

Distillation

The starting point for all refinery operations is the crude distillation unit (CDU). Crude oil is boiled in a fractioning column, which breaks the crude down into more useful components. The crude oil enters the column near the bottom and is heated to around 380°C. The lighter fractions are vaporised and rise up the column. As they rise, they are cooled by a downward flow of liquid and condense at different points. This enables fractions with different boiling points to be drawn off at different levels in the column.

These fractions range from lighter, low boiling point gases such as propane and butane to heavier, higher boiling point diesel and gas oil. They are then sent on to other refinery units for further processing. What is left over at the bottom of the column is a liquid residue, which requires further processing to be turned into more valuable, lighter products or blending components.

This residue is first sent to a second stage of fractional distillation in the vacuum distillation unit (VDU). This unit performs the distillation under reduced pressure which allows the distillation of the crude residue at lower temperatures. Using the same approach as before the VDU separates into different components from gas oil to a heavy liquid residue.

The streams from the CDU and VDU are then processed further by the remaining refinery units to provide the high quality products that consumers expect and that comply with all relevant legislation.

Conversion, Reforming, Desulphurisation and Blending of Different Streams

Distillation does not produce enough of the lighter, more valuable products such as petrol that the market wants. Therefore conversion units (eg FCC) are used to treat some of the streams from the vacuum distillation column with the aim of turning the heavy components into lighter transport fuels. Reforming units are used to upgrade the octane of the petrol components produced from the CDU.

Desulphurisation units are then used to remove sulphur from the products. This enables the products to meet today's tighter fuel specifications and allows the refinery additional flexibility to process higher sulphur 'sourer' crude oils. Reliance on low sulphur crude oils alone limits the flexibility of a refinery.

Main Products

LPG is taken directly from the crude distillation unit and the FCC and used with no further processing.

Petrol streams from the distillation process are cleaned in the unifiner. This unit strips out unwanted sulphur and nitrogen compounds as hydrogen sulphide and ammonia.

The streams are then sent on to the reformer and isomer units for processing to raise the octane number of the petrol by modifying its molecular structure. The reformer produces a

large amount of hydrogen as a by-product, and this is recycled for use in desulphurisation (hydrotreater) units.

Finally the petrol streams from the reformer, fluidised catalytic cracking (FCC) unit, the isomerisation unit and the alkylation unit are blended to meet fuel specifications and current regulations.

Jet fuel/kerosene streams from distillation are cleaned in the merox unit. This uses a caustic wash and additives to remove sulphur compounds and to inhibit gum formation.

Diesel/heating oil streams are processed in the hydrotreater, which cleans the streams by removing sulphur and other unwanted compounds using hydrogen and a catalyst. The hydrotreater is supplied with recycled hydrogen from other process units such as the reformer. The diesel/heating oil streams are separately blended to meet fuel specifications and current regulations.

The lighter **fuel oil** streams from the VDU are processed in the FCC unit whilst the heavier residues from the VDU are processed in the visbreaker.

In the FCC unit, heavy oils are reacted with at high temperature with a catalyst which breaks the heavy fractions into more valuable lighter products. The LPG and petrol components are then cleaned in a merox unit and some of the LPG is converted in an isomerisation or alkylation unit into high octane petrol blending components. The FCC's products are blended into petrol, LPG, diesel/gas oil and fuel oil product streams.

In the visbreaker, the heavy fractions are held at high temperature until they become less viscous. This stream is then blended into other fuel oil product streams.

The **fuel oil** components from the different units are then blended to give fuel oil meeting current regulations and specifications.

Desulphurisation and Waste Treatment

The sulphur recovery unit takes waste hydrogen sulphide from the units which remove sulphur from product streams. The hydrogen sulphide is then reacted with oxygen to give solid elemental sulphur and water vapour. After treatment, this sulphur is sold to other process industries.

All other waste streams are treated according to the current regulations.