



710 Spirits Solubility Parameter

Hildebrand Solubility Parameters

Hildebrand solubility parameters are one way to examine the solubility of compounds in different solvents. It is a numerical value that indicates the relative solvency behavior of specific solvents and compounds. This parameter is derived from the heat of vaporization and correlates to how much energy is needed to overcome the intermolecular forces (van der Waals) holding the molecules together. The value for these parameters, δ , was calculated in 1936 by Joel H. Hildebrand and has the unit $\text{MPa}^{1/2}$. The equation is below:

$$\delta = \sqrt{C} = \left[\frac{\Delta H - RT}{V_m} \right]^{1/2}$$

The solubility parameters can give an idea of whether or not a compound will be soluble in a solvent or if one solvent is similar to another. If the values of the solute and the solvent have a difference around $5.1 \text{ MPa}^{1/2}$, then the solute should be soluble in the solvent.

Solvent and Cannabinoid Solubility Parameters

When extracting cannabinoids, a process known as winterization can be used to precipitate out unwanted compounds. The waxes and fats from the plant material will precipitate as the material sits in a solvent in cold temperatures. According to Hildebrand solubility parameters, these compounds precipitate out since their solubility parameters are lower than that of certain solvents. They do not match the difference of $5.1 \text{ MPa}^{1/2}$ so they come out of solution during winterization.

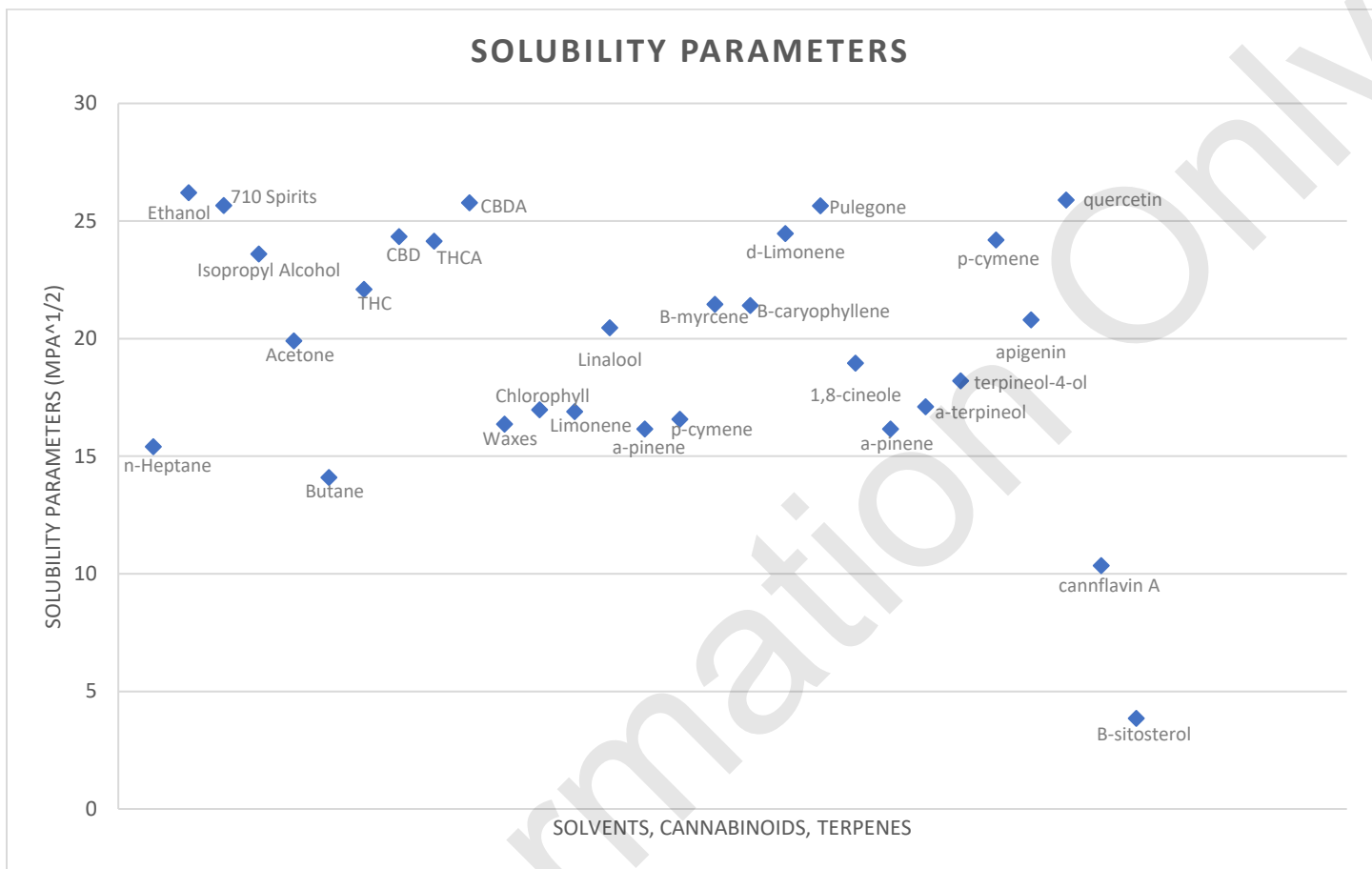
The following table lists the solubility parameters of some common solvents, cannabinoids, and terpenes:

Compound	$\text{MPa}^{1/2}$
Solvents	
n-Heptane	15.40
Ethanol	26.20
710 Spirits	25.66
Isopropyl Alcohol	23.6
Acetone	19.9
Butane	14.1
Cannabinoids and Terpenes	
THC	22.09
CBD	24.34
THCA	24.14
CBDA	25.77
Waxes	16.36
Chlorophyll	16.98
Limonene	16.90
Linalool	20.46

Compound	$\text{MPa}^{1/2}$
a-pinene	16.16
p-cymene	16.57
B-myrcene	21.46
B-caryophyllene	21.41
d-Limonene	24.46
Pulegone	25.65
1,8-cineole	18.96
a-pinene	16.15
a-terpineol	17.10
terpineol-4-ol	18.21
p-cymene	24.20
Flavonoids	
apigenin	20.80
quercetin	25.89
cannflavin A	10.35
B-sitosterol	3.86



Based on these parameters, an examination of cannabinoid and terpene solubility in different solvents can be conducted. The graph below gives a visual representation of the solubility parameters from the compounds listed above.

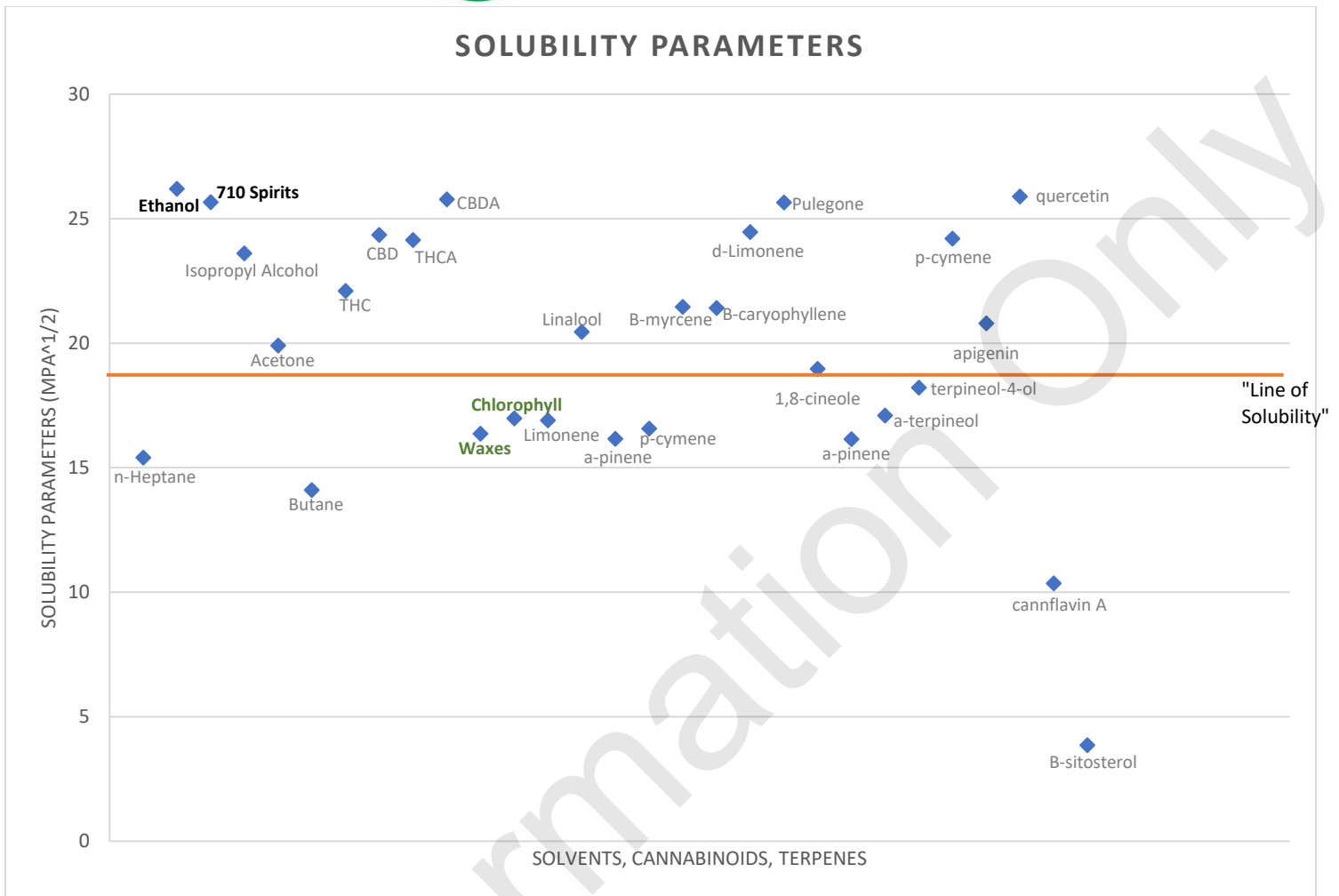


The solubility parameters of the solvents and cannabinoids are widespread. Ethanol, isopropyl alcohol, acetone, and 710 Spirits have similar parameters, as is the case with chlorophyll and plant waxes. There is also a large grouping of terpenes that have parameters that are close together. This indicates that some solvents will be more suitable than others depending on the desired solute.

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710 Spirits is comparable to ethanol based on these parameters. Ethanol has a solubility parameter of 26.2 MPa^{1/2} while 710 Spirits has a solubility parameter of 25.66 MPa^{1/2}. Most compounds that are soluble in ethanol will be soluble in 710 Spirits. The following graph shows the “line of solubility.” Anything below the line will precipitate out of solution during winterization and everything above the line will stay in solution.

This graph is representative of the concept behind solubility parameters. It is important to note that solubility can be effected by different conditions in the extraction process. When choosing a solvent, it is also important to consult the manufacturer of the equipment to be sure the solvent is compatible with the system.



If using 710 Spirits, unwanted plant material such as waxes and chlorophyll should precipitate out during winterization because their solubility parameters do not give a difference of 5.1 MPa^{1/2}, their values are too low. Other compounds that may come out during this process will need additional processing or adjustments during the extraction process if they are wanted in the final product.

The Hildebrand solubility parameters are one way to examine the solubility of 710 Spirits with different compounds. Based on this concept, 710 Spirits can be a suitable replacement for solvents such as ethanol and isopropyl alcohol, as well as others that may not be listed here. However, it is still important to take into account equipment manufacturer specifications, extraction type, desired final products, safety and costs when considering which system and solvent to use with a cannabis extraction.

References:

<http://cool.conservation-us.org/byauth/buke/solpar/solpar2.html>

<https://www.learngreenflower.com/course/210/mjbizcon-science-symposium>