

Alternative Solvents

Spotlight #3: CO₂

Specifications

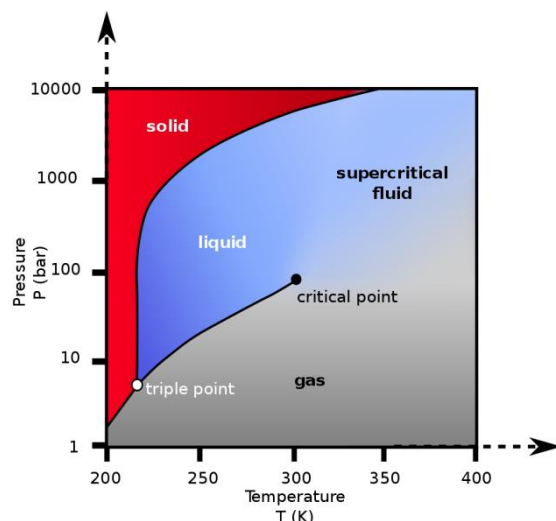


Carbon dioxide

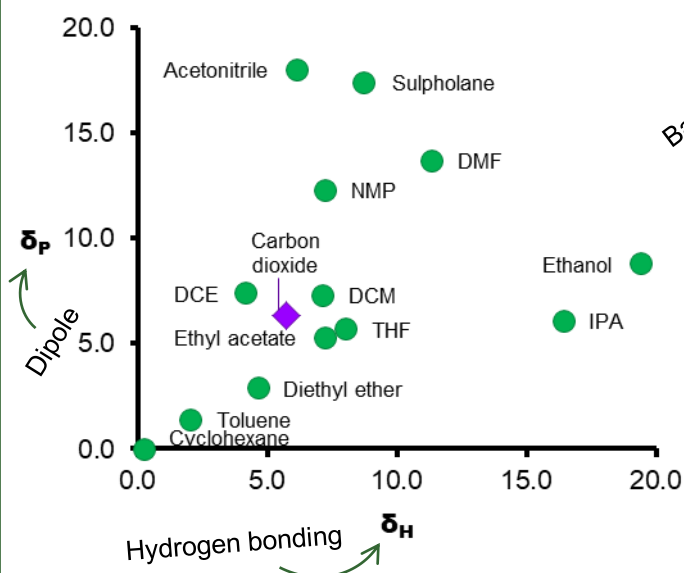
CAS	124-38-9	
REACH registration	Exempt	
Hazards	Risk of asphyxiation	
Bio-based content	0-100%, dependent on source	
Producer	Numerous industries (e.g. brewing)	
Boiling point	Flash point	Autoignition
-78.5 °C	Non-flammable	Non-explosive

Carbon dioxide can be obtained as the waste from various industries. When pressurised into a supercritical fluid, it attains properties inbetween a liquid and a gas. The exact conditions (temperature, pressure) determine the properties of supercritical CO₂.

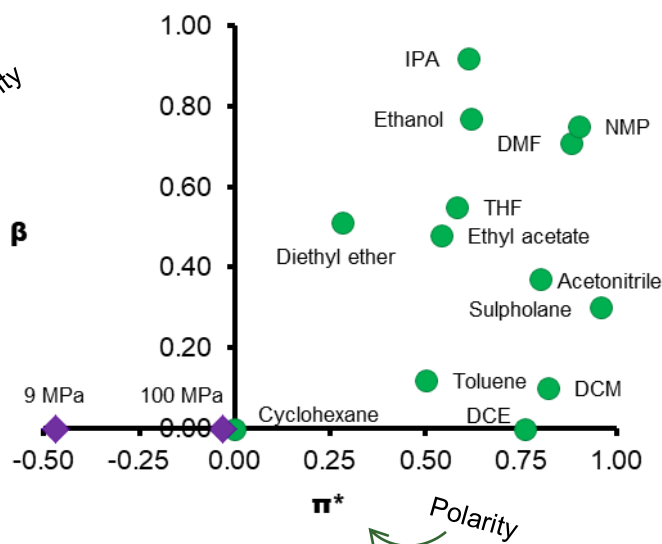
Image from wikipedia.org



Polarity



Hansen solubility parameters:
Similar to oxygenated solvents



Kamlet-Abboud-Taft parameters:
CO₂ polarity depends on pressure.

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Applications



Carbon dioxide

Supercritical CO₂ is a non-hazardous alternative to hydrocarbon solvents.

Supercritical carbon dioxide can be used for residue-free extractions of foodstuffs and biomass.

Its easily tuneable properties and combination with other solvents allow processes to be readily optimised.

The extraction of nonacosan-10-ol from spruce needles with supercritical CO₂ is selective at 200 bar and 60 °C. Hydrophobic coatings were then made from the nonacosan-10-ol with water contact angles up to 149°.

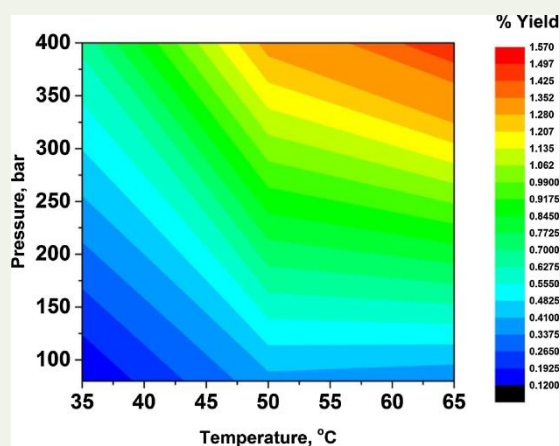


DOI: 10.1016/j.jclepro.2017.10.002

Image by Greg Hume

Waxes and cannabidiol (CBD) have been extracted from hemp wastes with supercritical CO₂. The greatest (crude) yields were obtained when the highest pressure and temperature were implemented (400 bar and 65 °C, as shown adjacently). However, selectivity for CBD is improved at moderate temperatures (>1 mg per gram hemp of dust).

DOI: 10.1016/j.indcrop.2017.10.045



The composition of waxes obtained from waste date palm fronds can be refined by controlling the pressure and temperature of CO₂. The wax obtained at optimum conditions (400 bar, 100 °C) has a comparable melting point to carnauba wax, making it a suitable alternative to overexploited commercial plant waxes.

Image: Free Stock Photos Club

DOI: 10.1016/j.jclepro.2018.03.117