

4.12: USES AND SOURCES OF ALKANES

Learning Objective

- describe the uses and sources of alkanes

OCCURRENCE

The most important sources for alkanes are oil and natural gas. Oil is a mixture of liquid alkanes and other hydrocarbons. Higher alkanes (which are solid) occur as residues from oil distillation ("tar"). One of the largest natural deposits of solid alkanes is in an asphalt lake known as the Pitch Lake in [Trinidad and Tobago](#). Natural gas contains primarily methane (70-90%) with some ethane, propane and [butane](#); some gas sources deliver up to 8% CO₂. Traces of methane (about 0.00017% or 1.7 ppm) occur in the Earth's atmosphere, the content in the oceans is negligible due to the low solubility of methane in water.⁽¹⁾

USE OF ALKANES

Alkanes are important raw materials of the chemical industry and the principal constituent of gasoline and lubricating oils. Natural gas mainly contains methane and ethane and is used for heating and cooking purposes and for power utilities (gas turbines). For transportation purposes, natural gas may be liquefied by applying pressure and cooling it (LNG = liquid natural gas). The [Sultanate of Oman](#), for example, exports most of its natural gas as LNG - see the [LNG plant at Qalhat](#) which has been designed to liquefy 6.6 million tons natural gas per year. Crude oil is separated into its components by fractional distillation at oil refineries. The different "fractions" of crude oil have different boiling points and consist mostly of alkanes of similar chain lengths (the higher the boiling point the more carbon atoms the components of a particular fraction contain - see the [list of alkanes](#) for details about the boiling points).

The following table provides a short survey of the different fractions of crude oil:

C ₃ ..C ₄	Propane and butane can be liquefied at fairly low pressures, and are used, for example, in the propane gas burner, or as propellants in aerosol sprays. Butane is used in cigarette lighters (where the pressure at room temperature is about 2 bar).
C ₅ ..C ₈	The alkanes from pentane to octane are highly volatile liquids and good solvents for nonpolar substances. They are used as fuels in internal combustion engines.
C ₉ ..C ₁₆	Alkanes from nonane to hexadecane are liquids of higher viscosity, being used in diesel and aviation fuel (kerosene). The higher melting points of these alkanes can cause problems at low temperatures and in polar regions, where the fuel becomes too viscous.
C ₁₇ ..C ₃₅	Alkanes with 17 to 35 carbon atoms form the major components of lubricating oil. They also act as anti-corrosive agents, as their hydrophobic nature protects the metal surface from contact with water. Solid alkanes also find use as paraffin wax in candles ⁽²⁾ .
>C ₃₅	Alkanes with a chain length above 35 carbon atoms are found in bitumen (as it is used in road surfacing). These higher alkanes have little chemical and commercial value and are usually split into lower alkanes by cracking .

Notes:

- Methane can co-crystallize with water at high pressures and low temperatures, forming a solid methane hydrate. The energy content of the known submarine methane hydrate fields exceeds that of all known natural gas and oil deposits put together.
- Paraffin wax should not be mixed up with true animal or plant wax, which consist of esters of various carboxylic acids and alcohols.

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