# Harnessing Plant Polymers for Bioplastics, Drug Delivery, and Cancer Treatment Applications

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## Abstract

The increasing interest in plant-derived biopolymers and phenolic compounds for climate and human health management is driven by their natural origin, biodegradability, and sustainability. This study pursued three objectives: (1) to develop bioplastic films from wheat bran, sugar beet pulp, and chickpeas for reducing carbon emission, (2) to utilize arabinoxylans (AX) extracted from wheat bran and sugar beet pulp in scaffolds for triple-negative breast cancer (TNBC) cell growth and development, and (2) to isolate and characterize bioactive compounds from quinoa inflorescences for their therapeutic potential.

Bioplastic films were prepared from wheat bran, sugar beet pulp, and chickpeas using glycerol as a plasticizer. Hot mold pressing converted these films into bioplastic sheets, which were analyzed for physical and mechanical properties. Preliminary results suggest that bioplastics derived from agricultural byproducts offer a viable alternative to conventional synthetic plastics. Arabinoxylans, the predominant non-starch polysaccharides in cereal and grass cell walls, were extracted from wheat bran (WBAX) and sugar beet pulp (SBAX). Composite scaffolds incorporating WBAX, SBAX, and other polymers were fabricated and evaluated for TNBC cell proliferation and morphology. These scaffolds supported TNBC cell growth, exhibiting features such as cell clumping, stemness, and hypoxic zones within aggregates. Quinoa inflorescence extracts obtained using various solvents were analyzed via GC-MS to identify bioactive constituents. GC-MS profiling revealed diverse bioactive compounds in quinoa with potential roles in cancer intervention. These findings underscore the promising applications of plant-derived biopolymers and phytochemicals in bioplastics, drug delivery systems, and cancer therapeutics.

## Keywords

Arabinoxylans, Wheat Bran, Sugar Beet Pulp, Quinoa, Biopolymers, Breast Cancer, Triple-Negative, GC-MS, Bioplastics, Drug Delivery, Plant-Based Therapeutics, Sustainability.