Electronic supplementary materials *Mendeleev Commun.*, 2021, **31**, 376–378

Dry reforming of lignin: the effect of impregnation with iron

Leonid M. Kustov, Andrei L. Tarasov, Vera D. Nissenbaum and Alexander L. Kustov

Experimental details

We used a powder of hydrolytic lignin 'Biosorb' (FLLC Toplivno-tekhnologicheskii kompleks, Belarus) with a bulk density of 0.38–0.4 g cm^{-3}. The dry substance was characterized by elemental analysis. Found (%): C, 60.9; H, 5.5; N, 1.6; O, 27.8; S, 0.8; the rest, 3.3. Calculated formula is $CH_{1.09}O_{0.35}$. Mineral ash: 8.6%.

Samples (0.4 g) were loaded into a quartz tube reactor with an inner diameter of 7 mm and heated in a nitrogen flow to 200 °C. A trap was installed at the outlet of the reactor to collect liquid products. After purging the samples with nitrogen (600 $cm^3\ h^{-1}$) at 200 °C for 1 h, CO_2 was fed into the reactor at atmospheric pressure with a flow rate of 600 $cm^3\ h^{-1}$. After 15 min, the temperature-programmed heating was started from 200 to 900 °C with a step of 50 °C. Gas samples were collected at the outlet of the reactor for chromatographic analysis. The total heating time from 200 to 900 °C was 3.5 h.

All chromatographic analyses were performed on a Granat model 3700 gas chromatograph. Analysis for CO, CH_4 and CO_2 was carried out at 60 °C using a HayeSep Q packed column (2 m) with a thermal conductivity detector. Gas samples were introduced using a fixed volume loop and a 6-way valve. The hydrocarbon gas fraction was analyzed at 60 °C using a SE-30 capillary column (25 m) with a flame ionization detector. The liquid reaction mixture was extracted with benzene or chloroform and analyzed using a SE-30 capillary column in the temperature-programmed mode (60 °C, 7 min, then heating at 7 °C min^{-1} to 240 °C).

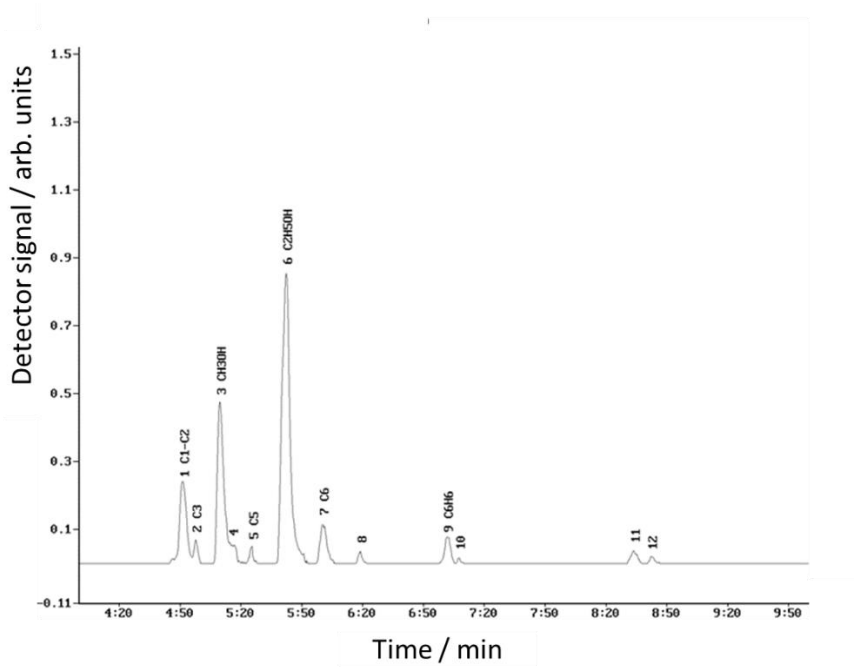

Figure S1 Chromatogram of the hydrocarbon gas mixture formed at 300 °C in the course of the dry reforming of the Fe(10%)/lignin sample.

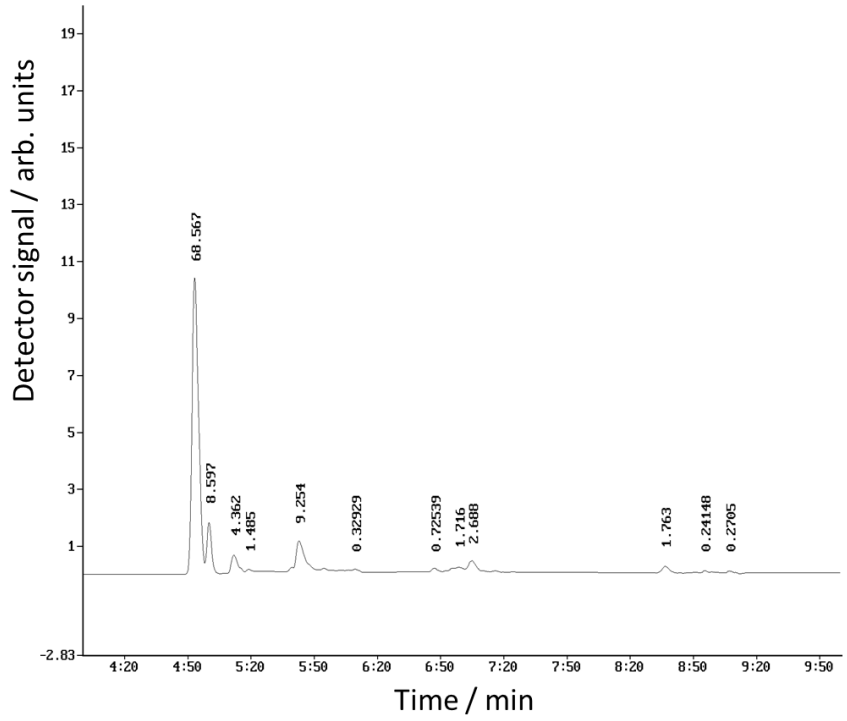

Figure S2 Chromatogram of the hydrocarbon gas mixture formed at 450 °C in the course of the dry reforming of the Fe(10%)/lignin sample.

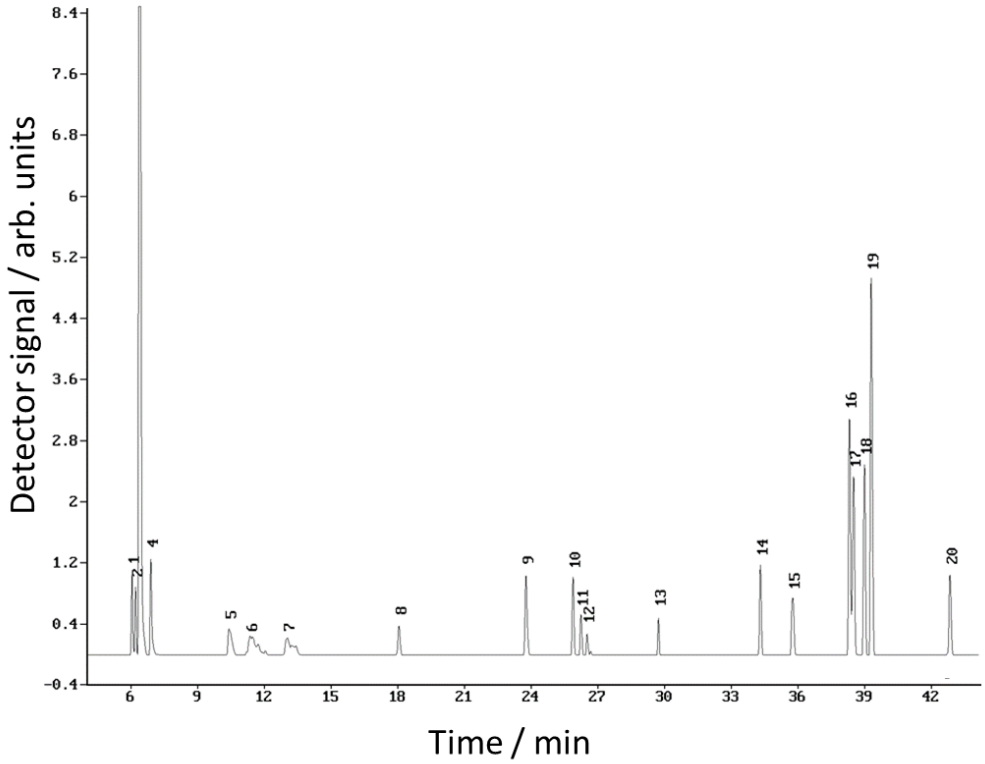

Figure S3 Chromatogram of products (extracted with $CHCl_3$) found in the liquid fraction in the course of dry reforming of the Fe(10%)/lignin sample in the temperature range of 200–400 °C.