Hydrocarbons (Natural Refrigerants)

Refrigeration plants using hydrocarbons like propane (R290, C_3H_8), propene (R1270, C_3H_6) or iso-butane (R600a, C_6H_{10}) have been in operation all over the world for many years. Hydrocarbons are colourless and nearly odourless gases that liquefy under pressure, and have neither ozone depletion potential (ODP = 0) nor significant direct global warming potential (GWP < 3). Thanks to their outstanding thermodynamic characteristics, hydrocarbons make particularly energy efficient refrigerants. Hydrocarbons are flammable, however, with current safety regulations, refrigerant losses are near zero. Hydrocarbons are available cheaply all over the world; thanks to their ideal refrigerant characteristics they are commonly used in small plants with low refrigerant charges.

Characteristics of propane:

ODP	0
GWP	3
Appearance	colorless
Odor	nearly odorless
Molecular weight	44.09 kg/kmol
Physical condition at 20 °C	gaseous
Freezing point	-186 °C
Boiling point	-42 °C
Explosibility limit (in air)	2.2-10.0 %
Ignition temperature	470 °C
Density (liquid, near boiling point)	0.585 g/cm^3
Relative Liquid Density at 15 °C	0.50-0.51
Relative Gaseous Density compared with air at 15 °C and 1013.25 mbar	1.40-1.55

Characteristics of butane:

ODP	0
GWP	3
Appearance	colorless
Odor	slightly sour

Molecular weight	58.12 kg/kmol
Physical condition at 20 °C	gaseous
Freezing point	-135 °C
Boiling point	-0.5 °C
Explosibility limit (in air)	1.8-9.0 %
Ignition temperature	365 °C
Density (liquid, near boiling point)	0.601 g/cm^3
Relative Liquid Density at 15 °C	0.57-0.58
Relative Gaseous Density compared with air at 15 °C and 1013.25 mbar	1.90-2.10