By the present invention, the liquid oil, e.g. pyrolysis oil is stabilized at low temperatures by the conversion of at least the most reactive compounds in the pyrolysis oil, such as furfural, furans, aldehydes, ketones and acids, into alcohols, for instance by efficiently converting carbonyls into alcohols. The alcohols can further be converted to saturated organic compounds during the stabilization, and/or in a subsequent hydroprocessing stage such as HDO.

SUMMARY

In an aspect of the present disclosure, there is provided a process for hydrotreating a liquid oil stream by, in a continuous operation in a fixed bed reactor, reacting the liquid oil stream with hydrogen in the presence of a nickel-molybdenum (Ni-Mo) based catalyst at a temperature of 20-240°C, a pressure of 100-200 barg, a liquid hourly space velocity (LHSV) of 0.1-1.1 h^{-1}, and a hydrogen to liquid oil ratio, defined as the volume ratio of hydrogen to the flow of the liquid oil stream, of 1000-6000 NL/L, such as 2000-5000 NL/L, thereby forming a stabilized liquid oil stream.

DESCRIPTION

Accordingly, in a first aspect, the invention provides a process for hydrotreating a liquid oil stream by, in a continuous operation in a fixed bed reactor, reacting the liquid oil stream with hydrogen in the presence of a nickel-molybdenum (Ni-Mo) based catalyst at a temperature, e.g. inlet temperature, of 20-240°C, a pressure of 100-200 barg, a liquid hourly space velocity (LHSV) of 0.1-1.1 h^{-1}, and a hydrogen to liquid oil ratio, defined as the volume ratio of hydrogen to the flow of the liquid oil stream, of 1000-6000 NL/L, such as 2000-5000 NL/L, thereby forming a stabilized liquid oil stream.

The combination of features i.e. low temperatures, high pressure, low LHSV and high H_2-to liquid oil ratio, as recited above, enables stabilization of the liquid oil by i.a. converting carbonyls to alcohols and thereby increase operation time before plugging issues - if any - arise, while at the same time suppressing coking of the catalyst and attendant catalyst deactivation, as well as avoiding hydrogen starvation

It would be understood that the unit “barg” denotes pressure above atmospheric (atmospheric pressure: about 1 bar). The pressure is also referred as “hydrogen pressure”.

The temperature range 20-240°C encompasses the inlet temperature of the liquid oil stream and the outlet temperature of stabilized liquid oil stream. For instance, the inlet temperature can be 20, 40, 60 or 80°C. The process is exothermic thus a raise in temperature of about 100°C or more occurs. The higher the inlet temperature e.g. 80°C, the easier the ignition of the process to initiate the exotherm. The outlet temperature can for instance be 150 or 200 or 240°C. More generally, the temperature in a given step or reactor (unit) thereof, means the inlet temperature in an adiabatic step, or the reaction temperature in an isothermal step. Accordingly, suitably said temperature of 20-240°C means inlet temperature.