CALIFORNIA STATE SCIENCE FAIR
2012 PROJECT SUMMARY

Name(s)

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Project Number

S0314

Project Title

Modeling Acidic Gas Removal Efficiency for a Semi Dry Reactor

Abstract

Objectives/Goals

To study the hazardous gas removal efficiency for SDR as a function of the stoichiometric ratio and the gas amount.To simulate SDR shape, reaction condition, and operating condition.To confirm and improve the design factor to increase the hazardous gas removal efficiency for SDR

Methods/Materials

This project was conducted using a computational fluid dynamics software called Ansys

Results

When the stoichiometric ratio was 1.0, 1.2, 1.5, the acidic gas removal was 37.9%, 44.9% and 55.7% respectively. When SR was 2.0 the removal efficiency did not change as much. The gas outlet temperature of SDR ranged from 175 ℃ to 200 ℃. For the base case velocity model,the inlet gas flowed down and diffused. The upper part of the gas was turbulent and caused the flow of gas to stagnate.The steam-line was sided near the outlet duct. For the base case pressure model, the inlet gas pressure was 30 Pa and the pressure was maintained throughout inside the SDR, but significant pressure loss occurred as the gas entered the outlet duct.

Conclusions/Discussion

Stoichiometric ratio of 1.5 showed the optimum removal efficiency.

When the nozzle placement was modified, the removal efficiency was 72.8%

Though the stoichiometric ratio was changed, the gas velocity remained constant. So when the amount of lime injection was changed, the total pressure drop from the inlet to outlet in the SDR stayed almost the same.

Based on the data collected from the modeling, it can be expected that the pressure drop loss of SDR can be improved if the outlet duct shape is modified

The gas velocity and the pressure drop were increased as the inlet gas amount increased and the most pressure drop took place at the gas outlet duct.

If the Stoichiometric ratio is constant the acidic gas removal efficiency does not get affected by the gas amount change. The gas outlet temperature of SDR well satisfied with the guide line of SDR design.

Summary Statement

The project was about finding the optimum condition of acidic gas removal efficiency for SDR(Semi Dry Reactor), system checking and finding the design factor of SDR to develop a more efficient SDR

Help Received

My supervisor helped me with technical parts using Ansys