkin peel powder within the bioplastic matrix, evidenced by characteristic peaks corresponding to pectin and cellulose from the peels and newspaper.



Conclusion

The project's success in developing biodegradable films from pumpkin peel and waste newspaper marks a promising advance towards environmental sustainability and commercial viability. The research opens avenues for further investigation, particularly in scaling production and refining the bioplastics' properties to meet diverse application needs. Future efforts will focus on optimizing the synthesis process and exploring broader uses, ensuring these innovative materials contribute significantly to a greener future.

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This incorporation is crucial, as it indicates a homogeneous blend of natural polymers, enhancing the film's mechanical and degradable properties.

These findings not only validate the biodegradable nature of the films but also highlight the potential of using agricultural waste and recyclable materials in creating sustainable packaging solutions. The results pave the way for further exploration and optimization of bioplastics, promising a greener alternative to conventional packaging materials.

Discussion on Commercial Scope and Environmental Impact

The synthesized biodegradable films exhibit significant commercial potential, especially in the realm of food packaging. Their eco-friendly nature not only addresses the urgent need for sustainable alternatives to conventional plastics but also aligns with growing consumer demand for green products. The adoption of these materials could markedly reduce plastic pollution, curtail reliance on fossil fuels, and consequently lower the carbon footprint associated with packaging. Moreover, the use of agricultural by-products and recyclable materials in their production promotes a circular economy, further enhancing their environmental benefits.

