CONTINUOUS PROCESS FOR THE PREPARATION OF 2-METHYLFURAN BY THE CATALYTIC HYDROGENATION OF FURFURAL

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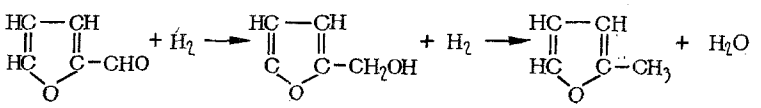
Up to 1964 no commercial method of production of 2-methylfuran (sylvan) existed in Russia although there had been laboratory studies in this field [1-5].

A continuous process for the preparation of sylvan by the catalytic hydrogenation of furfural was developed by the All-Union Scientific-Research Institute of the Petroleum Industry, the All-Union Scientific Research Vitamin Institute, and the Belgorod Vitamin Combine. This process is carried out in a commercial plant in the experimental operating department of the Belgorod Vitamin Combine.

The process of catalytic hydrogenation of furfural to 2-methylfuran proceeds in the gas phase on an alumo-copper-chromium or alumo-copper catalyst via the intermediate formation of furfuryl alcohol at the temperature 200-250°C and pressure 5 kg/cm^2 according to the reaction:



The heat effect of the reaction of hydrogenation of furfural to 2-methylfuran is 34 kcal/mole.

The process of hydrogenation of furfural to 2-methylfuran is carried out according to the line diagram (q.v. Fig. 1).

Furfural, purified from polycondensation products by vacuum distillation, is continuously fed with space velocity 0.2-0.3 h^{-1} under a pressure of 5 kg/cm^2 from the measuring tank (1) by the metering pump

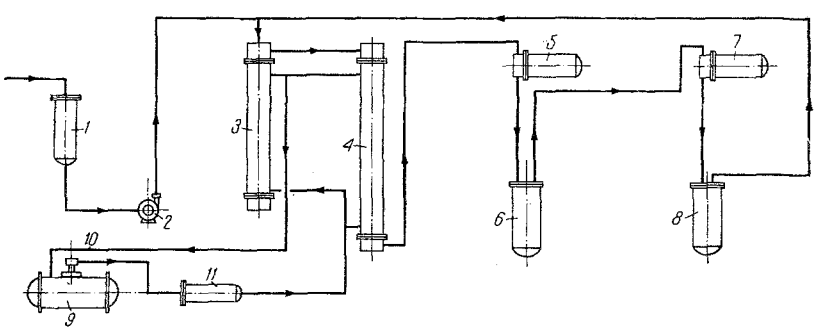


Fig. 1. Line diagram for a continuous process for the preparation of 2-methylfuran. 1) Furfural measuring tank; 2) metering pump; 3) preheater; 4) reactor; 5) condenser; 6) separator for isolation of hydrogenation product; 7) condenser; 8) separator for complete separation; 9) tank for high temperature organic heat transfer agent; 10) immersion pump; 11) heat generator.

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(2) and in mixture with hydrogen enters the preheater (3) where vaporization of the furfural and heating of the hydrogen occur.

The vapor gas mixture at a temperature not below 195° enters the hydrogenation reactor (4) from the preheater (3) and hydrogenation of furfural to 2-methylfuran occurs on the catalyst at a temperature of 200-250°. The hydrogenation products and unreacted hydrogen are cooled in the condenser (5) and enter the separator (6) for separation. After further cooling of the uncondensed vapors from the hydrogenation products and the hydrogen in condenser (7), separation of the liquid phase from hydrogen is carried out in separator (8).

The hydrogenation products are periodically recovered from the separators (6) and (8) and subjected to distillation for isolation of the 2-methylfuran.

The vaporization of the furfural in preheater (3) and the removal of heat from the reactor (4) are achieved with a high-temperature organic heat transfer agent. A mixture of freshly distilled technical and recovered furfural was used for the hydrogenation process both on the alumo-copper-chromium and also on the alumo-copper catalyst, using this material the yield of 2-methylfuran from the furfural was approximately 60%.

According to its characteristics, the 2-methylfuran produced in the apparatus satisfied the requirements necessary for 2-methylfuran for use in the production of vitamin B_1 and it had the following qualitative indices: a) specific gravity not less than 0.910; b) refractive index 1.4312-1.4400; c) sylvan content 80-90%.

The developed process can be operated according to the continuous scheme.

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