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CONSIDERATIONS ON THE IMPORTANCE OF THE CONDITIONING OF INDUSTRIAL HEMP SEEDS

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Abstract: Hemp (Cannabis sativa L) is a plant whose use is expanding in countless industries. Given that there are many facilities to purchase hemp now, it is important for growers to produce the best quality product for processing. In this article, different conditioning solutions (cleaning, sorting and storage) and technical equipment are analysed in order to obtain high quality seed material or raw materials for industrial hemp processing. The quality of a crop, as well as of the products obtained after processing, crucially depends on maintaining a favourable climate during the storage period, maintaining the physical and chemical properties of the seeds resulting from the harvest. Non–compliance with the rules cancel the good practices applied by farmers during each stage prior to this time. Seed damage is associated with genotype, history and physical and chemical compositions. Hemp seed can be dried to a low moisture content and stored at low temperature for several years. In order to process, store and capitalize the seeds for sowing, immediately after harvest, must be maintained the properties of biological value, of improvement and maintenance of those of cultural value, of carrying out appropriate treatments against diseases and pests, of packaging and labelling the seeds according to destination and the provisions of the regulations in force, to periodically analyse the seeds in accredited laboratories and to deliver or use them only on the basis of quality certificates or analysis bulletins.

Keywords: hemp seed, conditioning, dryer, separator

INTRODUCTION

In order to process, store and capitalize the seeds for sowing, immediately after harvest, must be maintained the properties of biological value, of improvement and maintenance of those of cultural value, of carrying out appropriate treatments against diseases and pests, of packaging and labelling the seeds according to destination and the provisions of the regulations in force, to periodically analyse the seeds in accredited laboratories and to deliver or use them only on the basis of quality certificates or analysis bulletins (Duda M., et al., 2007).

Also, the seeds of each cultivated species can reach a maximum quality level in a complex of conditions that ensure the most favourable interactions between their genetic nature and the large number of variables during their formation on the plant and during harvesting, primary processing, conditioning and preservation (Tenu I e al., 1988; Mogârzan A. et al., 2003).

During formation and maturation there are a number of factors that can prevent this maximum level from being reached, either by all the seeds produced by the respective crop, or only by some plants or some seeds on a plant. It is generally considered that the seeds reach their maximum quality at the beginning of full maturity, and from this moment, either on the plant or in the period from harvesting to sowing, except for physiological maturation in some species, only deteriorating processes take place (Mureşan T. et.al., 1986; Jovičić D. et.al, 2019).

On the other hand, the quality of a crop, as well as of the products obtained after processing, crucially depends on maintaining a favorable climate during the storage period, maintaining the physical and chemical properties of the seeds resulting from the harvest. Non–compliance with the rules cancel the good practices applied by farmers during each stage prior to this time.

Hemp (Cannabis sativa L) is a plant whose use is expanding in countless industries. Given that there are now many facilities to purchase hemp now, it is important for growers to produce the best quality product for processing.

This article analyses different solutions for cleaning, sorting and storage in order to obtain high quality seed material or raw materials for processing industrial hemp.

MATERIALS AND METHODS

Seed damage is associated with genotype, history and physical and chemical compositions. Hemp seed can be dried to a low moisture content and stored at low temperature for several years. According to the literature, hemp seeds contain 20 ÷ 25% protein, 20 ÷ 30% carbohydrates, 10 ÷ 15% insoluble fiber and especially 25 ÷ 35% oil which was considered to be the main contributor to seed damage (Garavand et al., 2013; Mahapatra N., 2020).

The steps prior to the introduction of the seeds in the conservation depot are shown schematically in figure 1.

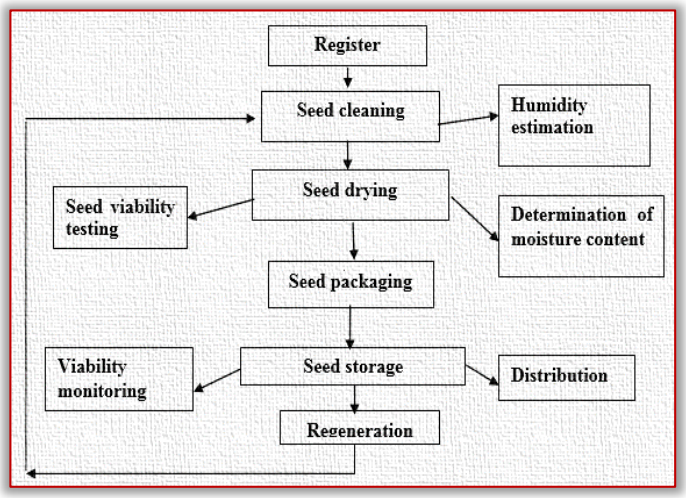

Figure 1 – The seed processing stages in order to preserve them and use as sowing material

Processors require industrial hemp seeds which are of good quality and which generally comply with the following standards and their explanations as shown in table no.1 (Kaliniewicz Z., 2021; Suriyong S. Et al., 2015).

Table 1. Requirements regarding the physico–chemical properties of industrial hemp seeds for processing

No.	Properties	Requirements	Remarks
1	Variety	From the approved list of hemp varieties	
2	Color and appearance	Brown–gray seeds	Good quality ripe hemp seeds will have dark marks on them. Degraded, immature or frozen seeds have a light brown, colorless seed layer.
3	Aroma and smell	light aroma and smell of walnut	
4	Purity	99,9% of cleaned seeds the maximum mixture of impurities is 0.1% by weight	All poor quality seeds must be removed through the cleaning process. Contamination with other crops, especially wheat, weeds and foreign materials, can lead to a repeated cleaning process and reduced or rejected raw materials
5	Toxins	acceptable levels of coliform and e–coli	–
6	Moisture	< 8÷9%.	–

To maintain optimum quality, harvested hemp seeds require immediate aeration within 3÷4 hours of harvest. Harvesting capacity should be appropriate to aeration capacity and seed drying.

Growers can improve the quality of hemp seed crops by minimizing their damage during harvesting, cleaning and handling.

Samples are taken throughout the conditioning process to ensure that the seeds are of the highest quality. After completion of the conditioning process, a sample must be sent (taken) for testing. This will ensure that the seeds meet official standards, while providing all the information needed for certification.

With the help of the technical equipment manufacturing industry, high–performance equipment has been developed to meet the processing and conditioning needs of hemp.

Drying technique is typically the single greatest determinant of end–product quality. Over–dried product will have low yield and under–dried product will mold.

Hemp seed is large, similar to wheat, and air moves through it easily (Păun A. et.al, 2018; Dudarev I. et al., 2020). One to three weeks of aeration is required to dry grain, depending on ambient conditions, grain moisture, fan and bin capacity.

Fluid beds use evenly distributed airflow to suspend and fluidize product, like ping–pongs ball over airstreams. Heat is used to improve performance, but because it is not the primary driver of evaporation, does not burn the oils like other popular methods. Because fluid beds perform best with shredded material, they are ideal for pre–rolls and extraction biomass.

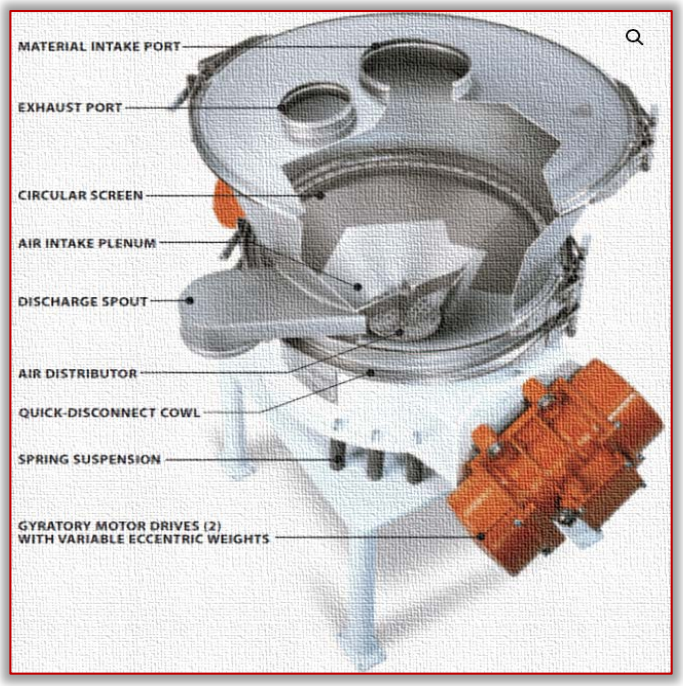

Figure 2 – Fluid bed dryer– constructive scheme (https://abmequipment.com/hemp–processing/drying/hemp–drying–systems)

Fluid bed dryers (Figure 2) use air traveling at a rate just higher than the product's terminal velocity, suspending the product above the grate. The large amount of dry air passing through the product achieves the same dry–rate as rotary (tumble) dryers without the use of high temperatures. Because they require homogenized product and can degrade product by up to 2 points, they're most popular for extraction biomass and pre–rolls.

Drying methodology is arguably the most important factor in differentiating processors and provide a competitive edge. Until recently, tumble and belt dryers have been the standard for the industry, however, both have inherent flaws and drawbacks. Tumble dryers use heat as an accelerant.

Belt dryers draw air from above, which creates concentrated air streams which inevitably causes wet spots which are prone to mold or over–drying.

Technological processes of separation and cleaning seeds are extremely important, since seed quality and cost depend on these processes. The seed separation and cleaning processes are carried out on separators of various types (Mureşan T et al., 1986; Duda M et al., 2007).

Hemp separators are placed after the dryer to separate the stalks and stems from the bud. Because bucking is too tedious for large–scale operation, it's much more efficient to grind everything together and separate it once dry. These separators are incredibly resilient, easy to use, and come with hardware to accommodate changing biomass properties.

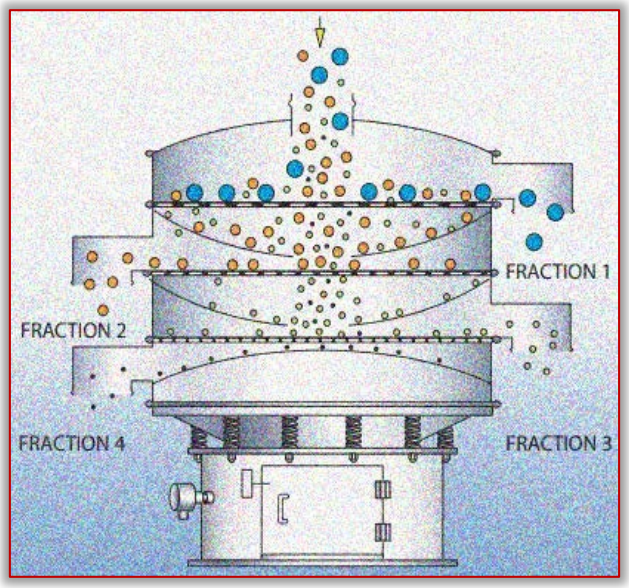

Figure 3 – Circular vibratory screeners – Principle of operation (https://www.kason.com/assets/files/Kason_Vibroscreen_Brochure)

The main screening assembly of a screener (Figure 3) is suspended on rugged springs that allow it to vibrate freely while minimizing power consumption and preventing vibration transmission to the floor. The assembly is equipped with one imbalanced–weight gyratory motor that creates multi–plane inertial vibration for the purpose of controlling the flow path of material on screen surfaces, and maximizing the rate at which material passes through the screen.

Material is fed onto the centre of the screen, causing particles larger than screen apertures to travel across the screen surface in controlled pathways, and exit through a discharge spout located at the screen's periphery, while particles smaller than screen apertures pass through the screen onto a lower screen or exit through a lower discharge spout.

Seed cleaning equipment will also need to be thoroughly cleaned to ensure cross contamination with other grains, especially wheat, does not occur. Most seed cleaning equipment, including air and screen, indent and gravity tables, are suitable. Colour sorters are becoming more common for ensuring the seed meets the strict quality specifications of 99.9 % purity because purity is a key issue with hemp seed. A representative sample of the cleaned hemp seed should be collected after cleaning and submitted to the processor according to their requirements.

RESULTS

Storage of seed is an important process of plant production to avoid unfavourable environmental conditions and the acceleration of the deteriorations, which is started after harvest. Storage conditions play an important role to maintain high seed quality, which directly related to environmental conditions (mainly temperature and relative humidity). However, the sensitivity of seed to high temperature is depended on the water content that the higher moisture content, the looser viability. Seed deterioration is associated with the genotype, seed history and their physiological and chemical compositions. As in hemp, seed is determined as an orthodox seed that can be dried to low moisture content (mc) and stored at low temperature for several years (Suriyong S. et al., 2015).

When selecting storage systems for hemp, priority should be given to cleanliness, handling, conditioning and aeration capabilities.

Hopper bins with aeration are the best choice. Flat metal bins with aeration flooring are also a good choice. Mini–bulk bags have been used to store hemp seed as long as the moisture content is eight per cent or less.

To plan and perform seed processing operations a thorough knowledge of the physical and mechanical properties of seeds is required. The structure and operating parameters of processing machines are largely determined by the seed properties.

Based on the evaluated properties, seeds are classified by those that are the most suitable for industrial processing and the production of propagating material, food, or feed. Only certified seeds that have been graded based on their size should be planted to guarantee uniform field emergence and uniform stands, which are easier to cultivate and harvest Because sorting processes based on seed mass are difficult to implement in industrial practice due to considerable variations in seed size and mass, other physical parameters that are significantly correlated with the seed mass are used in sorting and cleaning operations (Kaliniewicz Z. et al., 2021). Therefore, the specific attributes of the processed seeds, the variations in the physical properties of seeds, and the correlations between these properties should be thoroughly examined before planning industrial operations.

CONCLUSIONS

Growers can improve the quality of hemp seed crops by minimizing their damage during harvesting, cleaning and handling. This can be achieved by harvesting a higher percentage of acceptable moisture content from seeds and by slowing down the speed of harvesting devices, harvesting and cleaning equipment.

To preserve grain quality, hemp seed must be properly dried, stored and monitored. Regardless of the storage method, the stored products must be periodically supervised and controlled, so that unfavourable phenomena can be prevented and combated.

The adequacy of artificial aeration or drying of hemp seeds depends on the moisture content of the seeds at harvest and the temperature / humidity conditions of the ambient air. It is essential to correlate the drying and conditioning capacity of the hemp seeds with the harvesting speed, being recommended to have an excessive drying capacity of the seeds, thus avoiding the risk of losing the quality of the seeds.

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