RESŌRSE™

Emulsions & Stability: An Overview

What Is an Emulsion?

An emulsion is a combination of two or more liquids which won't mix, like oil and water. Emulsions provide a pathway to present these two liquids as a uniform mixture. Emulsions contain two components – a dispersed oil phase and a continuous aqueous phase. The dispersed phase can include the active oil to be dispersed, other oil blends, emulsifiers, and weighting agents. The continuous phase can include water, emulsifiers, preservatives, flavors, sweeteners and other dissolved solids. By definition, emulsions are unstable and will eventually break; however, in a well-formulated emulsion, the separation process can be slowed.

What Makes Liquids Immiscible?

Water is a polar hydrophilic (fat/oil-fearing) molecule, whereas Cannabidiol (CBD) is a non-polar hydrophobic (water-fearing) molecule. Most oils used for foods and cooking are considered non-polar and hydrophobic.

The Functions of a Cannabinoid Emulsion

A cannabinoid emulsion: 1) Isolates the negative sensory aspects of the cannabinoid, 2) Enhances potential flavor profiles, 3) Provides a highly uniform/homogeneous and stable solution of active cannabinoids, and 4) Can be diluted and remain stable.

The Importance of Uniformity/Homogeneity

For many consumer beverages, homogeneity may be nothing more than a measure of aesthetics and personal preference. This is not the case for beverages containing cannabinoids such as CBD, where the CBD should be evenly dispersed so that the first sip is the same as the last.

How and Why Emulsions Fail

Gravity is an enemy of emulsions, causing creaming and sedimentation. The emulsified particles remain intact, yet they concentrate at the top or bottom of the liquid due to gravity and different densities. The result is a non-uniform product with uneven cannabinoid distribution.

- **Creaming:** The dispersed oil phase that has a lower density than the continuous phase moves upwards and creates a thick, separated layer
- **Sedimentation:** The dispersed oil phase has a higher density than the continuous phase, causing the droplets to move downward
- **Coalescence:** Over time, the oil droplets recombine and grow in size over time, resulting in a solid layer or "ring" forming at the top of the liquid
- **Flocculation:** Inter-colloidal forces between the oil droplets are out of balance, leading to irregular collections of grouped droplets at the top of the beverage

Appropriate, suitable emulsifiers will stabilize the emulsified oil droplets which in turn decreases the rate of coalescence and flocculation.

Beverage Stability and the Superiority of SōRSE

It is not just the formula that makes an emulsion successful, but the formulation combined with specific processing to ensure uniformity and safety. SōRSE has been specifically designed to provide long-term uniformity, homogeneity, and stability over time, which are verified using a number of analytical techniques.

Particle Size and Distribution

Particle size and distribution throughout the medium are equally important to stability, homogeneity, and safety. Particle size also impacts the emulsion's clarity and turbidity. As particle size decreases, the surface area of the oil increases, typically leading to an increase in stability.

Turbiscan Lab and Interpreting Turbiscan Data

The Turbiscan is the recommended method for monitoring dispersed phase uniformity and stability over time. Backscattering compares multiple measurements taken over time. The Turbiscan utilizes static multiple light scattering to measure changes in the emulsion system via backscattered light and transmitted light. This verifies that SōRSE provides stability in excess of one year. The Turbiscan Stability Index (TSI) is a single value metric corresponding to a cumulative sum of all of the backscattering and transmission across the entire sample. TSI can be used to compare and rank stability objectively across samples, as well as evaluate and identify different phenomena contributing to destabilization.

High Performance Liquid Chromatography (HPLC)

Chromatography is used to make qualitative observations and quantitative determinations by separating a solution into individual components based on molecular weight and the ability to flow through a medium. Chromatography techniques can vary, from thin layer chromatography (TLC) to more complex methods such as High-Performance Liquid Chromatography.

Particle Size Analysis

Consistent small particle size with a narrow range is most beneficial for long term stability. To determine particle size, SōRSE labs utilize the Horiba LA-960 high performance laser diffraction analyzer. This equipment determines particle size with sensors that detect wavelength, relative refractive index, and scattering angle, and gives the user a histogram of size variation. The distribution range given by the histogram allows further predictions and indications of stability.

Microbial Limit Testing

Any agricultural product can be a carrier, potentially leading to exposure to pathogens, pests, pesticides, and potential heavy metals. To ensure a product is safe for human consumption, analyzing microbial contamination is critical. Multiple testing methods should be used and verified to ensure quality and microbial safety. Many products have a natural microbial load, including SōRSE and its raw ingredients. The preservative package ensures that the microbial count does not increase and the product remains safe over its shelf life.

Conclusion

Some specific challenges working with cannabinoids include: Uniformity and stability; achieving desirable sensory; achieving rapid and repeatable onset with predictable experience durations; and ease of use in manufacturing environments. With ease of manufacturing in mind, SōRSE's water-based emulsion easily dilutes in either a tank or individual bottle environment. The emulsion's uniformity makes let down easy and ensures near perfect dosing. The two powder forms are designed for either dry mixing or tablet compression or, in the case of the agglomerate, easily reconstituted beverages.

SŌRSE™ TECHNOLOGY

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