Hydrodeoxygenation of guaicol on transition metal phosphides formed *in situ*

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Nowadays, catalysts based on transition metal phosphides can provide competition with traditional hydroprocessing catalysts due to their high catalytic activity and low cost. Transition metal phosphides poorly known and need more work in the hydrodeoxygenation of bio-oil phenolic compounds—biomass fast pyrolysis products.

This work is devoted to the catalysts based on molybdenum and tungsten phosphides generated *in situ* from metal carbonyls and triphenylphosphine in a stainless-steel batch reactor during the hydrodeoxygenation of bio-oil model compound - guaiacol. *In situ* formed molybdenum and tungsten phosphides are amorphous that was found by XRD. The molar Mo/P in MoP and W/P in WP ratios calculated from energy dispersive X-ray analysis were 1.3 and 1.1, respectively.

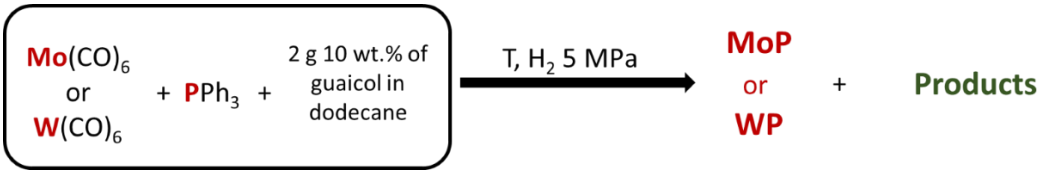

Fig. 1. Scheme of *in situ* production of catalysts based on molybdenum and tungsten phosphides

It was shown that conversion of guaiacol was 89–91 % and 80–86 % on MoP and WP respectively at 320–380°C, 5 MPa H_2, after 6 hours of reaction. The main hydrodeoxygenation product of guaiacol was phenol; anisole, cresols, and toluene were also formed. The highest selectivity for phenol on MoP was reached 80% at 360°C (5 MPa H_2, 6 hours). The highest selectivity for phenol on WP was 72% (340°C, 5 MPa, 6 hours). The recycling test of molybdenum and tungsten phosphides formed *in situ* from triphenylphosphine and metal carbonyls in the hydrodeoxygenation of guaiacol led to a slight decrease in catalytic activity. It should be noted that the selectivity for phenol remained unchanged.

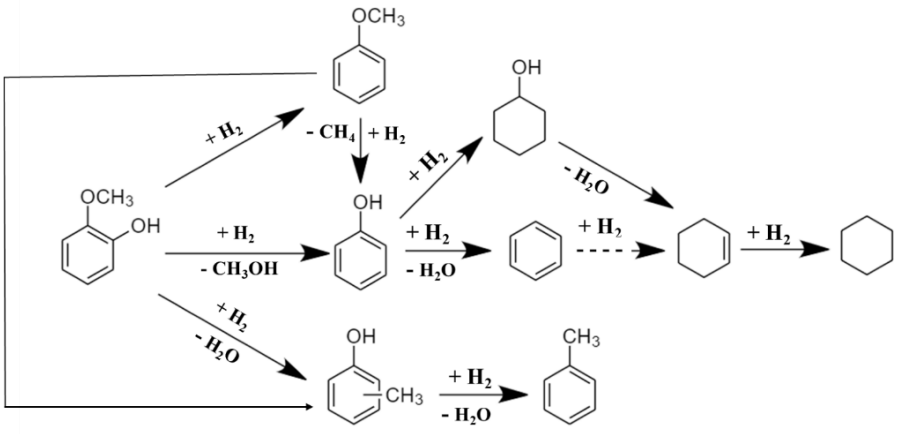

Fig. 2. Proposed reaction pathways of guaiacol hydrodeoxygenation in dodecane on *in situ* generated molybdenum and tungsten phosphides based catalyst