Report

Evaluation of CBD Concentrations in Brewed Coffee: Ground coffee infused with CBD concentrates and post-brew addition of a CBD concentrate

Client

CBD Health Collection

Testing Laboratory

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Introduction

Beginning in the fall of 2020, the Hocking College Cannabis Analytic Laboratory initiated a research project with CBD Health Collection to evaluate the concept of formulating ground coffee with cannabidiol (CBD) concentrates. A series of experiments were conducted between October of 2020 and April of 2021. The research was conducted in three phases.

Results for experiments conducted in this research indicate that infused coffee formulations using either Full spectrum CBD oils or water-soluble powders result in poor quantitative transfer of CBD to the brewed product and poor consistency with regards to CBD concentration from brew to brew. The post-brew addition of a premeasured packet of ISOEdge to the hot liquid coffee resulted in quantitative dissolution/suspension of CBD in the brewed product and consistent brew to brew CBD levels.

Phase 1: Evaluation of Infused Ground Coffee with Full Spectrum CBD Concentrate

Two ground coffee varieties were infused with Full Spectrum CBD Concentrate at 1,000 and 2,000 mg per pound of coffee and shipped to the laboratory for brewing experiments. Both formulations were brewed in the laboratory using a pour over technique at two different temperatures (180 and 200 °F). The brewed liquid coffee was analyzed by HPLC for CBD concentration immediately after completion of brewing (0 minutes) and at 5, 10 and 15 minutes after the completion of brewing to determine the stability of CBD in the brewed liquid coffee. Results (Table 1) indicated poor quantitative transfer of CBD from both formulations of ground coffee into the brewed liquid coffee. In all experiments, less than 1% (Percent of Theoretical) of the CBD in the ground coffee was transferred to the brewed product. CBD in the brewed liquid coffee appeared to be stable for 15 minutes following the completion of brewing.

Table 1. CBD Concentrations in Brewed Coffee from Two Infused Ground Coffee Formulations (Phase 1)

Sample ID	Description	CBD (mg/11.8 oz. Brew)	CBD Theoretical Amount (mg/11.8 oz. Brew)	Percent of Theoretical
JMC Sample	Brewed Coffee (0 min.)	0.372	44.3	0.841
JMC Sample	Brewed Coffee (5 min.)	0.411	44.3	0.929
JMC Sample	Brewed Coffee (10 min.)	0.439	44.3	0.992
JMC Sample	Brewed Coffee (15 min.)	0.364	44.3	0.822
435°	Brewed Coffee (0 min.)	0.590	77.8	0.758
435°	Brewed Coffee (5 min.)	0.524	77.8	0.675
435°	Brewed Coffee (10 min.)	0.646	77.8	0.831
435°	Brewed Coffee (15 min.)	0.504	77.8	0.648

JMC Sample: 1,00 mg Full Spectrum CBD/lb. ground coffee
435°: 2,000 mg Full Spectrum CBD/lb./ ground coffee

Phase 2: Evaluation of CBD Health Collection Zero-THC Water Soluble Powder in Simulated and Pilot Infusion Brewing Experiments

A water-soluble CBD powder (WSP) was submitted to the laboratory to determine if the material could be used to formulate ground coffee and improve the mass transfer of CBD from the ground coffee to the brewed product. CBD Health Collection Zero-THC WSP (20% CBD on a weight basis) was used for this phase of the research. The WSP material as received (not formulated into ground coffee) was submitted to simulated pour over brewing conditions using only water (no coffee) at 200 °F and ambient room temperature. Results (Table 2) indicated that the amount of CBD solubilized in hot water was only 38.7% of the theoretical concentration. This was greater than the room temperature simulated brew indicating that heat increased the yield of CBD and did not result in degradation in CBD during the brewing process. Although CBD yields were low in the simulated brew, dissolution or suspension of CBD in hot water was significant enough to evaluate the WSP in ground coffee.

Table 2. CBD Concentrations from Simulated Brewing Experiment

Sample ID	Description	CBD (mg/11.8 oz. Brew)	CBD Theoretical Amount (mg/11.8 oz. Brew)	% of Theoretical
100 mg of Water-Soluble Powder	Hot Water Simulated Brew Rep. 1	7.36	21.8	33.8
100 mg of Water-Soluble Powder	Hot Water Simulated Brew Rep 2	9.46	21.7	43.5
	Mean	8.41	-	38.7
100 mg of Water-Soluble Powder	Room Temperature Water Simulated Brew - Rep. 1	4.49	21.8	20.6
100 mg of Water-Soluble Powder	Room Temperature Water Simulated Brew - Rep 2	7.28	21.8	33.4
	Mean	5.88	-	27.0

Next, the WSP was added to ground coffee. Three formulation levels were evaluated in duplicate: 200 mg WSP/25 g ground coffee, 400 mg WSP/25 g ground coffee and 600 mg/25 g ground coffee. For each brew, 25 g of ground coffee was mixed with the prescribed amount of WSP (200, 400 or 600 mg) and submitted to a pour over brewing technique using water heated to 200 °F. The objective was to achieve an infusion rate of the WSP in ground coffee that yields a CBD concentration of 20-30 mg CBD/11.8 oz. cup of brewed liquid coffee. CBD concentrations were measured in the brewed liquid coffee immediately upon completion of brewing and 15 minutes after completion of brewing. Results (Table 3) indicate that the 200 mg infusion level produced a mean CBD concentration in the brewed liquid coffee of 29 mg CBD/11.8 oz. This fell within the target range of 20-30 mg CBD/11.8 oz., but the repeatability of the replicates was poor, indicating that achieving consistent CBD levels on a brew to brew basis may not be possible. The higher infusion rates of 200 and 400 mg exceeded the 20-30 mg target range by a significant amount.

Table 3. CBD Concentrations in Brewed Coffee using Laboratory-Infused Ground Coffee

Description	CBD (mg/11.8 oz. Brew)	Mean (n=2)	Description	CBD (mg/11.8 oz. Brew)	Mean (n=2)
Pour Over Brew w/200 mg WSP 0 min.-Rep. 1	19.6	0 min. 29.3	Pour Over Brew w/200 mg WSP 15 min.-Rep. 1	32.3	15 min. 29.6
Pour Over Brew w/200 mg WSP 0 min.-Rep 2	39.1		Pour Over Brew w/200 mg WSP 15 min.-Rep 2	26.9	

Description	CBD (mg/11.8 oz. Brew)	Mean (n=2)	Description	CBD (mg/11.8 oz. Brew)	Mean (n=2)
Pour Over Brew w/400 mg WSP 0 min.-Rep. 1	45.8	0 min. 50.5	Pour Over Brew w/400 mg WSP 15 min.-Rep. 1	43.6	15 min. 50.2
Pour Over Brew w/400 mg WSP 0 min.-Rep 2	55.2		Pour Over Brew w/400 mg WSP 15 min.-Rep 2	56.9	

Description	CBD (mg/11.8 oz. Brew)	Mean (n=2)	Description	CBD (mg/11.8 oz. Brew)	Mean (n=2)
Pour Over Brew w/600 mg WSP 0 min.-Rep. 1	87.6	0 min. 72.4	Pour Over Brew w/600 mg WSP 15 min.-Rep. 1	100	15 min. 82.1
Pour Over Brew w/600 mg WSP 0 min.-Rep 2	57.2		Pour Over Brew w/600 mg WSP 15 min.-Rep 2	64.0	

Phase 3: Evaluation of CBD R&D Prototype ISOEdge in Brewed Coffee Added After Brewing

The final phase of the research was conducted using an IsoEdge CBD concentrate (25 mg CBD/1.6 g packet) which would be added to hot liquid coffee after brewing. Previous experiments indicated poor transfer of CBD from infused coffee into the brewed product and poor repeatability with regards to CBD concentrations in the brewed product. This experiment utilized a single packet of ISOEdge CBD concentrate which was added after brewing to the liquid coffee. Two replicate pour over brews were prepared. Ground coffee (25 g) was brewed using the pour over method utilized in previous experiments. The contents of the 1.6 g ISOEdge packet were added to the brewed coffee in a mug and stirred. The coffee was then analyzed for

CBD concentration. Results (Table 4) indicate quantitative dissolution/suspension of CBD from the ISOEdge CBD concentrate into the brewed liquid coffee. The mean concentration found was 29 mg/11.8 oz. This was about 16% higher than the target concentration of 25 mg/11.8 oz. The level of CBD found between the two replicate brews indicates excellent repeatability.

Table 4. CBD Concentrations in Brewed Coffee with CBD R&D Prototype ISOEdge

Description	CBD (mg/11.8 oz. Brew)	Mean (n=2)
Pour Over Brew: 1.6 g packet ISOEdge – Rep 1	29.7	29.4
Pour Over Brew: 1.6 g packet ISOEdge – Rep 2	29.0	

Conclusions

Results for experiments conducted in this research indicate that infused coffee formulations using either Full spectrum CBD oils or water-soluble powders result in poor quantitative transfer of CBD to the brewed product and poor consistency with regards to CBD concentration from brew to brew. The post-brew addition of a premeasured packet of ISOEdge to the hot liquid coffee resulted in quantitative dissolution/suspension of CBD in the brewed product and consistent brew to brew CBD levels.