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Dehydrogenation of methylbutenes to isoprene: Mathematical analysis of technology upgrade options. Part i

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Abstract

© 2015 Pleiades Publishing, Ltd. The mathematical modelling of conventional metylbutene dehydrogenation technology (performed in an adiabatic reactor) and of three versions of this process conducted in a pseudo-isothermal mode is performed to select a variant of modernization that is optimal in terms of energy efficiency. These variants are (1) a single-reactor design with a fractional supply of steam to the upper and middle zones of the catalyst bed; (2) a design with two reactors in series and intermediate heating of the contact gas in an interstage superheater; and (3) a design with two reactors in series and the adding of an overheated gas into the interreactor space. It is shown that each of the new designs can significantly increase the effectiveness of the process, compared to the conventional technology. A comparative analysis is performed of the dependences of the selectivity and yield of isoprene formation on the amount of heat energy Q supplied in the experimental designs. It is concluded that at long times of contact, the greatest increase in the isoprene yield (5.5%) and selectivity (5.6%) is obtained with design (2), especially when $Q > 8.5 \times 106$ J/kg.

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Keywords

dehydrogenation of methylbutenes to isoprene, mathematical modeling of technological processes