



GAVIN CONFERENCES

International Conference on Petrochemical Engineering

July 10-12, 2017 Dubai, UAE

Desulfurization of diesel using biomass

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In today's world, environmental regulations have been introduced by many countries around the world to reduce sulfur content in liquid fuels to low levels with the intention of improving air quality. Beginning in 2001, the U.S environmental protection agency passed rules requiring use of ultra- low sulfur diesel fuel. To protect the environment most of the countries have limited their sulfur content up to 10 ppm. In India, sulfur level in fuel less than 50 ppm in capitals and 350 ppm sulfur in the rest of India. Generally, a liquid fuel contains a mixture of hydrocarbon with small amount of sulfur compounds, present in the form of free sulfur, sulfides, disulfides, mercaptan, thiophene, benzothiophene, dibenzothiophene etc. The sulfurous materials have many direct and indirect negative effects on the environment and the economy. Combustion of sulfur compounds result in air pollution, acid rain as well as cardiovascular disease, cancer and asthmatic symptoms in human health etc. Desulfurization is a process which involves reducing the sulfur content in liquid fuels. Currently existing methods for desulfurization are hydro desulfurization, oxidative desulfurization, adsorptive desulfurization, bio-desulfurization and extractive desulfurization.

The present commercial desulfurization methods have the major disadvantage like critical operating conditions, expensive catalyst and require high initial cost. Adsorptive desulfurization is the only alternative method for effective removal of sulfur from liquid fuels. Desulfurization by adsorption is a process that depends on the ability of a solid sorbent to selectively adsorb organo sulfur compound from fuels. Various adsorbents like natural, synthetic, carbon based, non carbon based, nano materials were used. Sulfur removal from diesel oil has been the big challenging task over last decades. In this study, Tamarindous indica shell powder was used as an adsorbent for effective removal of sulfur from diesel. The prepared shell powder was characterized by FTIR- Spectral analysis.

The effect of various conditions such as adsorbent dosage, contact time & temperature were studied in this work. By using 3 gm of Tamarindous indica shell powder for 100 mL of diesel, the removal efficiency was achieved 72 % at 38°C for 0 to 60 minutes. The adsorption behavior was studied on the basis of adsorption isotherms and kinetics. The equilibrium data were fitted to the Freundlich isotherm and pseudo second order model. This study provides the effective and economical adsorptive desulfurization process for sulfur removal from diesel. Such as the concentration of the adsorbent increases the amount of sulfur removed or adsorbed also increases but the uptake capacity of the adsorbent per gm reduces. The amount of sulfur adsorb also increases with the increasing time. The amount of sulfur adsorb decreases as adsorption is an exothermic process, where as with the size of adsorbent, as small as it is the more adsorption will take place. Thus, desulfurization of diesel by adsorption process using Tamarindous indica shell powder shows a reduction in amount of by more than half of the original amount of sulfur.

Biography

Vanrajsinh Gadhavi is a student at Pandit Deendayal University, India. He is pursuing his Bachelors in Technology in Petroleum Engineering (Downstream)

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