

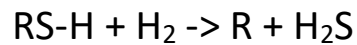
What is Hydro Treating?

(Superposition of Hydrogenation and catalytic cracking)

Addition of HYDROGEN is an **EXOTHERMIC** process

Dearomatization to cyclohexane

Desulphurization



There is **Competition** among these reactions.

Olefin saturation is quickest.

Denitrogenation is difficult than desulphurization – requires stronger catalyst.

Suppose we want sulphur content in gasoline to be less than 10 ppm

TRICKLE BED REACTOR – when pressure of gas is higher and liquid flow rate is less.

Concept: - Both liquid feed and gas feed comes from top.

OR

Liquid is trickled downed

Three Phase Reactor

Catalyst is **fixed**

Whatever the product we want to generate depends on mixing time rather than the reaction time.

Another case – gas from bottom and liquid from top

Excess of H_2 – **Hydrogen Separator**

When H_2 enters the reaction – there's a drop in pressure so when put the recycled H_2 back to reactor we need a **compressor**

Channels/channeling

Heterocompounds

Sulphur is the most important compound

Mercaptans-LPG **Mercaptans** are the organic components of hydrocarbons with sulfur; they also have a bad smell and corrosive properties

Disulphide $R-S-R'$

Ring would open

Pyridine -> **Breaking of unsaturated bonds -> removal of Nitrogen as ammonia**

Phenol-> **cyclohexane**

Feed- gasoline, kerosene, diesel etc

Why do we need Preheater?

Increase the Rex rate

If not preheated, the feed may be too viscous or too cold to react effectively.

Since hydrogenation is exothermic. Backward rex is favored

Any sideeffects- Thermal cracking

What will happen if we have oxygen based compounds in our fuels.

It forms gummy kind of product

Outlet temperature is greater than inlet temp

We preheat the feed using the energy generated at the outlets.

Hydrogen separator at low temperature

What happens if H_2 escapes the pipe?

When H_2 pressure decreases its temperature decreases.

To check H_2 leakage we use metals which glow when H_2 is passed through them

Note: Hydro cracking involves converting of heavy hydrocarbons with high boiling point to lighter and lower boiling point using H_2 gas and catalyst.

This is similar to hydro treating but with more severe conditions and breaking C-C bond.

Questions:

1) Are these reactions selective?

Ans) Reactions are not 100 percent selective .Depends on the catalyst type.

2) How selectivity affect the hydrogen consumption?

Ans) Less selectivity -> more hydrogen consumption

3) What will happen to the exothermic reaction if we increase the temperature in case of multi component system?

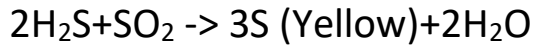
Ans) Composition will change – one way to manage selectivity

Hydro cracking.....

We have formation of saturated bonds

Hydrogenation – Octane number decreases

Most of sulphur comes from desulphurization



Benzene is not usually added

Catalytic reforming (properties do not change much) :- The process of converting hydrocarbon molecular structures into high octane number aromatics using a minor amount of cracking.

It increases the octane number but decreases the yield

BTX: Benzene, Toluene, Xylene

We convert paraffin (C7s, heavy naphtha) to aromatics.

Since LSR naphtha contains low carbon number compounds it cannot be aromatized thus cannot be reformed.

Byproduct – Hydrogen (H_2)

We have to heat the mixture again and again

Tatoray Technology

The good thing about catalytic reforming is that the properties of gasoline do not change much.

$\text{C}_7 + \text{C}_9 \rightarrow \text{C}_8(\text{Xylenes})$ (want more xylene? Can't use distillation/ use chromatography)

P-Xylenes are important

BLOCK DIAGRAM FOR HYDROTREATING

