

Novel Hybrid Organosolv: Steam explosion-based integrated biorefinery of the lignocellulosic biomass (an evolution from pretreatment to fractionation processes)

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The current state of biorefinery development is focused almost entirely on the production of fuel ethanol. However, a glucose/ethanol-centric approach misses the crucial example set by the petrochemical industry. The ability to fractionate a raw material, rather than simply pretreat it, enables the parallel production of low value, high volume fuels and high value, low volume chemicals. A novel biomass pretreatment was established in the current work, which combines the fractionation efficiency of the traditional organosolv cooking with the size reduction and improvement of the hydrolysability that steam explosion offers. This hybrid method was applied on both hardwood (birch) and softwood (spruce) biomass where various process parameters were optimized toward achieving high fractionation efficiency. The pretreated solids presented superior hydrolysability, allowing their use to various biotechnological applications such as ethanol fermentation, biogas, microbial oil and cellooligosaccharides production. High purity lignin was also isolated permitting its use in advanced applications such as nanoparticles formation, aromatics production and use as lubricant additive. The newly established hybrid method can play a significant role towards the establishment of a biomass biorefinery, allowing the use of all biomass components for the production of fuels, chemicals and materials.