Development of Hemp Food Products & Processes

An ARDI supported project

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Final Report

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Project Purpose and Objective

The theory is that hemp seeds do not contain THC, but rather that the seed coats are contaminated by the leaf matter surrounding the seed bud. Our project purpose was to develop processes that would allow us to eliminate and/or reduce the levels of THC presently found in hemp food products and develop a process to sterilize the whole seeds and render them non-viable. Development of various processes would be the key to moving hemp food products from "niche" markets into the main stream for use by value added manufacturers and food processing companies looking to boost the nutritional content of their products.

Our approved project involved researching three particular processes to eliminate and/or reduce the levels of THC:

1. **Develop a process to pre-wash the whole hemp seeds with a chemical or non-chemical agent which would breakdown the THC component and wash it away.**
2. **Develop and improve existing impact hulling processes to accommodate hemp seeds and completely eliminate the contaminated hulls and abnormal seeds through screen separation and air-washing, resulting in a "THC Free" hemp nut (meat).**
3. **Develop various "dry heat" processes to effectively sterilize hemp seeds by utilizing and improving existing grain drying, roasting and microwave technologies.**

***Research note:** In a separately conducted project funded in part by the Manitoba Rural Adaptation Council (MRAC) and Websar Laboratories entitled **"Laboratory Analysis of THC content in Industrial Hemp Seed"**, it was determined that:

"THC is intrinsically found in all parts of the hemp seed, albeit at far lower levels in the hemp seed nut than that found on the seed coats which receive the highest degree of contamination."

With this knowledge, we were able to best focus on methods of reducing these levels of THC versus the complete elimination of such contaminants.

Procedure and Project Activities

1. **Development of a process to pre-wash the whole hemp seeds with a chemical or non-chemical agent which will breakdown the THC component contaminating the hulls and wash it away.**

The development of this process (and the other 2 processes researched) required that the Δ^9-tetrahydrocannabinol (Δ^9-THC) baseline data be collected first from six varieties of industrial hemp seed being grown in Manitoba. The varieties selected included Fedora 19, USO 14, Felina 34, Fin 314, Fasamo and Ferimon 12. The seed analyzed above was first commercially cleaned and conditioned in a seed cleaning plant.

The Δ^9-THC analytical expertise of Websar Laboratories in Ste. Anne, MB., was enlisted to prepare the samples for analysis and determine the Δ^9-THC levels of the six whole seed varieties according to the Health Canada approved protocols for testing Δ^9-THC. The results are summarized in Table 1 below.

With the baseline data in place, the next step was to select one of the six varieties to utilize in the pre-washing process. The German seed variety Fasamo was selected for this purpose.

Numerous cleaning agents were identified, discussed and selected for testing in this study including:

1. **a food grade detergent**
2. **a food grade degreaser**
3. **a super-chlorinated solution called Oxilink used for cleaning contaminated water sources and a second double strength Oxilink solution**
4. **a hydrogen-peroxide solution**
5. **a food grade ethanol/water solution**
6. **water only**

Preparation of the cleaning agent solutions tested above were prepared according to the various manufacturers specifications/instructions. Triplicate samples (10 grams) of Fasamo seed were weighed out for each of the washing trials. The 10 gram sample portion of seed was stirred for 2 minutes, using a stainless steel spatula, in 250 ml of each of the test solutions. The seed was then removed from the cleaning solution and rinsed in 100 ml of HPLC grade water by stirring for 2 minutes with a stainless steel spatula. The seed was then drained and dried in a dehydrator for 30 minutes at 35ºC. The individual samples were then stored in an amber storage bottle until the Δ^9-THC analysis was performed. Duplicate analysis of each sample replicate was performed with the results indicated in Table 2 below.

Project Results & Discussion

Table 1. Δ^9-THC in Whole Hemp Seed – Baseline Data

Variety	Sub-Sample Size (grams)	Sample Size Analyzed (mg)	Δ^9-THC Range (μg/g)	Δ^9-THC Level (μg/g)
Fedora 19	10.0	200	2.19 – 2.96	2.53
USO 14	10.0	200	0.40 – 0.66	0.54
Felina 34	10.0	200	2.15 – 2.84	2.55
Fin 314	10.0	200	2.17 – 3.05	2.57
Fasamo	**10.0**	**200**	**2.19 – 2.79**	**2.46**
Ferimon 12	10.0	200	2.62 – 4.66	3.57

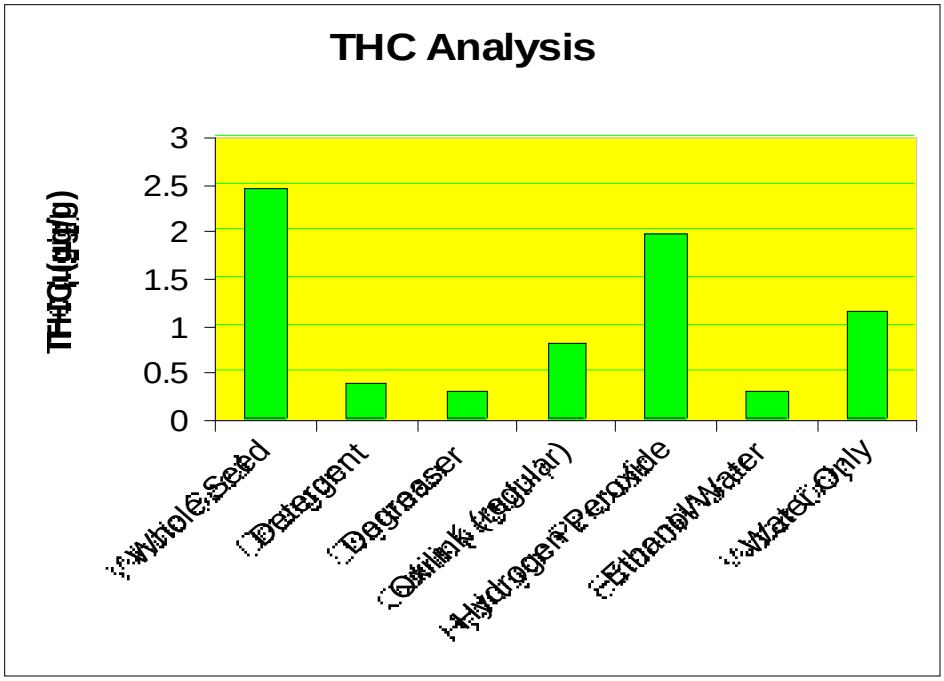
* Fasamo seed was selected to utilize in the pre-washing solution tests. Note: the allowable limit by Health Canada for any hemp seed derivative is 10 μg/g (parts per million). All varieties tested for the baseline data were within this range.

Table 2. Results of Δ^9-THC levels after cleaning in test solution

Test Solution	N	Δ^9-THC Range (μg/g)	Average Δ^9-THC Level (μg/g)
Fasamo whole seed (baseline)	**3**	**2.19-2.79**	**2.46**
Food grade detergent	3	0.39-0.43	0.41
Food grade degreaser	3	0.28-0.32	0.30
Oxilink (regular strength)	3	0.76-0.82	0.80
Oxilink (double strength)	1	5.01-6.06	5.54
Hydrogen-peroxide	3	1.76-2.19	1.98
Food grade ethanol/water	3	0.27-0.35	0.31
Water only	3	1.11-1.28	1.17

n = number of replicates. Each replicate consists of a duplicate analysis of the sample.

A bar chart of the result in Table 2 is shown on the following page.



Note: The results from the double strength Oxilink test were not included above. It was postulated that this solution may have caused oxidation of the CBD also present on the seed coat which turns it into Δ^9-THC, thus increasing the level of Δ^9-THC as compared to the baseline data for the whole seed.

Conclusions

The results of pre-washing the whole seeds in the various solutions proved that the levels of Δ^9-THC contaminating the seed coats could indeed be significantly reduced from 20% up to 88%.

The most interesting observation is that a simple pre-wash of the seeds in water only was also relatively as effective as any of the other solutions tested. The use of water as a pre-wash would obviously be the most economical cleaning agent to utilize. However, the study did not address the advantages of each test solution being utilized also as an agent to rid the seed of any microbial food contaminants.

From purely a cost perspective to reduce the levels of Δ^9-THC, the use of a food grade detergent or degreaser was most effective.