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Lignocellulosic Residues for Biorefineries

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The biorefinery concept is an important strategy in the development of biomass usage. It is based on the productive biomass chain similar to the oil chain [1] fuels, energy, materials, bulk chemicals, and fine chemicals are the final products with a large variation in their market value. Biorefineries use a large number of conversion processes (chemical, biochemical, and thermochemical) as a result of the chemical diversity of biomass and the high content of oxygen and water. The increase in the demand for bio-derived chemicals not only offers a great number of opportunities for green technologies and processes which use lignocellulosic biomass in biorefineries, applying the green chemistry principles [2], but it also presents several challenges related to science and technology, market prices and replacement of non-renewable products (e.g., petrochemicals) for a renewable chemistry.

Nowadays, the estimated worldwide production of renewable biomass for use in biofuels, fibers and agriculture is currently 210.7 $\times 10^6$ tons per year [3]. An exact value is difficult to obtain because there is a large variation in production among countries. However, the importance of biomass to the modern economy is clear. Lignocellulosic biomass comprises wood and agricultural residues, which are sources of cellulose, hemicellulose and lignin (the lignocellulosic fractions), and represents the major biomass source; since plants can contain high amounts of cellulose (40% to 50% w/w), lignin (18% to 35% w/w), and hemicellulose (10% to 35% w/w) [4], lignocellulosic biomass are considered as one of the most promising sources of industrial raw material from renewable source. Each of these types of lignocellulosic fractions has its own particular structural characteristics and chemistry, which can be exploited in chemical analyses [5].

Biofuel and pulp and paper industries are good examples of biorefineries and an opportunity to develop renewable chemicals from lignocellulosic residues [6], generating additional profits for the agro-industry. For example, from the production of ethanol from sugarcane and biodiesel from soya we can generate a large diversity of bio-products, such as bioelectricity, ethanol 2G, biogas, biofertilizer, organic acids, sugars (C6 and C5), materials (fibers, composites), fine chemicals and specialties [7]. The chain of pulp and paper has, also, great possibilities for bio-products because, as well as a sugarcane industrial plant, it is a well-established biorefinery model, mainly due the high availability of cellulose and lignin, besides to reduce its negative impact on environment. These are cases of the application of bio economy concept, where an economy model based on the oil as a non-renewable raw material for the industry and society is gradually changed to a model based on the biomass, a renewable source of raw material.

Conclusion

The lignocellulosic biomass residues are a renewable raw material for biorefineries and an opportunity of complementary profits for agro-industrial new chains. Furthermore, the usage of these residues can aid to reduce their negative impacts on the environment and to promote the bio economy.

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