

Formation of Biodegradable Plastic Using Extracted Cellulose of *Phragmites Karka*

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ABSTRACT

Biodegradable plastics are made from the raw materials of plants so that they possess a natural decomposition process. Bacteria and fungi attack these bio plastics and start assimilating them. There are multiple reasons involved behind the formation of biodegradable plastics in Pakistan for e.g. it will reduce the importation cost for the biodegradable plastic, it reduces the pressure on landfills, it conserves nonrenewable energy sources such as petroleum supplies, it reduces the global carbon emission, eco-friendly and non-toxic as upon biodegradability, it also acts as a source nutrients for the soil. Bio plastics come from the switch grass or agricultural by-products like corn whereas non-biodegradable plastics come from heating and treating toxic oil molecules and then converting them into polymers. Biodegradable plastics also have less emission of carbon compared to traditional plastic. Moreover, they consume less energy since they do not require fossil fuels during production. Due to less consumption of energy the pollution and environmental impact is reduced. It lastly provides an eco-friendly solution.

Usually, biodegradable plastic is made from food or agricultural waste materials like banana peels and other fruit waste which have more significant value in various industries like food, pharmaceutical, cosmetic industries etc. Where there by products are used for various purposes. However, with increase in world population, there will be an increase in the demand for food products and consequently their byproducts for nutritional value purposes. From future perspective, to produce a nontoxic, biodegradable plastic from such renewable and non-food source which has little to no industrial applications would be ideal and far more sustainable. Pakistan produces 81 million ton of biomass which can be used to generate renewable energy or can be used in various industries. The biodegradable plastic from source such as halophytic plant is novel as well as sustainable as these plants have very limited potential applications such as phytoremediation, secondary metabolite production price uses in medicine for extraction of bio active compounds.

Phragmites karka is commonly known as Reed and belongs to the genus of four species of Perennial reed grasses floating in wetlands all over the temperate and tropical regions of the world. *P. karka* is a tropical specie and a hydro halophyte. It is widely distributed in the countries like Africa, Australia, South Kenya, India, and Pakistan. In Pakistan areas like Sindh, Balochistan, Punjab, and N.W.F.P have most of the *P. karka*. It is also found in District Dera Ismail Khan. The biodegradable plastic produced from the cellulosic nanofibers from an abundantly found halophytic plant species such as *Phragmites karka* will be susceptible to enzymatic hydrolysis making it environmentally friendly. Our biodegradable plastic can be used in packaging industries like for food items like chips and biscuits or for medicine packaging.

During literature review, methodology from research papers discussing biodegradable plastic formation using agricultural waste was studied. The usage of non-toxic biopolymer such as Polyvinyl Alcohol (PVA) when combined with extracted cellulose formed a hydro-degradable film like material. Polyvinyl alcohol is water soluble, synthetic and nontoxic biopolymer with Good mechanical and thermal

properties which makes it an excellent biopolymer for the formation of biodegradable plastic. Cellulose increases the mechanical strength and reduces the water vapor permeability. Cellulose can be methylated to make it soluble and miscible with PVA enabling increased crosslinking with PVA and therefore a more stable plastic film.

Objectives: Objective of this study is to form biodegradable plastic by using extracted cellulose of *P. karka*.

Methodology: *P. karka* consists of 26% cellulose content that was extracted, methylated and combined with biopolymers like PVA for a smooth, homogenous, transparent biodegradable plastic from a renewable source. Starch was also added to the film to increase the biodegradability and reduce the overall cost of the film. Moreover, Glycerol was added which acts as plasticizer therefore making the film soft, flexible and homogenous. Glycerol adds additional beneficial properties as it acts as a good water holding agent. Water soluble extracts like pectin, hemicellulose and lignin were also extracted and saved for later to be utilized in other experiments.

Conclusion: Biodegradable plastic was formed by using PVA and extracted cellulose of *P. karka*. Currently, there are no competitors for the biodegradable plastic manufacturing in Pakistan that makes our idea the newest for plastic manufacturers and sustainable production. Whereas, some of the worldwide producers of biodegradable plastic are Unilever (London, UK), FKUR (Germany, USA and India), Green Dot Bio plastics, Novo enzymes, Biosphere plastic are international companies and many others that manufacture biodegradable plastic. Importing the biodegradable plastic from different countries would increase the cost and time, whereas if we produce it locally with available native, raw materials, we can counter the cost and work as a sustainable approach keeping the environment safe and conserved.

Keywords: Biodegradable plastic; Cellulose; Halophytic plant; *Phragmites karka*

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