Microfluidics™

Application Note

Microfluidizer® Technology – Case Study on CBD infused beverages

A bottle of CBD infused water

INTRODUCTION

Beverages infused with CBD are becoming more popular.

As cannabidiol (CBD) is hydrophobic, it is not 'water soluble' so cannot simply be directly introduced and mixed into a beverage. Often when it is added it creates a cloudy beverage.

In order to make it water soluble a nanoemulsion needs to be created.

This paper explores a Case Study and shows the results of forming a CBD oil into a nanoemulsion.

Microfluidizer® Technology - Case Study on CBD infused beverages

FORMULATING A NANOEMULSION

In this study the goal was to produce concentrated nanoemulsions that could create clear CBD infused water.

Two formulations were developed using different emulsifiers (referred to as Emulsifier A and Emulsifier B) whilst keeping constant the concentrations of the surfactants and all the other components.

Both nanoemulsion formulations were prepared using the following steps:

1. Preparation of oil & aqueous phases:

Both phases were heated to assist and maintain the dissolution of the CBD isolate in the carrier oil and were individually mixed.

The first formulation consisted of an oil phase containing CBD isolate and MCT oil, and an aqueous phase consisting of deionized (DI) water and Emulsifier A.

The second formulation consisted of an oil phase containing CBD isolate, MCT oil, and Emulsifier B, while the aqueous phase consisted solely of DI water.

The phase which each emulsifier was added to was based on the nature of the emulsifier.

2. Forming a coarse emulsion:

The oil phase was slowly introduced to the aqueous phase and mixed with a low shear rotor-stator mixer to create a coarse or pre-emulsion.

The coarse emulsion was stable enough to not experience phase separation prior to processing in the Microfluidizer® processor.

3. Processing in a Microfluidizer ® processor:

The coarse emulsion was passed through the Microfluidizer® processor a number of times under controlled conditions and converted into a nanoemulsion.

All processing conditions were held consistent throughout, including processing pressure, temperature, Interaction Chamber™ selection, and number of passes.

PARTICLE SIZE RESULTS

After processing, both formulations were measured for particle size using dynamic light scattering. Results in Table 1 compare the z-average particle size (roughly equivalent to mean particle size) and the Polydispersity Index (PdI – a measure of particle uniformity). Figure 1 shows corresponding particle size distributions.

Emulsifier	Z-Average (nm)	PdI
A	36.93	0.166
B	91.06	0.297

Table 1 – Z-average particle size and PdI for processed concentrated nanoemulsions formulated with Emulsifier A and Emulsifier B, respectively

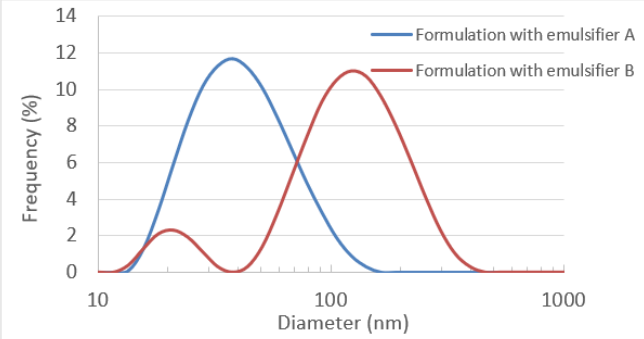

Figure 1 – droplet diameter vs frequency for formulations made using Emulsifier A and Emulsifier B, respectively

Microfluidizer® Technology - Case Study on CBD infused beverages

OPTICAL PROPERTIES OF THE RESULTING CONCENTRATE & FINAL PRODUCT

As Table 1 and Figure 1 clearly showed, the formulation using Emulsifier A was able to achieve a significantly smaller, and tighter particle size distribution than the formulation which used Emulsifier B.

Because the formulation developed using Emulsifier A had smaller average droplet size, this resulted in it having a more translucent appearance (as shown in Image 2).

It is important to note that this concentrated nanoemulsion is *translucent* but not completely *transparent*. This is due to the amount of droplets in the sample, which, regardless of their size, will tend to create at least a certain level of opacity.

However, at such low particle sizes, this level of opacity becomes negligible when properly diluted into the whole water based beverage.

Image 3 shows how when it is diluted to the desired ratio, it creates a bottle of clear CBD infused water, with a final concentration of 20 mg CBD per 500 ml, which was confirmed via analytical analysis.

Image 2 – Emulsifier A formulation results in concentration

Image 3 – the final bottle of CBD infused water

PLEASE NOTE – Microfluidics information & literature is intended for the use of its equipment in jurisdictions where such activities are legal.