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Investigation the Effect of Changes in feed Distillation Rates of Catalytic Conversion of Continuous Reduction on Octane Number

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ABSTRACT

As mentioned, another important characteristic of gasoline produced in addition to octane number is the amount of benzene in it. The maximum permitted benzene level is 1% vol. in accordance with the European standard of 2005 in gasoline. Of course, for 2011, the United States has lowered benzene levels to 0.62%. Therefore, in optimizing the gasoline product, the parameters affecting the reduction of benzene production should be considered. In this research, we tried to study the changes in the distillation curve of the refined heavy naphtha catalytic converter unit, the results of the octane number and the benzene volume percentage contained in the final gasoline product. In order to carry out this study, changes in the Reboiler thermal bar of the naphtha hydrogen purifier separator tower should be made in response to the low temperature variations of the tower and, consequently, the value of the product distillation curve at the bottom of the tower, which is essentially the feed of the catalytic converter unit. This study was carried out under nominal capacity of 150 ton/hr, heavy catalytic converter and flow of 22 ton per circulating gas with 92 percent purity of hydrogen and 800 kg/h of catalyst and 525 °C reactors input.

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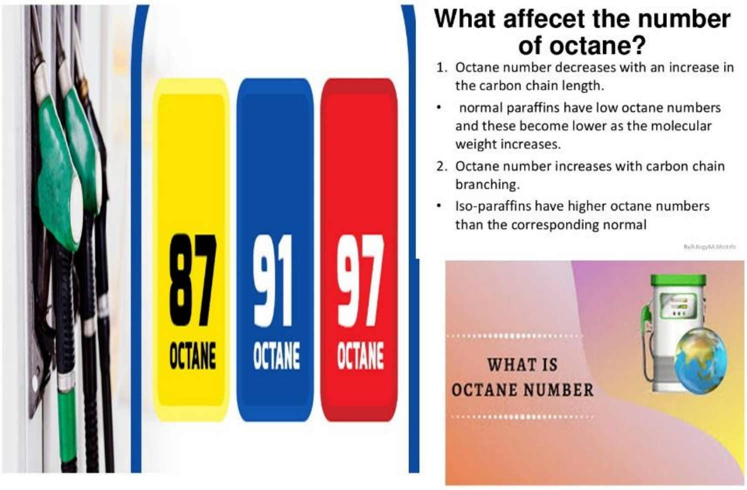
GRAPHICAL ABSTRACT



Introduction

The accuracy of the obtained values is specified, the results of the low temperature changes in the tower at the initial boiling point of the initial point of distillation of the heavy naphtha product at the bottom of the tower are much more pronounced than the final boiling point. What certain is the increase in the temperature of the tower leads to an increase in the amount of distillation of heavy naphtha at the bottom of the tower, which has a greater effect on the initial boiling point. More importantly, the increase in the boiling point of the heavy naphtha feed catalytic conversion unit increases the octane number and also reduces the volumetric percentage of benzene present in the gasoline product. Finally, the final result of this study is that the optimum temperature of the naphtha hydrogen sulfide distillation unit at a pressure of 1.5 relative bar temperature is 155 °C, which results in the initial boiling point of the heavy naphtha feed catalyst conversion unit to an optimum of 107 °C which led to gasoline production with an octane number 95 and a content of 0.4319% vol. of acceptable benzene in a capacity of 150 t/h and the conditions mentioned in this review [1-5]. Higher temperatures do not have much effect on optimizing product conditions and only lead to increased energy consumption and economic costs [6-8].

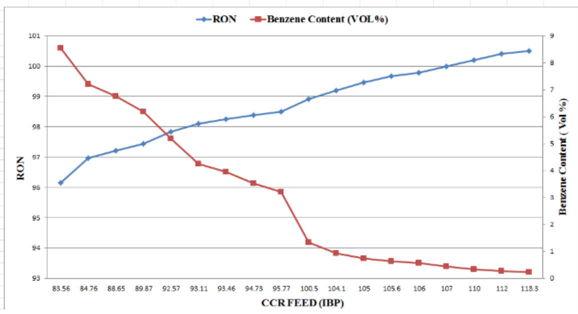


Figure 17. The results diagram of study the effect of changes in the initial boiling point of heavy naphtha distillation rate of catalytic conversion unit of continuous reduction on the octane number and the volumetric percentage of benzene product by produced gasoline.

Investigation the Effect of Catalytic Conversion Unit Reactor Temperature Variations on the Benzene Product volume Percentage

Considering the importance of benzene in gasoline production and, on the other hand, the most effective independent variable increasing octane number, i.e. reactor input temperature, therefore, it seems necessary to study the effect of reactor temperature changes on benzene rate in the product. This study was carried out at a nominal capacity of 150 ton/hr of heavy naphtha feed catalytic converter unit fluctuation with a flow of 22 ton/hr of circulating gas and a flow 800 kg/hr catalyst flow [9-12]. Due to the importance of gasoline octane number that is the main objective of this project, the simultaneous changes in this parameter along with benzene in gasoline appear to be beneficial due to temperature changes to optimize single conditions. Therefore, the reactors input temperature, the independent variable, and benzene volume percentage rate present in the product and the octane number, are dependent variables of this experiment [13-16].

Due to the importance of the reactors input temperature in catalytic conversion process, the sensitivity analysis on the change in the reactors input temperature was carried out on benzene rate. With the increase in the reactors input temperature, benzene rate in the gasoline product increases the catalytic conversion unit, although, given that benzene is produced from the dehydrogenation of naphthenes, this reaction is firstly equilibrium and, secondly. Therefore, the lower the reactor input temperature, the lower the benzene production will be [17-20]. But in the catalytic conversion process, the temperature cannot be reduced to the desired value, because the gasoline octane number will change. Therefore, in this experiment, the effect of reactor input temperature on two variables of octane number and benzene volume percentage has been investigated. Also the optimum input temperature of catalytic conversion reactors with a nominal capacity of 150 ton/hr and specified conditions was selected in the range (520-530) °C [21-25].

Investigation the Effect of Changes in the Capacity of Naphtha Catalytic Conversion Unit on Gasoline Octane Number and Coke formed rate on the Catalyst

The purpose of this study is to show the effects of unit capacity on two important parameters of the catalytic conversion process and determine the importance and necessity of setting the process conditions and the appropriate operational variables for each capacity to fix the octane number 95. The main result of this study is that by increasing the catalytic conversion unit capacity, the gasoline octane number decreases and increases against the coke content formed on the unit catalyst surface [26-28]. Of course, in this variation of unit capacity, the coke formed percentage is within the permitted range. If the conditions are constant, 22 ton/hr flow circulating gas with 90 percent purity of hydrogen and flow 800 kg/hr of catalyst and temperature of 525 °C of reactor input, the range of (150-125) ton/hr of heavy naphtha catalytic conversion unit capacity. It is continuous for the process conditions of the above. Lower capacities for waste of energy and higher capacity will result in a failure to reach the octane number 95 and an increase in stack coke [30-33].

Investigation the Effect of Catalytic Conversion Unit Reactor Temperature on Octane Number and Coke Content Formed on Catalyst

One of the important results of this study is that the maximum allowable reactor input temperature is 550 °C. The main result is that with the reactor temperature rising, the gasoline octane number increases, but the coke formed rate will also increase as the reactor temperature rises [34-36].

The slope of this coke formation at 520 °C increases dramatically, which is an increasing problem, limiting the possibility of temperature rise. As a result, the optimum input temperature of the catalytic conversion reactors in a fixed capacity of 150,000 kg/hr is the heavy naphtha refined catalytic conversion unit, a constant mass of 22 ton/hr of hydrogen gas returned with a purity of 90%, and a constant mass flow rate of 800 kg catalyst per hour, ranges from 525-530 °C.

Investigation the Effect of Catalytic Fluctuation Changes on Coke Composition Formed Percentage on the Catalyst

In the nominal capacity of 150 t/h and in terms of returned hydrogen gas rate equivalent to 22 t/hr with a purity of 90% and a constant temperature of 525 °C, reactor inputs, in the range of 200 to 1600 kg/hr fluctuation of the catalyst, this study was carried out. The important conclusion is that by increasing the mass flow rate of the catalyst, the percentage of coke formed on the catalyst decreases and for the nominal capacity of 150 t/h with the process conditions set, a flow of 800 kg/hr of catalyst is used to adjust and control 3.8% of the coke is proper [37].

Comprehensive Review of the Effect of Reactor Input Temperature Changes and Unit Capacity on Gasoline Octane Number

The most important factors and parameters affecting the gasoline octane number are the reactors input temperature and catalytic conversion unit capacity. The purpose of this experiment is to find the optimum reactor input temperature for different values of catalytic conversion unit capacity. This study was carried out in a fixed mass of 200 gr/hr with a purity of 90% and a stabilization of 3.5% of the coke formed on the catalyst. By checking the results, the optimum return temperature of the reactors can be obtained at 525 °C, because in addition to the ability to produce gasoline, the octane number 95 for a nominal capacity of 30,000 barrels per day, a catalytic conversion, has a greater range of different capacities for producing gasoline is included with the octane number 95 [38].

Investigation the Effect of Reactor Input Temperature Changes on Yield Volume and Gasoline Octane Number

The test was conducted at a constant capacity of 137 ton/hr of refined heavy naphtha, equivalent to 27500 b/day, and a constant flow of 800 kg/hr of catalyst. Investigating and observing the results suggests a decrease in the yield volume of the product in exchange for an increase in the reactor input temperature. Based on the volumetric flow rate and the inclusion of the gasoline octane number, the optimal input temperature of the catalytic conversion reactors is in the range of (520-535 °C), which results in a volumetric efficiency of 84 to 79%.

Investigation the Effect of Changes in the Mole ratio H_2/HC on Gasoline Octane Number rate and the amount of coke Content Formed on the Catalyst

This study was carried out in a fixed capacity of 150 ton/hr of refined heavy naphtha feed of catalytic conversion unit and constant input temperature of single reactors equal to 525 °C and a constant flow of 800 kg/hr catalyst circulation. Increasing this molar ratio reduces the amount of coke content formed on the catalyst. But the results of this study on the effect of increasing this molar ratio on octane numbers indicate an increase in the number of gasoline octane number. From the observation of values obtained from this study it can be concluded that in the above conditions, the molar ratio of H2/HC higher than 2.5 in order to increase the octane number and reduce the coke formed percentage is optimal and appropriate. But usually lower molecular ratios of H2/HC are preferable because of higher costs and energy costs [39].

Conclusion

One of the most important process in refineries is Naphtha catalytic conversion. In this process, gasoline with high octane number produce in the petrochemical complexes of precious aromatics such as benzene, toluene and xylene. Due to the importance of fuel and its more production of initial oil materials and the optimization possibility and catalytic reactor performance improvement in order to increasing the quality and quantity of products, the necessity of simulation and investigation the involved parameters and its performance improvement will be necessary. This process contains three numbers radial flow reactors, furnace, a separator tank, some thermal conversion and a compressor which has been done more than 300 reactions in these reactors that should be use the presented kinetics models for simulation. In the refinery, the input temperature of the three reactors is same that the catalyst will gradually be inactive, the reactors input temperature will increase with respect to product quality analysis. Also, the input features feed changes and its flow rate fluctuations will effect on products distribution and octane number then will make it unstable. It should be noted that if the percentage of compounds and the values of distilled feed of purificated Naphtha unit changed, the recommended operational values and unit process conditions will be changed.

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