

# Safe CBD/THC Product Manufacturing

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## OBJECTIVE

These products can quickly become illegal contraband if not properly dealt with in a timely manner. In addition, these products frequently have packaging that develops a greasy texture, that has a negative impact on the customer when purchasing and potentially greater ramifications after. Customers should be made aware of any dangers and should be enabled to have a comfortable shopping experience free of worry.



## CUSTOMER PROBLEM AND BACKGROUND

### Customer Description

Dr. Charles Steele is a forensic science professor at Purdue Northwest who conducts research on the chemical properties of CBD products, particularly their potential to convert into THC, a psychoactive compound that becomes illegal above certain thresholds. His work focuses on identifying and understanding how legal CBD products can transition into controlled substances, supporting both academic research and regulatory compliance in the field.

### Problem Statement/Background

CBD products, if not properly formulated or stored, can quickly degrade into THC and become illegal contraband. This transformation poses significant risks not only to researchers and manufacturers but also to consumers and retailers. Additionally, many CBD oil products in Northern Indiana exhibit packaging issues, such as the development of a greasy outer layer on their bottles. With an estimated 50%–70% of CBD products in the region containing nonnegligible levels of THC, it is critical to empower customers and researchers with tools to identify and address these concerns.

## CONCEPTS AND EXPERIMENTATION

### Thermal Stability Testing

5mL of Hempberry, cbdMD, and Charlotte's Web™ (mint) are incubated at 60 °C  
Samples are analyzed before incubation and after 1, 2, and 5 weeks incubation

### CO<sub>2</sub> Stability Testing

20 mL of Charlotte's Web™ (lemon) is sparged with CO<sub>2</sub> at 60 °C for 45 min  
The oil is stored in the dark and covered with parafilm for one week

### High-Performance Liquid Chromatography (HPLC) Analysis

0.020 mL of CBD oils are diluted in ethanol (10 or 25mL)  
Column: Accucore aQ (100 x 3.0 cm, 2.6 μm, C18)  
Solutions analyzed by HPLC/UV using 25:75 (H<sub>2</sub>O:ACN) mobile phase  
Wavelengths of 209, 223, 273, and 280 nm were scanned (runtime of 8 min)

### DIY Spectrometer Testing

Use a light proof box with a fluorescent light bulb in the center  
Placed a known wavelength color sample behind the bottle  
Compare measured wavelengths to determine if there is a difference.



## REQUIREMENTS AND FINAL DESIGN



Figure 1



Figure 2



Figure 3



Figure 4

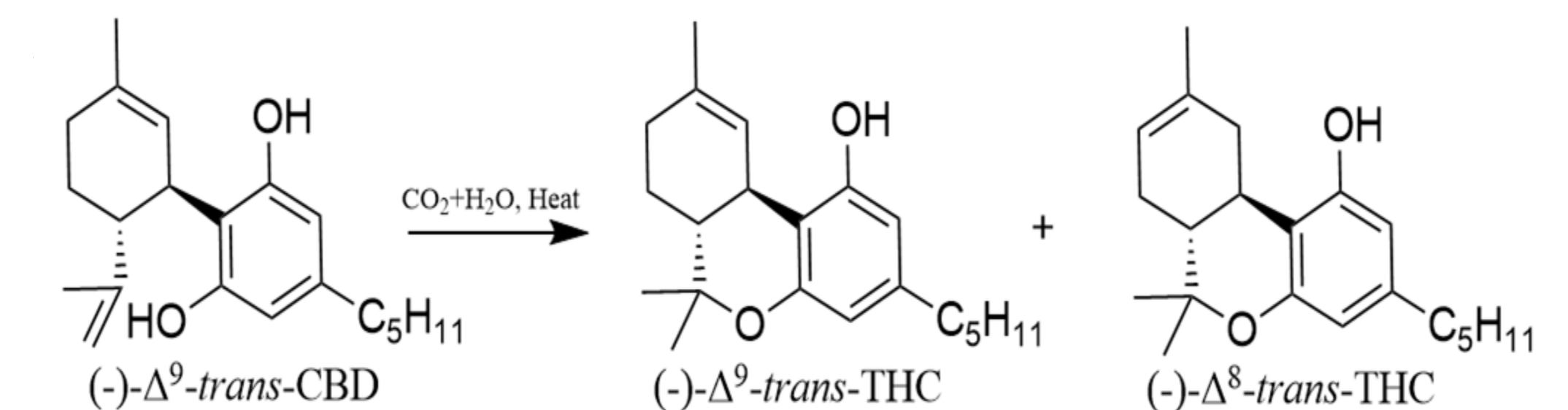
Our final design demanded that we analyze various aspects of the CBD oils, including how much of the solution was already THC, how quick the CBD to THC conversion occurs, if it is possible for us to analyze the solution without breaking the seal and to determine if any of the oil was absorbed over its production.

There are many tools used to test the CBD oil vials and to produce the data shown in Testing Results. The testing devices and their purposes are as follows:

- An incubator (Figure 1) was used to simulate environmental factors that could impact the effects oil leakage.
- A spectrometer (Figure 2) was used to observe the effects of soda-lime glass bottles and to determine if we could analyze the chemical solution through the bottles.
- A HPLC-UV Vis (Figure 3) was used to test the oils to monitor the conversion of CBD into THC.
- A scale (Figure 4) was used to observe if the low-quality plastic bottles used in general CBD oil production were absorbing any of the oils.

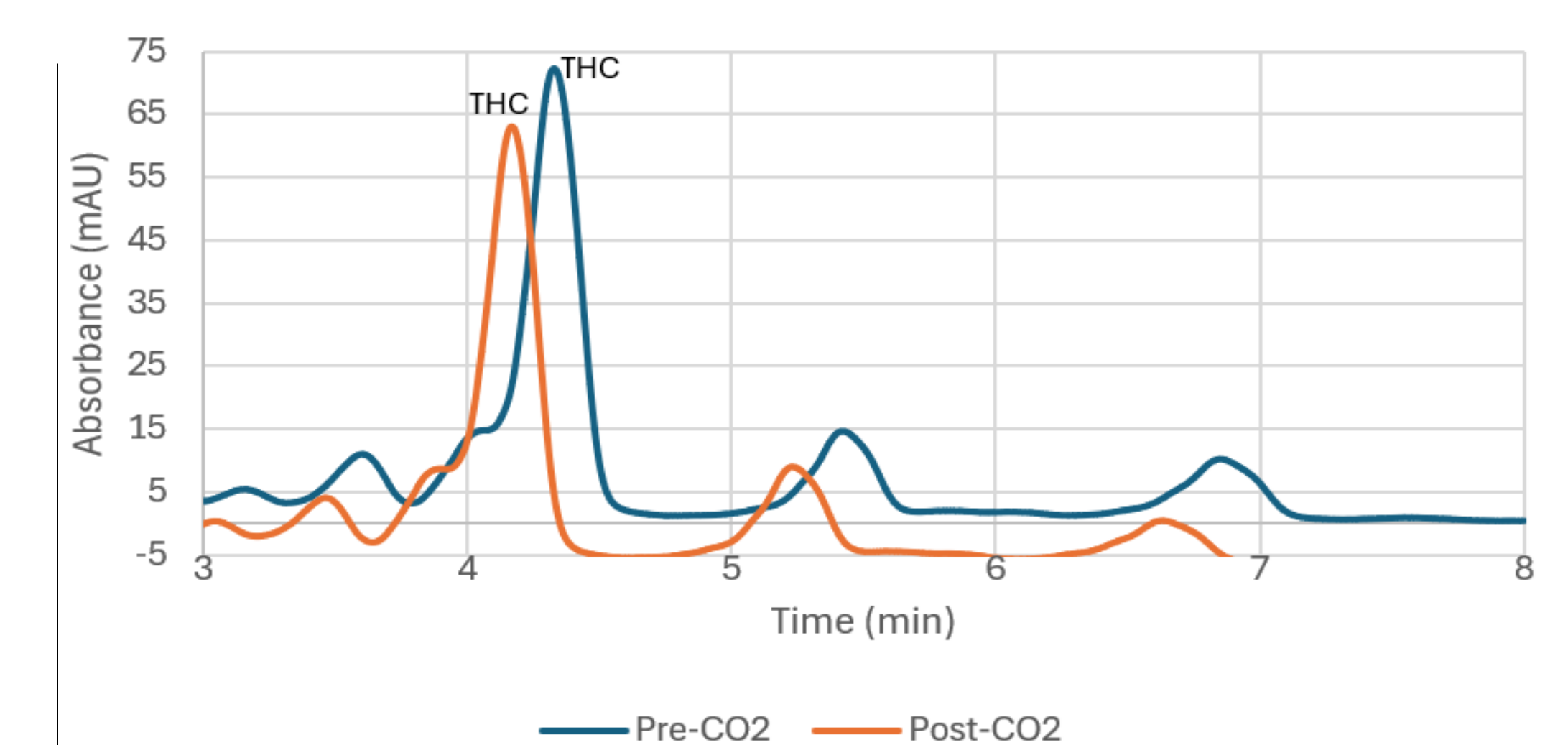


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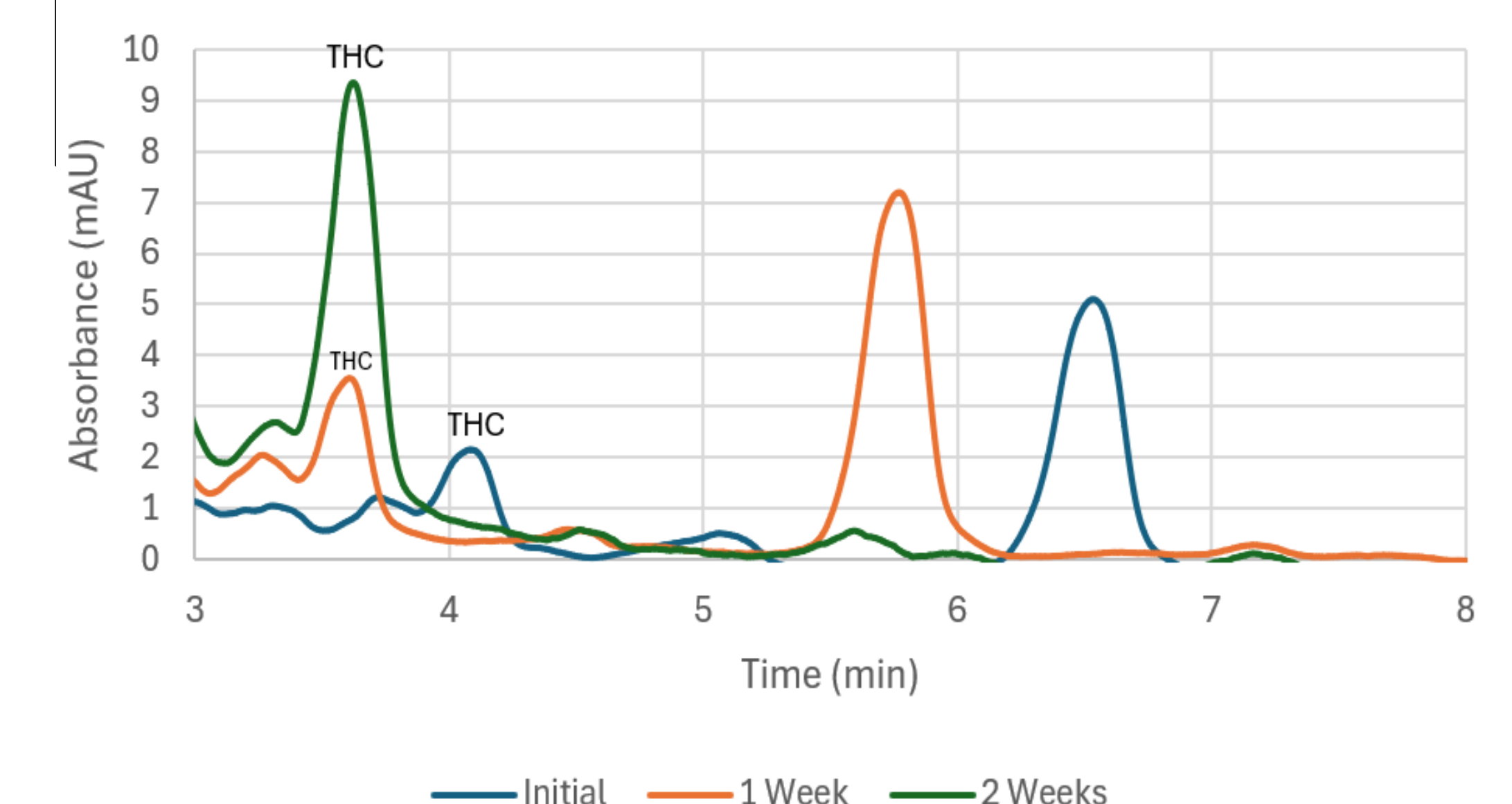


## TESTING RESULTS

CO<sub>2</sub> Cyclization Chromatogram



Hempberry Trial 2



## CONCLUSION AND RECOMMENDATIONS

We observed THC formation during incubation at 60 °C in 2/3 of the products studied (specifically, Hempberry and Charlotte's Web). We CANNOT, however, certify that the THC generated came from CBD, as in some of our products we observed an increase in CBD accompanied by the increase in THC, suggesting that residual cannabinoid acids could be the source of the contamination. CO<sub>2</sub> does not dissolve in oils as carbonic acid, but we do seek to later investigate this conversion in CBD sparkling waters. Soda-Lime glass (SLG) bottles block spectrometers from accurately reading through them. A specialty SLG bottle with a flat quartz glass bottom could be used to create a readable alternative. Rubber dropper tops allow for saturation with CBD leading to grease buildup. A plastic dropper insert would solve this problem.