



## Application Note #64

# Common Sources of Contamination in Cannabis

As the legalization and medicinal utilization of cannabis increases around the world, so does the potential threat of contaminants making their way to consumers. Cannabis contains many naturally occurring microbes which benefit the plant and are not considered dangerous as they help fight off plant pathogens. However, the very fact that cannabis is a plant and not a synthetically made drug, increases the risk of contamination as the conditions needed to grow are ideal for the propagation of harmful microbes. Many cultivators are discovering that contamination is a huge risk no matter how careful they are. It can occur as early as the pre-harvest stage all the way through to harvest and post-production. The most common types of cross contamination are microbial but also include pesticides, heavy metals, and residual solvents. Most microorganisms do not present a problem at low levels and do not usually affect or infect humans. Similarly, most molds are relatively harmless and ubiquitous in the environment. However, in both cases, some may present a health threat when inhaled, particularly to immunocompromised individuals like some medical cannabis users with AIDS or those undergoing chemotherapy.

Unless cannabis is grown in a clean room with appropriate air filtration and other good growing and laboratory practices, it is inevitable that contaminants will be found on cannabis flowers and products made with them. Contamination can happen during the cultivation, harvesting, drying and curing, or extraction processes. Cannabis plants and products can pick up molds or bacteria while growing (particularly if they are grown outdoors or in an unsanitary indoor environment) or during subsequent handling and processing. This risk can also be exacerbated by poor production practices. For example, the harvesting or storage of cannabis plants while they are wet may create humid conditions which can lead to the growth of fungal mold or harbor mite infestations.

Cannabis is often exposed to contaminants when held in long-term storage. The worry of microbial contamination that affects consumers comes post-harvest, during storage and handling. In a study of black market cannabis in Spain, nearly 90% of the cannabis samples collected tested positive for E. coli. A 2017 study conducted in California found fungal and bacterial pathogens on 90 percent of the cannabis samples tested. In 2018, Steep Hill Labs collaborated with medical researchers at University of California, Davis - Medical Center and found that of 20 randomly selected samples submitted for testing, all had detectable levels of microbial contamination. Many had significant pathogenic microorganism contamination including Klebsiella, Pseudomonads, Enterobacteria, Aspergillus, and Botryotini. Some of the samples studied even harbored multiple

potentially pathogenic microorganisms (e.g., Aspergillus, Fusarium, Penicillium, Enterobacter, Pseudomonas). There are multiple ways cannabis can become contaminated, from employees to supplies, to environmental factors that are outside of your control. The best way to avoid an issue is by being aware of how cannabis can be contaminated in the first place.

## **EMPLOYEES**

Handling cannabis improperly is one of the most common ways to contaminate it. Handwashing is the most basic and effective strategy to prevent cross contamination at your farm or facility. Employees should wear clean scrubs and face masks when handling the flower, especially during post-harvest processing. Gloves should also be worn and changed every time they come into contact with something other than the plant. Ensuring your staff stays informed and follows best practices is ultimately the best line of defense.

## **EQUIPMENT AND SUPPLIES**

There are a lot of tools that are used to grow and process cannabis, such as buckets, scales, and scissors. Make sure that there are supplies for each room and that these supplies aren't being transferred from one area to another, which can increase the possibility of cross-contamination. Unsanitized equipment and supplies can easily cause contaminants in the form of mold, bacteria and even heavy metals from old equipment. If your machinery is contaminated, you can easily cross-contaminate your crop during any phase of the harvest process. This can either destroy your crop or become a major health threat if your final product is compromised. Be sure to establish robust equipment, surfaces and storage cleaning protocols. Make sure all countertops and workspaces are clean at all times using effective methods to eliminate pathogens.

## **HARVEST AND POST-HARVEST**

A large percentage of mold begins after harvest as a result of poor air quality and high moisture levels. When cannabis is first harvested, it is still full of moisture. This situation becomes a prime opportunity for the plant to become contaminated with mold. Mold can grow on almost any substance where moisture is present, and it reproduces through spores that can easily travel through the air and attach to your skin or plants. The damage can cause slight odor, plant spoilage, or even significant illness to the end user if left unchecked. Extra care must be taken to ensure that—during drying and curing—temperature, humidity, and air circulation are being controlled. Later after the drying phase, you will also want to confirm that your final product is safe by testing for mold, mildew and other microbial pathogens.

## **ENVIRONMENTAL**

A lot of cultivation facilities are in areas that do not have the best environments for growing cannabis. Both a personal and business decision should be made when it comes to choosing between indoor grow versus outdoor grow. Each type of grow has its pros and cons.

Indoor cannabis growers can potentially control the room's temperature, humidity, light intensity, and CO2 levels to achieve idyllic growth rates and conditions. The right combination of moisture, temperature, humidity, and light can help accelerate the growth of both cannabis and its pests. If contaminants or toxins enter one of your grow rooms, it may be difficult to detect and eliminate. This could result in you having to destroy the entire batch. Because fungal spores are extremely small, they can (and will) eventually get into a facility through the HVAC system. If growing indoors, you must completely sanitize your space to kill all microbes before you start. Unfortunately, while this will prevent most issues at inception, you must also make sure there is always proper (and filtered) ventilation to ensure no microbes enter via the HVAC system.

Cannabis manufacturers that choose to grow in outdoor greenhouses enjoy a low cost, low energy method that can use what nature gives in the forms of heat, light, and water. The idea is that the enclosed space traps humidity and controls wind while allowing the sun's heat to go through the panels and reach the plants. It can also keep away pests and prying animals. However, diseases are a serious recurring problem for greenhouse cannabis growers because the high humidity created in a tightly packed growth area creates conditions for mildew, mold, and other foliage pathogens to attack. Geographical areas that experience a drastic temperature and humidity shift between day and night can also promote mildew and mold.

Growing cannabis outdoors is the most natural and least expensive way. Plants grown outdoors with natural sunlight will grow to their full genetic potential and will have a full and natural terpene profile. Much less energy is required (no lights, no cooling/heating) and nutrients can be regenerated and recycled. However, plants grown outdoors are exposed to all of the elements, all the time. This includes the environment, weather, pests and animals, which can have a very big effect on the final product. For growing outdoors, it is common for cannabis producers to use pesticides and insecticides on their plants. Unfortunately, these pesticides can go on to create issues themselves if they are not thoroughly removed from the plant matter during processing as many fungicides and insecticides can be harmful to human health. Although pesticides are one way to control contamination, they're not a perfect solution, and every state treats them differently.

Policing the quality and safety of cannabis products is far from straightforward. At the federal level in the United States, cannabis is still considered an illegal drug. As a result, neither the Food and Drug Administration (FDA) nor the Environmental Protection Agency

(EPA) has provided any guidance on how to regulate contaminants or on which cannabis-related exposures can be considered safe. States have had to determine on their own how to protect millions of cannabis users, and the result is an uncertain and occasionally incoherent regulatory landscape with no consensus. Cannabis cultivators are familiar with the challenges faced as contaminants pose a potential threat to their consumers. By learning about the sources of contamination as well as prevention and remediation options, growers can more confidently face testing and consistently provide a safe product.

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