HVO BIOFUEL PRODUCTION IN A CENTRAL EUROPE REFINERY

BY MARCIN MASEK- GAS SAMPLE SP. Z O.O.

INTRODUCTION

This case study describes a newly built HVO (vegetable oil hydrogenation) unit, with a focus on process analytics solutions used to monitor and optimize production. The plant, built by a leading petrochemical company from Central Europe, produces 300,000 tonnes of biodiesel or aviation biofuel per year. The total cost of the investment is estimated at around EUR 140 million.

PROCESS

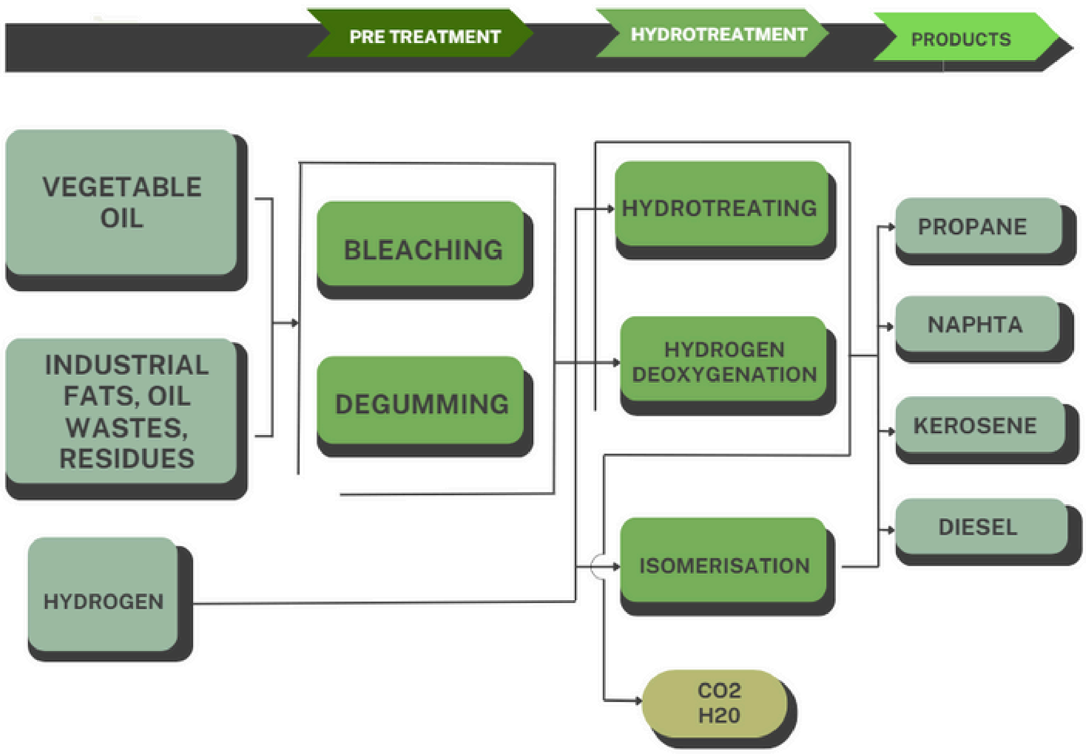
Hydrotreated vegetable oil (HVO) is a high-quality, second-generation biofuel that is increasingly used due to its sustainability and efficiency advantages over conventional biodiesel. HVO can be applied directly to diesel engines without any modifications, offering an effective solution to reduce CO2 emissions. The production process includes the following steps:

Pretreatment: Vegetable oils and animal fats are pretreated to remove contaminants such as phosphorus, metals, and solids.

Hydrotreatment: Oils are subjected to high pressure and temperature in the presence of hydrogen. Hydrogen saturates the double bonds in fatty acids and removes oxygen in the form of water, resulting in a paraffin-like biofuel that closely resembles conventional diesel.

Isomerization: Paraffin hydrocarbons are then isomerized to improve the cold flow properties of the fuel, making it suitable for use in colder climates.

Distillation and purification: The final HVO product is distilled and purified to meet the specifications required for transportation fuels.



KEY ANALYTICAL TECHNOLOGIES

To ensure the quality and safety of the HVO production process, four advanced analyzers were used: two Maxum II gas chromatographs, one TOC Biotector analyzer and one SOLA iQ sulfur analyzer. These devices play a key role in monitoring process parameters, detecting contaminants and optimizing production conditions.

Gas chromatograph 1 (Maxum II) measures hydrogen (H_2), carbon monoxide (CO), carbon dioxide (CO_2), hydrogen sulfide (H_2S), and hydrocarbons in the process gas. Placed in a central technological unit, it ensures an efficient and safe hydrogenation reaction.

Gas chromatograph 2 (Maxum II) analyzes gas used in the amine regeneration process. It measures hydrocarbons (C1-C6) and traces of hydrogen sulfide (H_2S). The gas sample is transported to the analyzer via a 67-meter-long heat-insulated line coated with SilcoNert®. This ensures precise analysis while meeting strict temperature and pressure requirements.

Gas Sample

The Biotector analyzer monitors total organic carbon (TOC) content of condensate samples from heat exchangers. By using ozone oxidation technology, Biotector provides accurate and reliable data on the level of organic pollutants, thus protecting the condensate pipes from hydrocarbon leaks. This information is essential to maintain the efficiency of the production process and ensure safety for the environment.


Gas Sample

The SOLA iQ analyzer uses pulsed UV fluorescence (PUVF) detection to accurately measure sulfur levels in HVO. The sulfur content of the final HVO product is a key quality parameter, as sulfur impurities can reduce fuel efficiency and increase emissions. This analyzer acts as the final step in the quality control of the produced fuel.


Gas Sample

CHALLENGES IN HVO PRODUCTION

HVO production involves many challenges that require careful management.

The hazardous nature of some process gases requires strict safety measures. Maxum II gas chromatographs, operating in hazardous areas, are housed in explosion-proof, purged Exp enclosures and equipped with automatic shutdown mechanisms to ensure safety in the event of an emergency. All the devices used have appropriate explosion protection.

Gas Sample

It is important to ensure that the correct sample parameters such as temperature, pressure, and flow are maintained. This is guaranteed by properly designed Sample Handling Systems (SHS), dedicated to specific measurements and analyzers. In addition, filters, pressure regulators, and temperature regulators ensure that the samples analyzed by the analyzers are free of particulates, oil droplets, and other contaminants that could affect the accuracy of the measurements. Moreover the innovative use of mini-modular components has significantly reduced the size of SHS.

The hydrogen used in the technological process must not contain any impurities. Due to the fact that measuring the sulfur and hydrogen sulfide content of hydrogen is particularly difficult, wetted surfaces of SHS have been coated with a special SilcoNert® coating to reduce the adhesion, absorption or adsorption of sulfur compounds.

CHALLENGES IN HVO PRODUCTION

Finally, it is important to remember that the complex nature of the hydrotreating process requires continuous monitoring of production parameters. That is why the analytical systems were equipped with intelligent measurement sensors that were connected to the unique Bricks'n'Cloud (B'n'C) installation monitoring system. The data transmitted from the sensors and the data transmitted by the analyzers to the B'n'C application are recorded and categorized into alarms that require immediate action and warnings that require action to prevent future failures. The database of emerging events on the installation allows the production process to be carried out safety and without brakedowns.

CHALLENGES IN HVO PRODUCTION

The HVO project is a great engineering success due to the proper selection of analyzers and devices in SHS and due to use of an unique B'n'C monitoring and prediction system.