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SUSTAINABLE MACROMOLECULAR MATERIALS: BIO-BASED COMPOSITES, FILMS, AND HYDROGELS FROM RENEWABLE SOURCES

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Abstract - In order to meet society's expectations regarding the availability of sustainable materials and to contribute to the advancement of the circular bioeconomy, research is being developed aimed at producing macromolecular materials from a high content of renewable raw materials, Fig. 1. In this context, bio-based polyurethanes have been synthesized in molds with simultaneous formation of composites reinforced by coconut or sisal sheets. In these syntheses, ricinoleic acid triglyceride (the major component of castor oil), sodium lignosulfonate, and cellulose have been used as polyol, generating materials with good impact and flexural resistance properties. The same reaction mixture has been spread on the surface of glass, with the formation of films simultaneously with the synthesis of polyurethanes, which exhibit properties that qualify them for applications such as packaging, dressings, among others. Citric acid, epoxidized soybean oil, and cellulose are used as reagents for synthesizing polyesters in molds, while simultaneously forming reinforced composites with coconut or sisal mats. These materials exhibit good impact and flexural strength. Lignocellulosic fibers are deconstructed using solvents suitable for cellulose and hemicelluloses, leaving lignin suspended in the medium. Hydrogels are then produced (Fig.1), demonstrating effective properties in metal sorption from wastewater and in the controlled release of herbicides. Studies are ongoing, and the results already obtained are promising, guiding new steps that contribute effectively to the circular bioeconomy.

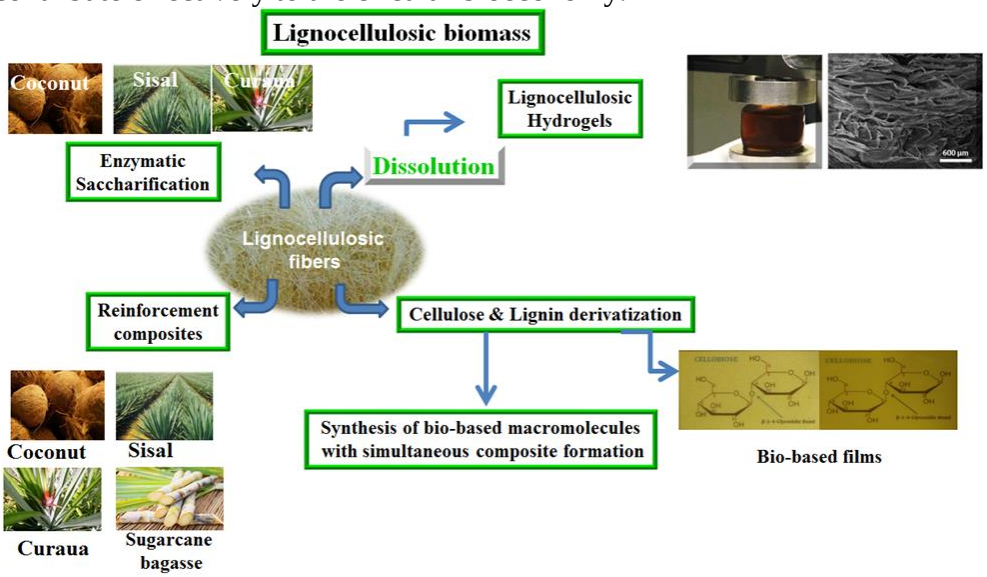

Figure 1 – Representation of renewable raw materials and their derived materials

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