

# All in a Nutshell: Synthesis and Analysis of Novel Bioplastics Enhanced with Organic Wastes

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Plastics form an integral part of daily life and are used in a plethora of ways. However, the primary raw material used in conventional plastic production is petroleum, which is harmful for the environment. There are also socioeconomic pressures to conserve petroleum resources. Bioplastics research focuses on creating biodegradable and sustainable solutions to this issue. This project's aim was to investigate the utility of organic wastes for bioplastics. In the first stage, the effect of natural additives (jute, cotton and eggshell) on starch and gelatine plastics were observed, with powdered eggshell working best with gelatine. In the second and major stage, waste pistachio nutshells, were used novelly to create enhanced bioplastics. The organic polymer lignin was extracted from ground pistachio shells. Sodium hydroxide was used to degrade the source after pre-treatment and boiled for 5 hours. The resulting aqueous solution was filtered and the filtrate precipitated with sulfuric acid to give wet lignin. Gelatine was then added to create the bioplastics. The pieces were cut out into dumbbell shapes or rectangular sheets (for samples with thickness <1mm) and left to cure. The pieces were assessed in a tensile testing setup. Tensile strength, elongation and qualitative analysis of the samples were conducted. It was found that the lignin enhanced plastics had an average tensile strength of 10.1 MPa, which is comparable to conventional LDPE plastics used in squeeze sauce bottles. The plastics also displayed impressive flexibility as well. Thus, organic wastes can be effective in the synthesis of enhanced bioplastics.

## Awards Won:

Fourth Award of \$500