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From ethnopharmacology to Green Chemistry: "Primum non nocere"

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Ethnopharmacological principles are always present in the search of new treatment for the reason that it's an inexhaustible source of informations. It was, may be, Hippocrates' idea who said one day: "Don't blush to borrow from people what may be useful in the art of healing". With green chemistry there is no exception in its fifth principle concerning "safer, non toxic and environmentally friendly solvents" when using water or vegetable oils for plants extraction under different conditions of heating. "Herbal teas" and "oily macerations" methods were the most used in traditional medicine and still to be favourable worldwide to treat many illnesses, especially with the return of natural healing. Within the search of new natural antibacterial agents, more powerful and less harmful, from Algerian ethnopharmacological knowledge, one methodology combining tradition - water as solvent - and modernity - using superheated technique- was used in comparison with herbal decoctions of clove buds, obtained extracts are called "totum" or the whole chemical composition. Antibacterial activity was tested on resistant and multi-resistant clinically isolates. Results of superheated water extracts were remarkable compared to decoctions, with total inhibition of gram positive bacteria, and about 95% of inhibition of gram negative bacteria. The antibacterial effect was more bactericidal than bacteriostatic. The phytochemical screening indicates the presence of phenolics as major compounds in both extracts; however, the supercritical extract concentration of compounds is higher than decoction. Decoctions and superheated water extracts are less abundant than other green techniques in scientific literature, but they are confirming their efficiency. Green chemistry takes their origin from Ethnopharmacology and symbolizes a natural way of extracting medicines in its fifth principle, it really respects: "*Primum non nocere, deinde curare*".

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Value-added biomaterials and biofuels from lignocellulosesbased on a green biorefinery scenario

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Biomass is mainly composed of lignin, cellulose and hemicelluloses, the three kinds polymers account for more than 90% of the total content of plant cell wall. However, from a biorefinery scenario, biomass should be effectively separated into single component, such as lignin, hemicelluloses, and cellulose and then transformed the single component into value-added products. In our group, based on the well-isolated, well-defined composition and molecular structure of the single component (hemicelluloses and lignin), a series of novel biomaterials were developed.Hemicelluloses are a kind of heterogeneous polysaccharides; their functional derivatives can be widely used in papermaking, food, and pharmaceutical industries. In our group, several novel methods for fractional purification of hemicelluloses have been established, and the green hemicelluloses/cellulose dissolution systems and various high efficient and low cost modification methods have been proposed. A series of novel biomaterials based on hemicelluloses have been developed, such as cyanoethyl hemi cellulosic derivatives containing alkene, acetylene and nitrile groups, hemicellulose-graft-acrylic acid ionic hydrogels, novel thermosensitive semi-IPN hydrogel, photo responsive and photo cross linked hydro gels, hemicellulosic scaffold conjugates with matching performance, photoresponsive nano-hydrogels, nanostructured lipid carries, nanoparticles, Internally plasticized hemicellulose film, novel fluorescent xylan-type hemicellulosic derivatives, magnetic nanoparticles based on hemicelluloses, hemicelluloses supported metal nanoparticles, and hemicelluloses supported metal nanocomposites. Lignin, a major component of the cell wall of vascular plants, has long been recognized for its negative impact and treated as a by-product in a biorefinery. As the most complicated composition in lignocellulosic biomass, the separation and characterization of lignin is currently an important research focus in the field of biorefinery. In our group, the research content of lignin structure generally includes: (1) original lignin structure analysis; (2) *in situ* nuclear magnetic resonance (NMR) technology in the application of lignin structure analysis; (3) structure analysis and functional groups determination of the isolated lignin polymers; (4) the structural transformations of lignin during the pretreatment by NMR quantitative analysis. In addition, based on the well-characterized molecular structures, some lignin-based materials, such as polyurethane, hydrogel, lignin-phenol formaldehyde adhesive, have been successfully developed.

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