Cleaner and greener fuels from an integrated petroleum refinery

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Abstract

For the foreseeable future, petroleum refineries will continue to be the primary source of transportation fuels. However, in order to eliminate hazardous emissions, it is necessary to continually enhance the quality of these fuels in order to make them cleaner and greener. However, quality gains in traditional refineries have reached a limit, necessitating the consideration of alternative and synergistic techniques to increase quality and establish higher requirements. Theoretical Orientation & Methodology: By combining Fischer Tropsch (FT) synthesis based on syngas obtained from natural gas reforming with a traditional refinery, the suggested technique intends to enhance the quality of key liquid fuels such as diesel and gasoline. High-quality, clean-burning diesel and gasoline fuels may be made through FT synthesis. The diesel fuel produced by the FT synthesis method, in particular, is almost devoid of particle emissions precursors (polynuclear aromatics) and has a sulphur concentration of less than 0.5 ppm. Similarly, gasoline from the FT refinery has low sulphur content and a high octane rating. Continuous attempts to boost drop-in biodiesel and bioethanol content will boost the renewable content of these fuels while also improving their quality. Conclusion and Importance: The proposed combination of a traditional petroleum refinery with the FT synthesis process, which produces high-quality clean diesel and gasoline fuels from natural gas, offers tremendous potential to reduce harmful emissions from these fuels. Drop-in biodiesel and bioethanol will increase the quality of these fuels while lowering greenhouse gas emissions. Renewable fuels have been one of the hottest subjects in the energy discussion this millennium. The increased interest is understandable, given the growing worry about CO2 emissions into the atmosphere and their influence on global warming. Political instability in the locations where crude oil is produced is another important element. Finally, local agriculture economics and trade deficits, which are partially owing to historically high crude oil costs, offer an additional impetus for many of the world's largest users of petroleum to derive more energy from domestic sources.

Flora has been a source of fuel, as well as numerous useful and necessary compounds and elements, for ages. Many of those items got cheaper and performed better when generated from fossil feedstock's during the oil period. The most sustainable approach to renewable fuels would be to encourage benefiting first from the value chain of biomass constituents and producing fuel only from the residues, or from a completely different feedstock, such as algae, which is not part of the food chain or the traditional green industry. Many businesses are already researching this way of moving from pollution to solution. Petroleum refineries are ideal places for the development of renewable fuels. They are, after all, designed for the most cost-effective production of sophisticated fuels and the delivery of acceptable goods to neighboring civilizations. Refiners have a lot of expertise with their raw materials and equipment, owing to the fact that they've been using them for a long time and have learned everything there is to know about them. Another significant point to consider is that processing renewable feeds as co-feeds in an existing refinery is not always the most cost-effective option. Furthermore, extant market criteria for renewable feed materials approximate only the main criteria for current uses, with no comprehensive description of biomaterial qualities. The major aspects and surprises will only be revealed via experience.

In the current economic context, however, "bio" also indicates a premium in product value, which alters the picture, not least because refinery margins are low or non-existent. When bio products are created in a petroleum refinery, the technical difficulty is to accomplish the integration right Furthermore, the objective is to design molecules that are structurally comparable to current fuel molecules. Bio-base stocks may be processed into sustainable fuels in conventional petroleum refineries. To promote distinct product slates, the bio refinery idea might be constructed on three basic starting platforms. Based on biochemical conversion processes, the sugar platform focuses on the fermentation of sugars derived from biomass, particularly lignocellulose material. Because the conversion is carried out by microorganisms, this platform necessitates a deep understanding of bio- and genetic engineering, as well as chemical engineering. The gasification of variable biomass feedstock's is the emphasis of the syngas platform, which is based on thermochemical conversion processes. It can run on practically any organic feedstock and generates synthesis gas, which may be turned into a variety of materials other than fuels. Although the syngas platform appears to be made up of well-known technological blocks that have been proved in other applications, there are several obstacles to overcome. Some of the technological blocks were created for other purposes and uses, and many of them had to be modified and adapted for this use. Bio-based feedstocks also contain minor amounts of components that differ from those found in fossil feedstock's, which must be demonstrated experimentally.

The component platform focuses on the separation of important biomass constituents for subsequent processing and is based on fractionation methods. The residues may be utilized by bioconversion or thermochemical means.

A classic pulp mill, also known as a component platform, is a biorefinery that uses chemical or thermomechanical processes to extract a main product, fibers, from chemical components. Multiple items may be made from the chemical fraction, including commodities, fine chemicals, functional foods, and medications. So far, the major by-products have been various biofuels in liquid or solid form. There are, however, alternative options. FAME production is now dominated via the fats and oils pathway. It produces a commercial product with drastically weakened qualities, resulting in blending restrictions in regular diesel applications or the usage of specialised automotive equipment. The new hydroprocessing approach produces considerably superior products and is now used in the NExBTL process, which has two operational references at Neste Oil's Porvoo refinery and a third unit that began operations in Singapore in November

Biography

Anand Prakash has contributed extensively to the development and analysis of multiphase reactors widely used in clean fuels and chemicals production processes. The reactor models and techniques developed by his research group have been used by other research groups in industry and academia. The reactor models for Fischer Tropsch synthesis were developed by integrating years of research by different groups and validated with data from pilot and demonstration scale units. His research group is also developing low-cost process for biodiesel production

This work is partly presented at 4th International Conference on Chemical Engineering

September 17-18, 2018 | Vancouver, Canada