Green chemistry and processes for functionnal bio-based materials

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In the current context of the development of a green and sustainable economy utilization of fossil-based materials need to be substituted by product issued from plant based or other renewable resources. Therefore, in the last decades due to both ecological and economic concerns, bio-based materials have been increasingly considered for the elaboration of novel functional materials.[1] Moreover bio-based materials and their composites present new characteristic and features over petro-sourced ones such as biocompatibility, bioactivity, self organization, … For this reason, they can be envisioned as valuable building blocks in the elaboration of functional materials with applications in areas as diverse as biotechnology, electronics, optics, energy, packaging or catalysis.
Bio-based materials can be synthesized mainly by two different methodologies. First the production of materials or composites can be envisioned directly from naturally occurring polymers such as polysaccharides (cellulose, chitin,…), lignin or proteins modified or not that could be reshaped or not. The second strategy concerns the production of bio-based monomers such as furanic derivatives, phenols (vanillin, guaiacol,…) and their subsequent (bio)chemical polymerization.
In this presentation we will propose several examples of bio-based materials using both these methodologies produced and developed by the Organic Chemistry and Alternative Technologies team within the “Transformations Intégrées de la Matiére Renouvelable” (TIMR) laboratory from UTC/ESCOM. In a first part we will show how silk proteins from *bombyx mori* silk worm can be extracted and shaped into different functionalized composites for biomedical or environmental applications.[2] Then we will describe the preparation of bioplastic as edible film coating from bio-polymers such as cellulose, chitosan or lignin and how the utilization of the nanoscale form of these biopolymers can influence the properties of the produced films.[3] Finally recent development in the preparation of bio-based polyester elastomeric materials[4] bio-based phenolic resins or polystyrene substitutes from small bio-based organic molecules we will be presented.

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