Circular approaches to formulate sustainable biocomposites and efficient wood waste treatments

Erika Alessia Di Liberto

erikaalessia.diliberto@unipa.it

Formulation of sustainable biocomposites

Concept

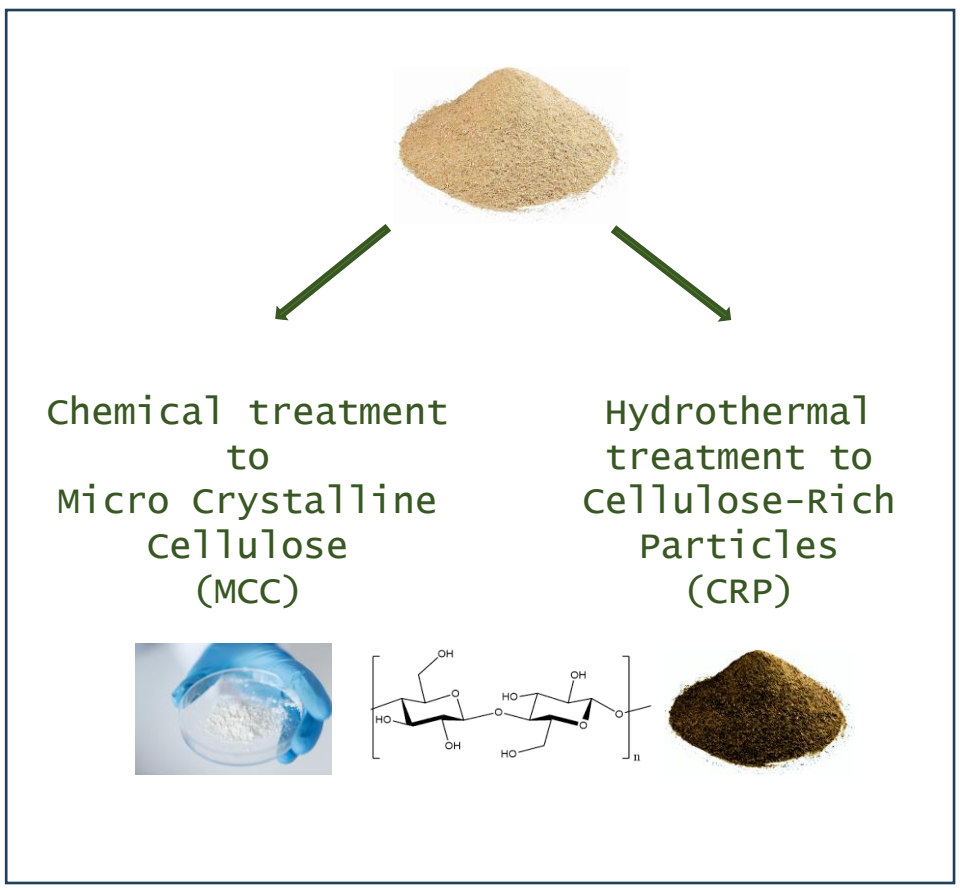
Global industrialization and overreliance on fossil resources have brought about an increase in solid waste and climate change. As a result, reducing greenhouse gas emissions, combating resource depletion and pollution, and optimizing waste management have become global challenges.

The circular economy aims to produce in a more sustainable way, using renewable energy sources, minimizing waste, reusing materials in multiple production cycles and recycling resources that cannot be reused. In fact, once the product has fulfilled its function, the materials from which it is made are recycled wherever possible, creating additional value, thus moving from a linear to a circular economy.

Furthermore, unlike fossil-based composites, biocomposite materials made from biopolymers and natural fibers are very attractive because they can be disposed of effortlessly after fulfilling their purpose without adversely affecting the environment.

Scientific approach

- Valorization of wood waste through conventional chemical processes to obtain microcrystalline cellulose and through much greener and more sustainable hydrothermal processes to produce cellulose-rich particles.
- Composite materials are formulated with other biodegradable and renewable materials (e.g. polybutylene succinate or polysaccharide) using conventional processing methods (e.g. melt mixing or solvent casting), with the aim of standardizing and optimizing the production conditions.
- The chemical-physical characterization of the composite materials will be carried out by: spectroscopic analysis (ATR-FTIR, UV-visible), mechanical analysis (tensile test, DMTA), surface wettability analysis (Water Contact Angle), thermal analysis (DSC, TGA), biodegradation test and photo-oxidation resistance analysis.



Research objectives

The overall objective of this research is to valorize waste for the formulation of new sustainable composite materials made from biobased, biodegradable and renewable materials, including wood wastes and biopolymers.

Sustainable composites made from renewable biopolymers and wood waste, such as microcrystalline cellulose or cellulose-rich particles, are of particular interest as they have the potential to reduce environmental impact and increase an efficient circular economy.

An objective is to establish and optimize the production conditions for biodegradable materials in view of their reduced range of processing window compared to that polymers.