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The kinetic study of toluene hydrogenation with response surface method over three Pt-supported catalysts

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Toluene is one of the unsaturated hydrocarbons. Breathing a high concentration of toluene leads to death, and lower concentrations affect the nervous system and lead to dizziness, unbalanced behavior and organ failure. Exposure to these volatile organic compounds causes harmful effects on the organs. Therefore, researchers are searching for new methods to replace these compounds with less dangerous substances. One of the methods presented in this process is the hydrogenation of toluene in the presence of suitable catalysts [1, 2].

In this process, the catalyst that has the highest efficiency is suitable for toluene hydrogenation. Before the experiment, the reduction of the catalyst was done, and in the next steps, toluene was injected into the reactor tube at different speeds. The flow of hydrogen gas was adjusted to the optimal value, and the kinetic study of hydrogenation was carried out continuously at one-hour intervals. The fixed bed micro reactor at 130-190 °C using 1 g of each catalyst, three parameters were reported as temperature, flow rate of hydrogen and toluene. The results show that with increasing the toluene flow, the reaction rate has a relatively upward trend. The highest value of the rate was reported at 190 °C and a toluene flow of 120 cc/min. The lowest rate was reported at 130 °C and a toluene flow of 62.4 cc/min.

According to the obtained results, the amount of hydrogen and toluene flow rates are effective and determine the amount of reaction rate.

Among these three catalysts tested in a certain temperature range, toluene with a flow rate of 4.8 cc/min and hydrogen with a flow rate of 45 cc/h, among the data obtained from the above reaction, the Pt/HMS and Pt/SiO_2 catalysts have the highest reaction rates.

Keywords: hydrogenation, Toluene, Flow rate.

References

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