

Fact sheet: fractional distillation

Crude oil is a mixture of many different compounds. It mainly consists of **hydrocarbons** – molecules made only of carbon and hydrogen atoms. Hydrocarbons have different uses depending on their properties. Some are useful as fuels and others are used as **feedstock** – raw materials – for the petrochemical industry where they are used to make products such as polymers, solvents and detergents.

The different hydrocarbons in crude oil must be separated in order to be useful. **Fractional distillation** separates crude oil into **fractions** – groups of hydrocarbon molecules with similar carbon chain lengths, properties and boiling points. Each fraction has a different use.

Did you know ...?

The oil tankers that carry **crude oil** to refineries are some of the largest ships known and can be over 350 metres long. That's approximately four football pitches.

Fractions

- **Liquefied petroleum gases (LPG) or refinery gas** Mainly consists of propane and butane and is used as bottled gas for cooking and heating.
- **Petrol (gasoline)** Used as a fuel for car engines.
- **Kerosene** Used as a fuel for jet engines in aircraft. Kerosene is also called paraffin in some areas of the world and is used in lamps.
- **Diesel** Used as a fuel for cars, vans, lorries and trains.
- **Fuel oil** Used as a fuel for ships, for heating and in power stations.
- **Residue (bitumen)** Used to surface roads and for sealing roofs.

Did you know...?

New cars and vans powered wholly by **petrol** and **diesel** will not be sold in the UK from 2030.

The fractional distillation process

1. The **crude oil** is heated in a furnace to over 400°C. At this temperature, most of the **hydrocarbons** in the crude oil mixture boil and turn into a gas.
2. The mixture of hot hydrocarbon gases passes into a **fractionating column** which is hotter at the bottom and cooler at the top
3. The hot gases rise up the column. Once the temperature of the column falls below the boiling point of a **hydrocarbon** in the mixture, it is no longer hot enough for the hydrocarbon to stay in **gaseous** form. The gas therefore **condenses** and is separated off.

4. The **longer chain** hydrocarbons have a higher boiling point and condense towards the bottom of the column where it is hotter. The **shorter chain** hydrocarbons have a lower boiling point and remain as gases higher up, only condensing once a lower temperature is reached near the top of the column.
5. **Very short chain** hydrocarbons have a boiling point so low they do not condense within the fractionating column and are separated from the top of the column as gases.

Did you know...?

Fractional distillation is also used to separate nitrogen and oxygen from air. The air is first **liquified** by cooling to below -200°C then the gases are separated based on their boiling points (nitrogen -196°C and oxygen -183°C).