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Oxidation of ethylbenzene with air oxygen in the presence of homogeneous and heterogeneous Mn(II)-containing catalysts

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Abstract

The process of oxidation of ethylbenzene by oxygen with the formation of the corresponding hydroperoxide as the primary intermediate was studied. The process was carried out by oxidation with air oxygen in a glass bubbling reactor at a temperature of 120 °C and atmospheric pressure in the presence of homogeneous and heterogeneous manganese-containing catalysts. The use of variable valence metals and their derivatives accelerates the oxidation process as compared to the blank experiment, and decomposes hydroperoxide with formation other oxygen-containing compounds according to the proposed scheme. It is shown that manganese-containing catalysts, both homogeneous and so coated on an inert carrier, lead to the formation of significant amounts of hydroperoxide. At the same time, the process of decomposition of ethylbenzene hydroperoxide proceeds simultaneously with the formation of the corresponding alcohols and ketones on the catalyst. With an increase in the concentration of the catalyst in the reaction mass, the inductive period of accumulation of hydroperoxide increases, and the fraction of catalytic decomposition of the hydroperoxide increases. It is shown that the use of manganese-containing compounds deposited on the surface of an inert carrier γ-Al_2O_3 as a catalyst leads to a more complete decomposition of ethylbenzene hydroperoxide with a minimum induction period. In this regard, the amount of catalyst required to produce and completely decompose the corresponding hydroperoxides to alcohols and ketones, if used on an inert surface, will be significantly less than for the homogeneous. Iodometric titration, gas chromatography with a mass-selective detector and the IRR method of IR spectroscopy were used as methods for evaluating the qualitative and quantitative analysis of the products obtained.

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