Anil Kumar et al., J Bacteriol Parasitol 2021, Volume 12

Bio-plastic from biomass: A facile key for a greener environment

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Statement of the Problem: Plastics have been an integral part of most of our daily requirements. Indiscriminate usage and disposal have led to the accumulation of massive quantities of waste. Their non-biodegradable nature makes them increasingly difficult to manage and dispose them. To counter this impending disaster, biodegradable polymers, especially polyhydroxyalkanoates (PHAs), have been envisaged as potential alternatives. Owing to their unique physicochemical characteristics, PHAs are gaining importance for versatile applications in the multiple sectors. The PHAs are microbially produced polyoxoesters which possess properties similar to various synthetic plastics like polypropylene. PHAs have the required potential to replace some of the today's petro-plastics, owing to their inherent bio-degradability, thermo-plasticity, bio-compatibility and mechanical properties like flexibility, elasticity and versatility.

Methodology and Theoretical Orientation: Synthesis of PHAs takes place under unfavorable growth conditions and imbalanced nutrient supply. It implies that on one hand there is abundant availability of carbon source in the surrounding medium for the microorganism but on the other hand, there is limited supply of other growth essential elements like nitrogen, phosphorous, dissolved oxygen, or certain micro-components like sulfur or certain metals with essential functions in cell growth metabolism. These circumstances induce PHAs synthesis as carbon and energy reserves in the cells. Although the industrial production of this bio-plastic commenced decades ago, its large scale production is still debilitated by factors such as rate of production by the bacteria and the raw materials used for its production, which finally escalates the production cost of PHAs. Selection of high PHAs producing bacterial strain along with optimized culture conditions and usage of biomass as raw material for biosynthesis of PHAs can remove the constraints in large scale economic production.

Conclusion and Significance: The commercial usage of green plastics (PHAs) can act as environmentally sustainable alternative to petro-based conventional plastics and can greatly lessen plastic pollution. The use of biomass as raw material for biosynthesis of PHAs may serve two purposes, one being the disposal of abundant surplus agricultural and industrial waste materials and another being economic utilization of such waste by its conversion into sustainable high valued bio-plastics.

Biography

Anil Kumar is presently working at Devi Ahilya University, India.