

Natural Products from Activated Aspen, Pine and Spruce Wood

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In the present work the chemical transformations of wood were investigated under different parameters of wood activation by exploded autohydrolysis method.

The aspen-wood, pine-wood and spruce-wood were used as starting raw materials with average size of particles 25×20×4 mm. The process of wood activation was studied with metallic reactor of 0.8 l volume at temperature variation in the range 180-240°C and residence time 0.5-5 min. The composition of water-soluble and volatile products was analyzed by gas-liquid chromatography, ¹H NMR, IR and UV spectroscopy, by chemical methods.

The main features of wood hemicelluloses, cellulose and lignin chemical transformations were established. It was shown that wood treatment by water-steam at 180-240°C results in the intensive destruction of hemicelluloses and in the conversion of some part of lignin to low-molecular mass compounds. Cellulose content was changed only a little during activation treatment. The yield of cellulose, isolated from activated wood by 0.1N NaOH, depends on autohydrolysis process parameters and ranges between 55-75%, referred to wood weight.

The optimum parameters of activation process for producing bleaching cellulosic product with yield up to 89 wt.% and pure cellulose content in obtained product 95-96% were found.

The main liquid and volatile products of autohydrolysis process were presented by mono- and oligo-sugars, low molecular mass lignin, acetic acid, furfural. Methanol, isopropanol, propionic acid and hydroxymethylfurfural were produced in a small amount.

The exploded autohydrolysis method of wood activation was used for producing the valuable organic products from wood components. The acid-catalysed hydrolysis of cellulosic product yields levulinic acid. The optimum parameters of the process was found resulting in producing levulinic acid with the yield 25-26% on the weight of initial dry wood. The oxidation of low-molecular mass lignin by O₂ in the presence of copper catalyst produces aromatic aldehydes. The influence of the nature of activated wood raw material on composition and yields of organic products was investigated.

The scheme of integrated wasteless processing of wood based on the combination of methods of exploded autohydrolysis, extraction, acid and oxidation catalytic reactions, and solid rest pyrolysis was suggested.