

Institute of Petroleum Refining and Petrochemistry

HYDROCYCLONE OIL TREATMENT

2020

The provided method and technology of producing petroleum solvent (nefras), fuel gas and stabilized oil using small-scale block units by means of centrifugal separation – i.e. hydrocyclones

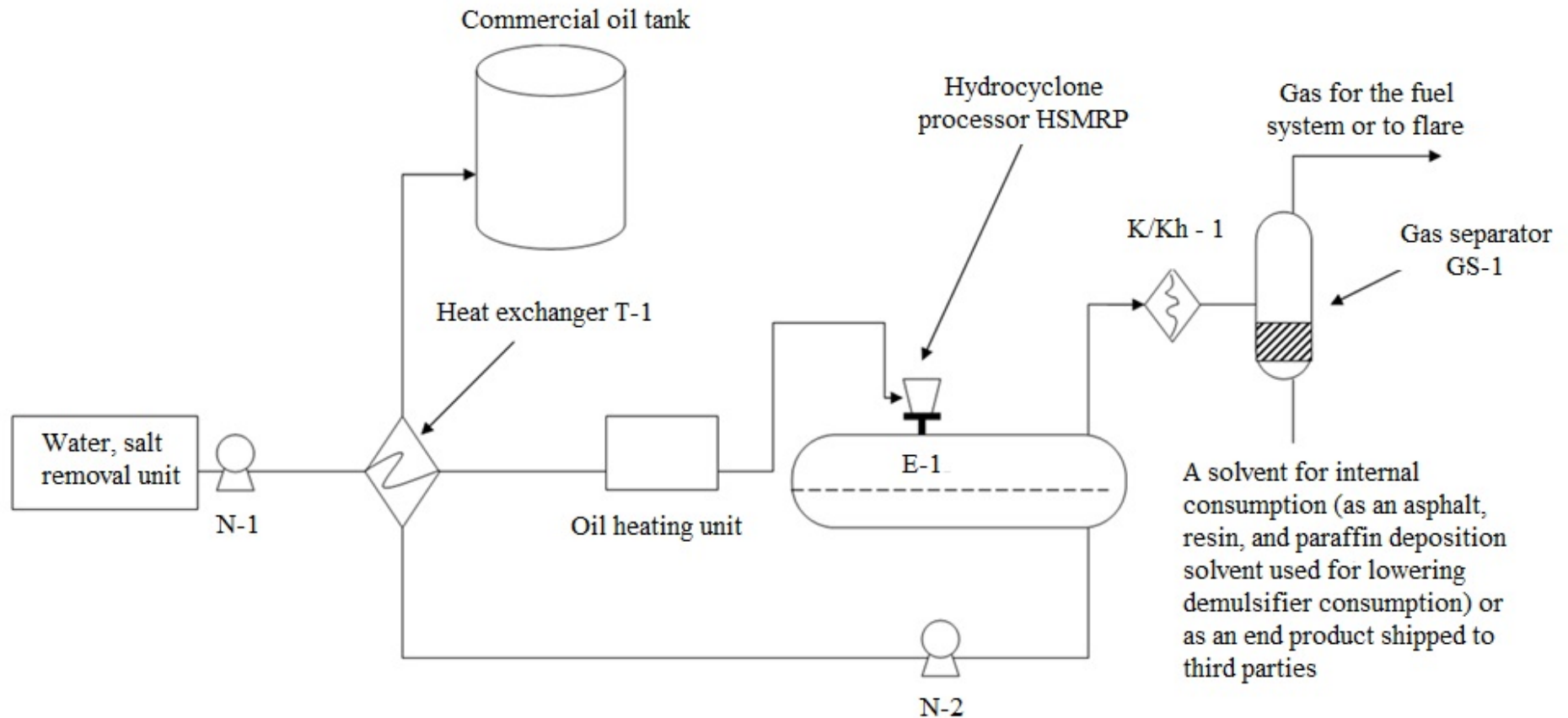
Petroleum solvent application

Consumed along with other plant utilities as a solvent for asphalt, resin, and paraffin deposits:

- as part of a stabilized oil collection and treatment process
- during well workover
- as a demulsifier component used for lowering its consumption rate
- for treating chronic emulsions and sump oils
- as an end product shipped to third parties

Compared to alternatives, this solvent, by far, is the most effective agent with respect to this class of produced oil as it is produced from these very kinds of oil, being a natural solvent for these very asphaltenes, resins, paraffines, etc.

Hydrocyclone oil stabilization diagram



Process description

After being heated to the required temperature (depending on a corresponding Nefras end boiling point), commercial oil is supplied to HSMRP installed over the E-1 tank.

In HSMRP, the oil flow is equally distributed among all hydrocyclone elements due to tangential injection in the supply chamber, and is actively swirled in them with the help of a special device.

The rate of oil injection in the hydrocyclone internal part can reach 35-40 m/s, and a fil flow condition is created in it.

The heaviest oil factions collect in the peripheral area, while in the center of rotation vacuum is created at up to 245 mm Hg. Due to this, a gas-air channel is formed where the lightest components flow and concentrate, being in gaseous form at this temperature (hydrogen sulfide, methyl-ethyl-mercaptanes, light hydrocarbons, hydrocarbon gas). After that, these components are removed from the top of HSMRP and are fed to the top of E-1 to separate the dripping liquid.

Process description

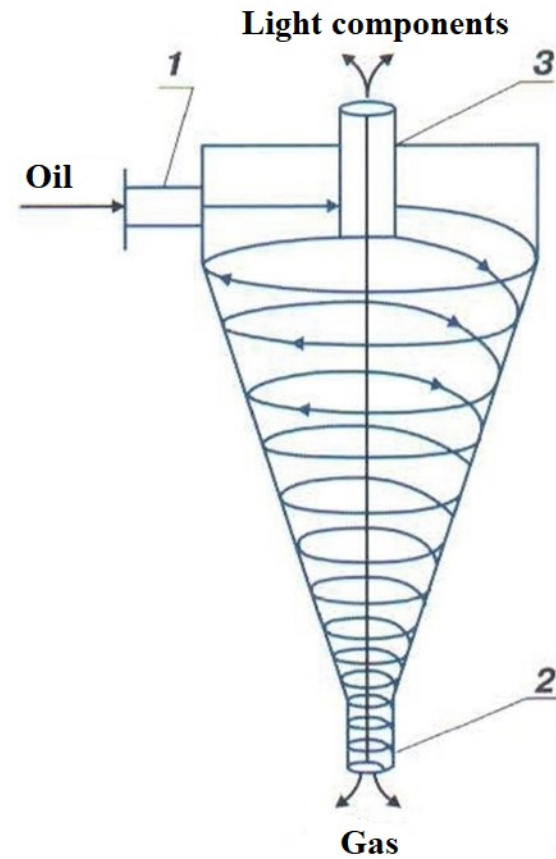
Stabilized oil with the most of acid components removed via HSMRP discharge outlets is supplied to E-1 with the set filling level maintained, after which the oil is transferred by a pump to the commercial tank cooling to maximum +400C on the way to the heat exchanger.

Light hydrocarbons, gas, hydrogen sulfide and mercaptanes from the top of E-1 are cooled in the condenser-cooler K/Kh-1 and are sent to gas separator GS-1, from which the non-condensed gas is sent to the fuel system or flare, while condensed light hydrocarbons are discharged from the bottom of GS-1.

HSMRP unit



HSMRP unit 3D model



Basic diagram of HSMRP section operation

Application of this product to intensify water and salt removal from oil at OTP.

Condensed light hydrocarbons, 2-5 % of the total volume, are supplied to the feed pump and intensively mixed with the emulsion.

Resulting conditions allow an increase of demulsifier molecules diffusion rate, dissolution of paraffin-type stabilizers in light hydrocarbons, penetration into and loosening of asphaltene micellae.

All this contributes to destruction of reinforcing membranes on water globules, increase of drops collision efficiency, phase disengagement speed-up, and demulsifier consumption decrease by 30-40 %.

Advantages

1. Low capital costs
2. Flash temperature decrease
3. Well work
4. Natural solvent production
5. Hydrogen sulfide and mercaptanes content decrease

Scope of application

A packaged small-size hydrocyclone unit has been developed and built for solvent production directly at the oil field.



The small-size unit is intended for paraffin deposit solvent production from hydrocarbon feed in remote areas.

Scopes of solvent application:

- Dissolution of asphalt, resin, and paraffin deposits in the oil production, collection and processing system
- Viscosity reduction of pumped high-viscosity oils
- Treatment of sump and slop oils
- Treatment of chronic emulsions and sump oils
- As a demulsifier component used for lowering its consumption rate
- As a finished commercial product for sale
- To intensify water and salt removal from oil at OTP