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Shape Resonance Spectra of Lignocellulose Components

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Replacing fossil fuels for biofuels from renewable sources is a viable way to reduce greenhouse gas emissions. A major goal to optimize biofuel production would be the development of high-yield methods to obtain fermentable sugars from lignocellulosic biomass (leaves, straw, bagasse, etc). This is not an easy task since the biomass is a composite material resistant to chemical or enzymatic hydrolysis. As a consequence, pretreatment processes, namely bio- or physical-chemical processes to expose the cellulose fibres, must be employed. In this work, we discuss the shape resonanance spectra of lignin subunits (phenol, guaiacol, *p*-coumaryl alcohol), cellulose and starch subunits (α-D-glucose, cellobiose, β-D-glucose, maltose), and the main hemicellulose subunit (β-D-xylose), since electronic discharges could be employed in pretreatment processes. In fact, free electrons are one of the reactive species in atmospheric-pressure dielectric-barrier-discharge apparatuses that efficiently transfer energy into the lignocellulose matrix [1]. We discuss electron-induced dissociation pathways based on electron scattering calculations, the available experimental data for phenol and the knowledge on electron interactions with biomolecules. Altogether, the resonance spectra of lignin, cellulose and hemicellulose components establish a physical chemical basis for electron-induced biomass pretreatment that could be applied to biofuels production [2,3].

References

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