

Chemical Transformations of Hemicellulose during Mechanochemical Carboxymethylation of Aspen Wood

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The mechanochemical carboxymethylation of air-dry sawdust (humidity - 6-8 %) of aspen wood was carried out using monochloroacetic acid in presence of sodium hydroxide. It was found that the hydroxyl groups of hemicelluloses take part in alkylation alongside ones of cellulose. The degree of hemicellulose transformations was estimated on the difference between the percent content of the substituted and non-substituted monosaccharides formed after hydrolysis of carboxymethylated wood with 3% hydrochloric acid. The content of monosaccharides in the hydrolysates was determined by paper chromatography (Table 1).

Table

The content of non-substituted monosaccharides in the carboxymethylated wood

Duration of reaction, min.	Glucose, %	Arabinose, %	Xylose, %
2	5,15	5,13	16,73
5	3,70	4,62	14,10
8	2,97	3,88	8,64
10	2,27	3,17	6,15

The percent content of the monosaccharides in the wood after grinding but before addition of the reagents is 8.45% glucose, 5.25% arabinose, and 17.50% xylose. After 10 minutes the percent contents of the non-substituted monosaccharides is 2-3 times smaller in comparison with initial percent content in the wood. The similar results were obtained after carboxymethylation with the reduced amount of sodium hydroxide and monochloroacetic acid. The rate constants and the orders of carboxymethylation reaction of monosaccharides contained in aspen wood were determined using Erofeev-Kolmogorov-Avraami equation for topochemical reactions. Comparison of these data with the appropriate data of wood carboxymethylation shows similarity of rate constants and more high reaction order in case of hemicellulose.