CATALYTIC SYNTHESIS OF PYRROLE FROM ETHANOLAMINES

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The catalytic transformation of monoethanolamine at high temperatures gives pyrrole. In addition to pyrrole, the liquid reaction products contain acetonitrile, resin, and water. The gaseous products consist principally of ammonia and hydrogen. The appearance of water and acetonitrile in the reaction products is evidence in favor of the fact that the formation of pyrrole proceeds through intermediate vinylamine.

The formation of pyrrole from diethanolamine proceeds more readily and gives better yields than in the first case. This is explained by the fact that the formation of pyrrole here proceeds through only one intermediate – divinylamine – the dehydrogenation of which leads to the final target product.

The experiments were carried out in a flow apparatus. The reactor was charged with 100 ml of filled volume of an aluminum–zinc–chromium catalyst (95.0 wt.% γ-Al_2O_3, 2.0 wt.% ZnO, and 3.0 wt.% Cr_2O_3). Ethanolamine was passed through the catalyst layer at 0.2 h^{-1}.

The catalyzate was analyzed by gas–liquid chromatography (GLC) [with an LKhM-7A chromatograph with a thermal conductivity detector; the thermostat temperature was 175°C, the column was 2 m long and 4 mm in diameter, the phase was PEGA (polyethylene glycol adipate)/Cellite-545, and the carrier gas (helium) flow rate was 60 ml/min].

In addition, the catalyzate was rectified. The isolated pyrrole fraction (bp 130-131°, n_D^{24} 1.5042, and d_4^{24} 0.962) gave the characteristic coloration with a pine splinter moistened with hydrochloric acid.

The yield of pyrrole from monoethanolamine was ~10.0%; the yield from diethanolamine was up to 18.5%.

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