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**Eng. Francesca Luzi**

Università Politecnica delle Marche, Dipartimento SIMAU

# **Biopolymers and their composites for packaging and biomedical applications**

## **ABSTRACT**

Recently, both academic research and engineering activities have shifted toward the development of sustainable and environmentally benign polymers to reduce environmental pollution, mainly due to the high impact of plastic wastes and plastic leakage on the ecosystems. Several limitations and regulations regarding traditional petrochemical polymers also represent the main driving forces for the design and development of natural based, biodegradable, sustainable materials for packaging applications.

Green polymers constitute a valid alternative to develop new eco-friendly materials able to reduce both the plastic wastes accumulated every day in landfills and the emission of greenhouse gases. On the other hand, biobased and biodegradable polymers show some limitations respect to traditional ones, lower water permeability, poor oxygen barrier characteristics and relatively poor thermal and mechanical properties. Therefore, the development of composites/nanocomposites and polymeric blends represents a valid approach to modulate/increase the physical properties of neat biodegradable polymers.

Lignocellulosic fillers, mainly cellulose and lignin nanostructures, have recently attracted much attention due to their renewable nature, wide variety of source materials available throughout the world, low cost and density, high surface functionality and reactivity. Silver and zinc oxide nanoparticles, recognised for their broad-spectrum biocide effects, have been also considered in conjunction with the biobased nanofillers. Moreover, active ingredients such as carvacrol, gallic acid etc. added to biodegradable polymers have been considered to induce antioxidant and antimicrobial effect.

In terms of materials' processability, solvent casting and melt compounding were applied as useful processing techniques for the realization of the biocomposites to be applied in many different sectors, such as biomedical, medical and pharmaceutical areas, drug delivery and tissue engineering.