GAS-CHROMATOGRAPHIC INVESTIGATION OF THE PRODUCTS OF THE THERMOLYSIS OF HYDROLYSIS LIGNIN

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In the thermal pyrolysis of hydrolysis lignin from cotton husks with the aim of obtaining activated carbon from it [1], about 8-10% of resinous substances is formed. Being products of of the decomposition of lignin, these substances should contain a considerable amount of phenolic compounds. The study of the composition of these phenols is important for their subsequent appropriate use.

Thermolysis is a complex high-temperature chemical process in which redox reactions, dehydration reactions, secondary condensation, etc., may take place. The low-molecular-mass substances obtained as a result of this process – phenols – show the far-reaching degradation of the initial lignin.

To study its phenolic composition, 30 g of the resinous product was dissolved in 300 ml of 1% of NaOH solution, and from this, after acidification to pH 3 with dilute HCl, the phenols were extracted with hexane and ether. The total yield of aromatic substances obtained in this way was ~58%. In principle, this by-product may be a source of phenols for various requirements. The composition of the total phenolic material was studied by the GLC method as described in [2], using a column to the stationary liquid phase of which H_3PO_4 was added, which permitted the simultaneous identification not only phenols but also of aromatic aldehydes, ketones, and acids.

In spite of the fairly severe conditions of thermolysis, the reaction products contain substances with the labile syringyl structure. In addition to phenols lacking a side chain or having only a shortened one (phenol, guaiacol, cresol, creosol), substances with a retained propane side chain (guaicylpropane, p-hydroxyphenylpropane) were identified.

The reaction products contained a fairly large amount of substances with carbonyl and carboxy groups, which indicates the occurrence of oxidative processes in the thermolysis of lignin. Such a diverse course of the degradation of lignin is probably connected with its irregular structure - with its inhomogeneity.

TABLE 1. Amounts of Phenolic Substances in the Products of the Thermolysis of Hydrolysis Lignin

Substance	Amount, % on the total	RRT	Substance	Amount, % on the total	RRT
1. X_1	1,0	0,16	13. X_5	2,0	0,86
2. X_2	1,5	0,17	14. X_6	2,9	0,90
3. Guaiacol	3,3	0,23	15. Vanillin	4,4	1,00
4. Phenol	2,6	0,25	16. Pyrocatechol	4,5	1,12
5. Creosol	2,6	0,31	17. Acetoguaicone	3,0	1,19
6. p- & m-Cresols	5,7	0,33	18. X_7	4,0	1,27
7. Guaiacylethane	6,4	0,43	19. X_8	3,2	1,33
8. Guaiacyl-propane	7,9	0,53	20. X_9	3,7	1,39
9. p-Hydroxy-phenylpropane	2,5	0,63	21. p-Hydroxybenz-aldehyde	11,1	1,49
10. p-Hydroxycin-namic acid	2,2	0,67	22. Syringaldehyde	4 4	1,64
11. X_3	1,7	0 70	23. X_{10}	9.0	1,76
12. X_4	1,5	0,74	24. Veratric acid	3.6	1,82
			25. Syringic acid	5.3	2,82

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Thus, it has been established that the resinous product obtained as waste material in the production of activated carbon consists of at least 25 phenolic compounds, 15 of which it has been possible to identify. This by-product may serve as a source of total phenols and of modified preparations based on them.

LITERATURE CITED

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