Researching Oil Viscosity to Better Explain Oil Behavior inside Vaporizers.

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More context. Many manufacturers are developing new heating technology to vaporize D9, Resin, Rosin, and Liquid Diamonds BEYOND just temperature change (i.e. lower volts). Additionally, I see Clients asking for Postless Devices to vaporize Resin/Rosin/LD effectively. Why is this? What is wrong with traditional ceramic and coils? Is anything wrong with traditional technology?

To begin the research assignment, I utilized the following different types of cannabis oils, as well as our Viscometer, in hopes to better understand the behavior of these oils as a substance. Also, I will utilize my vaporizer knowledge, to hopefully make some conclusions on what's going on, where potential failures can occur, and what we could potentially develop in the future to better vaporize certain oil, for example; aperture size, cotton wicking, ceramic porosity, ceramic material, designing of the heating core, etc.

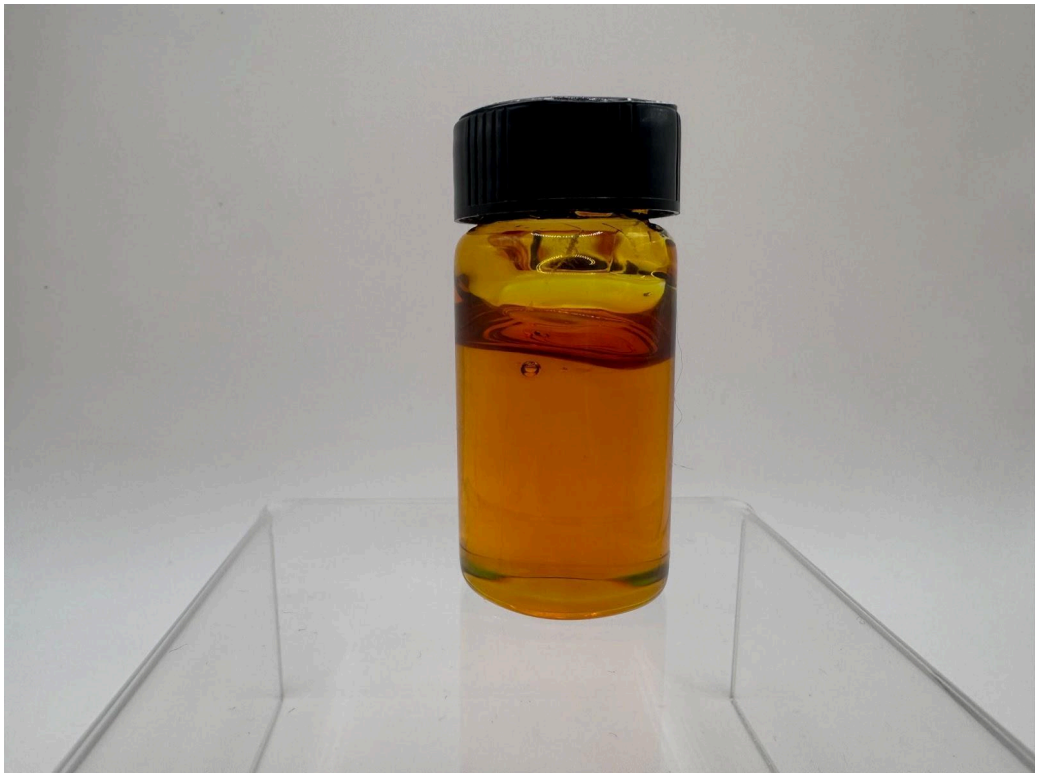
At the very least…I will display the properties of these oils.

The lists of oils that tested viscosity

- **Delta-9 distillate (0% terp)*** This is NOT the market formulation.**
- **Delta-8 distillate - Kush Cake (6%,8%, and 12%)**
- **Live Rosin**
- **Live Resin**
- **Liquid Diamond**
- **HTE (High Terpene Extract)**

***Orange = 30-36°C** ***Green = 40°C** ***Red = 60°C**

Delta-9 distillate (0% terp)



Description

D9 distillate is one of cannabis concentrates. This oil is extracted with many varieties of solvents (Ethanol, Propane, Butane, Carbon Dioxide, Heptane, and Hexane) The biggest difference is pure D9 distillate should not contain any terpene and wax during extraction process, so if you use hydrocarbon gasses to make distillate you have to have one more step to remove terpene. This is the reason why people tend to use ethanol as D9 distillation solvent because distillation machines have better filtration methods of removing wax and terpene. D9 distillates tend to have high concentration of THC because the distillation process removes impurities and other cannabinoids from the cannabis extract. This results in a highly concentrated form of THC, often reaching purities of 90% or higher.

Delta-8 distillate (6%, 8%, and 12%)

Description

Delta-8 THC and Delta-9 THC distillates are both highly refined cannabis extracts, but they have distinct differences in terms of chemical structure, potency, and effects. Delta-8 THC distillate contains Delta-8 Tetrahydrocannabinol, which is an isomer of Delta-9 THC. The key structural difference is the position of a double bond in the carbon chain; Delta-8 THC has this bond on the 8th carbon, while Delta-9 THC has it on the 9th carbon. This slight variation results in Delta-8 THC being less psychoactive than Delta-9 THC. Users often describe Delta-8 THC as providing a clearer, more focused, and less anxiety-inducing "high" compared to the intense and sometimes anxiety-provoking effects of Delta-9 THC. Both distillates are used for their therapeutic benefits, including pain relief, appetite stimulation, and anti-nausea properties, but Delta-8 THC is preferred by those seeking milder effects. Legally, Delta-8 THC may be more accessible in regions where Delta-9 THC is restricted. Delta-8 THC has a boiling point of approximately 175-178°C (347-352°F), while Delta-9 THC boils at around 157°C (315°F). This higher boiling point of Delta-8 THC means it requires more heat to vaporize, which can influence the choice of vaporization equipment and methods. In terms of viscosity, Delta-8 THC distillate is slightly less viscous than Delta-9 THC distillate.

Live Rosin

Description

Live rosin is made by fresh frozen cannabis flower or hash(trichome isolation) under low temperature and pressure. Live rosin does not need to use solvents for extracting cannabinoid, so it's usually called the most natural and clean cannabis concentrate product in the market. Live rosin has a higher ratio of waxes; cuticular wax, tricome wax, epicuticular wax, and cannabinoid-associated wax, than any other cannabis concentrate because the process of making live rosin involves pressing the plant material with heat, which can extract more of the natural waxes present in the plant. However, these waxes are often considered part of the natural composition of the product and contribute to its texture and overall experience. The characteristic of oil viscosity is kinda similar to candles. Live rosin has decent thickness in room temperature; however, the viscosity turns to low significantly due to wax. In the vape cart, if live rosin oil is heated once in a heating core, it turns out to be thinner than other kinds of cannabis oil.

Live Resin

Description

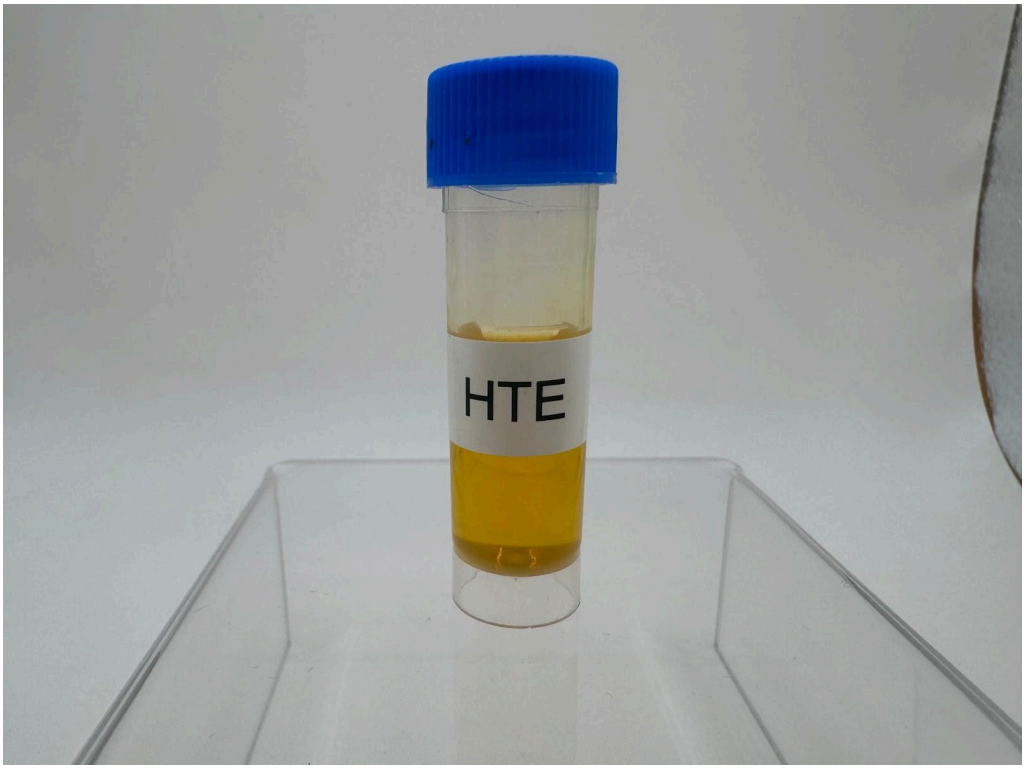
Live resin is the oil that has higher concentration of cannabinoids especially THCA and THC with natural cannabis terpene derived from fresh cannabis plants. This oil is extracted by hydrocarbon gasses or Co2. Those types of gasses have non-polar solvent and have high volatility efficiency due to low boiling points. Cannabinoids have non-polar compounds, so Non-polar solvents such as hydrocarbon gasses and Co2 have high efficiency of dissolving non-polar compounds. Hydrocarbon and Co2 extraction do not use heat, so concentrates by those extraction methods have less content rate of plant wax than any other types of cannabis concentrates because

Liquid Diamond

Description

Liquid Diamond is the decarbed THCA isolation solution. This oil is extremely solid under the room temperature and low heat condition(60°c). You can imagine it's like melted plastic, and Liquid Diamond is the most viscous cannabis oil type ever. Liquid Diamond has no odor and flavor, and it won't flow well even 60°c without diluting solution like Terpene, CRD(Cristal Resistant Distillate), and HTE. Liquid Diamond carts have a higher chance to crystallize like CBD carts. The reason why crystallization occurs is that THCA and CBD can crystallize over time, especially in the cold enviroment. Crystallization occurs because THCA and CBD tend to form solid crystals when it is in a supersaturated solution, meaning there is more THCA or CBD than can remain dissolved in the liquid. People use Liquid Diamond as an enhancement of cannabis THC potency. For example, If you have D9 distillate 80% THC potency, it would be 800 grams of THC in 1000 grams. Adding 1000 grams of Liquid Diamond to 1000 grams of the 80% THC distillate possibly making 90% THC potency D9 distillate. Calculation: 80% of D9 distillate = 800/1000. (1) 800+x/1000+x = 0.9 (2) 800+x =0.9 x (1000+x) (3) 800+x = 900+0.9x (4) 800+x-0.9x = 900 → 800+0.1x = 900 (5) 0.1x = 100 (6) X = 1000 → 1800/2000 = 0.9

HTE



Description

HTE is technically the same oil type of live resin because they are both extracted by hydrocarbon extraction. The biggest difference between those two oils is what cannabis component they prioritized to extract. HTE is the method of extracting cannabis oil with the full spectrum terpene profile from cannabis. Live Resin extraction is focused on the potency of THCA and THC which are supposed to be main psychoactive components.

Conclusion

Live rosin exhibits a higher viscosity than live resin at around 30°C (86°F), but its viscosity dramatically decreases when warmed to higher temperatures. At 40°C (104°F), live rosin's viscosity is three times lower than that of live resin. Live resin viscosity values closely align with those of oils with Delta-8 THC concentrations between 8% and 12%, indicating that devices functioning well with these oils may also perform well with live resin.

Due to the presence of plant waxes, live rosin's viscosity characteristics are unique and not comparable to other oil types. Therefore, it is recommended to develop a specific device model for live rosin rather than aiming for universal compatibility.

The viscosity values of High Terpene Extract (HTE) 80% and Liquid Diamond (LD) 20% mixtures are similar to D8 12% oils. This suggests the potential to create similar viscosity D8 oils as alternatives to live resin and HTE, though these oils would have different boiling points. Live resin requires lower heating temperatures than D8 oils. The data values for D8 6% may fall outside the typical viscosity range of market oils.

Recommendations

1. **Data Collection**:
    - Collect more oil viscosity sample data from the market and customers to develop a comprehensive and accurate database. This will help in refining device designs and ensuring optimal performance across various oil types.
2. **Device Specifications**:
    - Each device should clearly state its working viscosity range and compatible oil types. Providing this information will help consumers choose the right device for their preferred oils and ensure consistent performance.
3. **Specific Device for Live Rosin**:
    - Develop a dedicated device for live rosin. This device should feature precise temperature control to handle the unique viscosity changes of live rosin, ensuring smooth operation at both lower and higher temperatures.

4. **Crystallization Education**:

    - Educate customers about the crystallization characteristics of Liquid Diamond and CBD oils. Inform them that crystallization is a natural process and not an issue with the device. Provide explanations on why crystallization occurs and how to manage it, such as gently warming the cartridge to dissolve the crystals.

By implementing these recommendations, manufacturers can create devices that are optimized for various oil viscosities, ensuring superior performance and customer satisfaction. This approach will also help in addressing the unique properties of different oil types, such as live rosin, live resin, and D8 oils, providing users with a reliable and high-quality experience.