

Wildfire Smoke and its Effects on Hemp Oil Quality

This year has presented the west coast with one of its most devastating wildfire seasons in history. Oregon spent weeks battling over a dozen sites that began in August and continued into November. The impacts have been widespread, ranging from people losing their homes and loved ones, to economic concerns for crop loss. Wine grapes have been in the spotlight for years and hemp recently followed suit with concerns of possible contaminants being passed through the smoke and ash.

Academic research on [bush fires in Australia](#) rose in the mid-2000's but there has been divergent information of the impacts based on the variability of conditions. The [California Department of Food and Agriculture](#) developed guidelines for quantifying phenols affiliated with smoke taint with detection limits starting at 0.5ppb. The west coast has found creative ways to mitigate this, but the crops can still be compromised. A small upside is that this research has opened pathways that allow wine grapes to be insured if compromised by smoke taint. With a high investment crop like hemp, we want to get ahead of the curve protecting our assets.

In our fifth consecutive season growing and extracting hemp, this detrimental reality is inherent. Being a vertically integrated system we know this could impair us from multiple angles. Iverson Family Farms has been growing hemp since 2016 and FSOil's experience with CO2 extraction began in 2015. A family affair, the two companies' combined forces when the Iverson's father, Ross, was diagnosed with cancer. He was put on pharmaceuticals that diminished his quality of life and their cousin Tim Shaughnessy stepped into help by extracting CBD oil. This alleviated Ross's pain and he was able to go off all other medications and live a happier, self-sufficient life for the remainder of his time here. Helping people through quality of product and quality of life are what continue to guide our goals in the industry.

These objectives pushed us to work simultaneously with Universities, scientists, growers, and labs along the west coast by conducting internal research on possible impacts from these fires. Our specific concerns for hemp have been modeled off of studies in the wine industry due to the extensive research that has been covered. Having the capability to fully track the history of the plant from seed to finished product gave us the opportunity to dive deeper into this project.

The [Beachie Creek Fire](#) came the closest to us at a distance of 9.75 mi with spot fires even closer at 8.6 miles. The main materials that were being burnt nearby were from forests. We were in a stage 3 evacuation for 10 days when the rains ended it on September 18th. This stopped the drifting ash and [Air Quality Index](#) (AQI) that was averaging between 300 and 500 daily. This span of time allowed us to collect data during the fires and after the rains. There have been limitations to the scope of our trials because this is a recently legal crop that has a torrid past and is still waiting for clear federal guidelines. Finding labs who accept hemp can be challenging and Columbia Laboratories in Portland, OR has diligently worked to help us find testing locally and globally.

Outline:

The trials were designed to understand the impacts of ash and smoke on flower and oil. Samples were taken from an early maturing photo-period variety. The biomass that was homogenized with ash was harvested on September 16, two days before the rain and 8 days into the fires. There was a small strip left behind to measure the impacts post-rains. All extraction took place on a 5L CO2 extraction machine using identical parameters.

Pesticides and Heavy Metals

Samples Analyzed:

1. Ash
2. Soil with Ash (Top 3" sampled)
3. Fresh Pre-Rain Flower with Ash (top 6" of upper lateral buds sampled)
4. Wet Biomass homogenized with ash (harvested Sept. 16)
6. Pre-Rain Oil homogenized with ash
7. Post Rain Oil with nearly all ash visibly washed away

With the six different samples analyzed we are able to detect any levels of pesticides and heavy metals in the ash all the way through to oil. The final analysis was in two different oils, one extracted from biomass that was homogenized with ash and one extracted from clean biomass post-rains.

Heavy metals were identified in the ash and soil with a slight increase from our 2019 soil samples. These were compared to [Department of Environment Quality](#) (DEQ) regional concentration guidelines and the levels were still below what is expected in the area. The metals diluted during the extraction process with both oil results showing below the limit of quantitation (<LOQ) for all analytes.

There were pesticide analytes identified in the oil which is typical for CO2 extraction due to its ability to concentrate molecules. This includes all of the beneficial cannabinoids we want and doesn't pose an issue because once formulated everything will dilute. Even with an increase in concentrations, all testing reported below limits. We do not see any levels of concern in heavy metals or pesticide for the flower or the oils.

Polycyclic Aromatic Hydrocarbons (PAH)

Based on the [Center for Disease Control and Prevention](#) (CDC) reports, PAH's are a class of chemicals that occur naturally in coal, crude oil, and gasoline. They also are produced when coal, oil, gas, wood, garbage, and tobacco are burned. PAHs generated from these sources can bind to or form small particles in the air.' There is still a lot of research being done on these but

at the moment 'possible impacts on human health have been linked to cancer causing chemicals and blood and liver abnormalities.'

Samples Analyzed:

1. Fresh Pre-Rain Flower with Ash (top 6" of upper lateral buds sampled)
2. Pre-Rain Oil homogenized with ash
3. Post Rain Oil with nearly all ash visibly washed away

For this analysis we wanted to quantify PAH's and track them through three different profiles. These would display the highest concentrations of what most growers would be harvesting or processing. A full panel of PAH was tested and all results showed <LOQ. This demonstrates there is nothing further we can determine to be concerned with.

Smoke Taint

Samples Analyzed:

1. Post Rain Flower with ash washed away (top 6" of upper lateral buds sampled)
2. Post Rain Oil (Extracted with post-rain biomass)

Smoke taint are volatile compounds that can derive from smoke and play a part in quality. Two primary phenols associated with this are 4-Methylguaiacol and Guaiacol. They can adhere to the plant and give them a smokey or ashy taste and smell. These phenol analyses are what the wine industry has used to quantify smoke taint.

There are a couple of issues we run into when comparing hemp to wine. The first is that smoke taint is an organoleptic analysis that has shown no signs of toxicity. Since this is sensory based, there is still a lot to explore in how a grower could reduce or remediate this possible issue. Something as simple as blowing ash off of the plant may work. In our experiment, we observed it's impacts on oil through CO2 extraction.

The second issue we run into is that the fermentation process and CO2 extraction are two very different methods. Both of which will impact these volatile compounds differently. We are not comparing apples to apples, but we can take the wine industries lead in helping growers and processors begin to understand the concerns so that they can make educated decisions in how to handle their product.

When we began this project there were no labs that had validated smoke taint in hemp. Working with Columbia Labs network, we were able to develop a method to analyze and quantify these phenols. We identified both Guaiacol and 4-Methylguaiacol in the flower and oil but don't have a relative point to compare these numbers to, we are optimistic that this gives us a starting point. Based on observation through smell and taste we detected no noticeable smoky or ashy characteristics in the flower or the oil. At this point, we are not concerned with these compounds impacting the quality of product.

Potency

Since the variety we chose to work with for these trials was harvested a few days after the smoke cleared, we weren't able to track its potency once the fires were over.

We had two other varieties that remained in the field which were not harvested until mid-October. We recorded weekly potencies on these and then compared them to our 2019 data. Our percentages overall showed lower during the week of the fires likely due to a decrease in photosynthesis. However, the plants rebound and finished either higher or at a similar potency.

Summary

As an overall analysis our results show that hemp grown within as close as 8-10 miles of the Beachie Creek Forest fire remains safe. We know this is something that is being reviewed and tested along the west coast and new data will arise based on what precisely burned in proximity to specific farms.

In [2019 Senator Jeff Merkley](#) advocated for 5 million dollars in research for the wine industry in Oregon. This was due to cancellations for wine grapes grown in 2018 that were impacted by smoke taint. We want to use this guidance as foresight and make sure we are ahead of the game in protecting hemp from perceived issues. The United States Department of Agriculture announced a pilot program for [crop insurance with hemp](#) in February of 2020. There is still realistic development within that program that needs to be addressed for the growers. As our research continues, if there is something that shows as problematic in our data we will continue to work with Universities, accredited labs, and specialists to help find solutions for remediation and promote crop insurance for farmers. We need to analyze and quantify this reasonably without encouraging alarm for a problem that may not be there.

