



IAQ RADIO+

Show Number: 736

Tess Eidem, PhD

IEQ, Bioaerosols and Worker Health in Cannabis Manufacturing

Good day and welcome to the IAQ Radio+ episode 736 blog. This week we welcomed Dr. Tess Eidem from the University of Colorado Boulder to talk about IEQ, Bioaerosols and Worker Health in Cannabis Manufacturing.

Dr. Eidem is a practitioner and researcher working with the cannabis industry. She is interested in IEQ issues from a very broad perspective such as relative humidity and ventilation to very specific topics such as Bioaerosol exposures when cultivating cannabis. This week we explored cannabis production, the worker health issues it poses and how we can learn from this new and quickly expanding area. Her most recent paper with Tara Nordgren and Mark Hernandez is on Bioaerosol Exposures and Respiratory Diseases in Cannabis Workers.

Nuggets mined from today's episode:

Bacteria infect people, plants and animals as pathogens. Microbes are good at adapting and becoming resistant to antibiotics. Even though microbes are tiny they have essential pathways within their cells that are vulnerabilities which can be exploited by researchers. DNA is the cellular blueprint.

"The central dogma of molecular biology deals with the flow of genetic information within a biological system. It is often stated as "DNA makes RNA, and RNA makes protein", although this is not its original meaning. It was first stated by Francis Crick in 1957, then published in 1958: The Central Dogma. This states that once "information" has passed into protein it cannot get out again." Wikipedia

All living organisms take parts of DNA and make RNA, which is translated into functional proteins. The way in which bacteria metabolize RNA is not targeted by clinically available antibiotics and is a good place to study small molecule inhibitors. Blocking bacterial-specific RNA metabolic processes and degradation presents a

novel class for development of new antibiotics. Discovery of new antibiotics takes a long time.

“ESKAPE is an acronym comprising the scientific names of six highly virulent and antibiotic-resistant bacterial pathogens including: Enterococcus faecium, Staphylococcus aureus, Klebsiella pneumoniae, Acinetobacter baumannii, Pseudomonas aeruginosa, and Enterobacter spp. The acronym is sometimes extended to ESKAPEE to include Escherichia coli.” Wikipedia

What types of projects does your lab work on?

Dr. Eidem works under Dr. Mark Hernandez UC Boulder’s Aerobiology and Disinfection Laboratory. This lab has a diverse portfolio of research projects including and not limited to: Aerobiology, Aeroallergens, Antimicrobial Intervention Strategies, Sterilization, Wastewater Treatment, etc.

Tell our audience about your background?

Historically, Dr. Eidem was a scientist who transitioned into a professor and then went into private industry where she worked for Columbia Care a large vertically integrated cannabis manufacturer in Rochester, NY. She worked in a supervisory capacity in cannabis production and quality management (e.g. environmental monitoring, inhouse QA/QC). Columbia Care grew cannabis flowers, extracted oil from the flowers, purified the oils through distillation and then formulated medical grade products according to very strict standard. Columbia Care’s products included: tablets, suppositories, tinctures and lotions. In 2020 the state of NY approved the sale of cannabis flowers.

Does FDA, CDC, USDA or ATF oversee the cannabis industry?

There is no federal oversight of the cannabis industry. As regulation and enforcement is left to the states; in many locales in the US, cannabis growing, and cannabis derived product manufacturing is akin to the wild west, with only piecemeal state regulations to protect consumers.

Which pathogen is of concern to cannabis growers and regulators?

One pathogen that regulators, growers, and cannabis derived product manufacturers are concerned about is *Aspergillus fumigatus*.

“*Aspergillus fumigatus* is a species of fungus in the genus *Aspergillus* and is one of the most common *Aspergillus* species to cause disease in individuals with an immunodeficiency.” - Wikipedia

Medical grade cannabis products are prescribed for immune compromised patients. Little data and research exist on cannabis products contaminated with pathogens. Some states (not all) mandate that products be tested for *Aspergillus fumigatus* contamination. If a product fails contamination testing, some states permit contaminated products to be remediated (e.g. ozone, irradiation, etc.). To avoid failing a contamination test, some growers and manufacturers use the strategy of “blind remediation”, remediating first and then testing for contamination, instead of addressing the root cause of contamination, as is required in food. US labeling laws in most states currently do not require remediated products to be identified as such on product labels, and even documentation to the state is often not available. Dr. Eidem has concerns over unintended consequences of some oxidative remediation methods (e.g.) terpene reactions, small particulate generation, cellular skeletons and harmful microbial metabolites left behind, etc.).

Is there a difference between cannabis and hemp? Hemp and cannabis are the same species. The difference between cannabis and hemp is how much THC they contain. Hemp is defined as having less than 0.3% of THC while cannabis contains more. Hemp doesn't have enough THC to cause a high, but it does contain CBD. Legally, hemp must contain less than .3% of THC. Hemp is not usually smoked. A high THCA (acid form) of hemp is making its way into the market, but this is essentially cannabis.

You can (illegally) obtain THCA from buying hemp, which isn't under the same controls as marijuana. Then, after heating it up, you can convert it into THC and get high. People use this method if they can't access marijuana or if it's illegal where they live. Another loophole exploited by the cannabis space.

Hemp is grown for fiber, seed oil and CBD. Another difference between hemp and cannabis is where and how they are cultivated. Hemp is often grown with both male and female plants outdoors (especially for harvesting seeds).

Most cannabis in the US is grown indoors using only female plants. When cannabis male plants aren't around; female cannabis plants make large flowers which are more desirable. Male cannabis plants produce pollen; so using only female cannabis plants eliminates pollen production and lowers occupational exposure and allergy risk to pollen, but not to other potentially harmful bioaerosols.

Cannabis Culture & Manufacturing

3 Steps- Cultivate, Dry Cure, Manufacture

Most cannabis strains are produced by cloning. Each clone is identical to their mom. Cannabis clones in their vegetative stage grow best and fastest in Warm Temperature with High Humidity. High Humidity and Warmth help push moisture and nutrients through the plants. When plants reach the flowering stage, the humidity is reduced, to reduce the mold threat. After flowering, plants are suspended on drying racks. Processing after harvesting is governed by the growers SOP (Standard Operating Procedures).

Worker safety is important- Ventilation, Air filtration and PPE are needed in the drying and processing areas where dust is most prevalent.

Dr. Eidem has encountered grow facilities that intentionally don't bring fresh air in or exhaust to save energy, maintain elevated CO2 levels, and prevent odor complaints. Among growers, processors and manufacturers, asking for forgiveness not permission is commonplace.

Bioaerosols Book Chapter

Seemingly high number of incidents related to cannabis, 10 of 800 in an investigation across industries in WA.

Respiratory exposure is a primary pathway.

Cannabis slurry known to cause allergic response to skin. Rashes from skin contact are not understood. Many people also cite mold exposure in these environments. VOC emissions during growing. Chemical, Biological and Particulate emissions during harvesting. There could also be chemical inhalation hazards during the processing of cannabis oils (solvents, volatiles from the oils itself, etc.)

Milling emissions- plant matter and microorganisms.

Similar organism found in water damaged buildings as cannabis facilities and at elevated levels (>500,000 CFU/m³ in some literature).

Few papers and research on the occupational risks.

There is no OSHA limit for cannabis levels.

Other considerations include: Viable pathogens? Endotoxins (lipopolysaccharides LPS), Beta glucans? Mycotoxins? Microbial metabolites? Protein allergies?

Shocking!

A cannabis worker in Massachusetts died due to a fatal asthma attack attributed to occupational exposure. OSHA dropped charges because there was no known research on occupational exposure to cannabis. Notably, there are agricultural dust studies which found: COPD, lung disease, neuro degenerative disease, IGE allergies and asthma.

Where to start when an IH receives call from cannabis grower/manufacturer?

There is a big disconnect between the IH and cannabis communities.

The cannabis community doesn't know what to do with the report and info they receive from the IH.

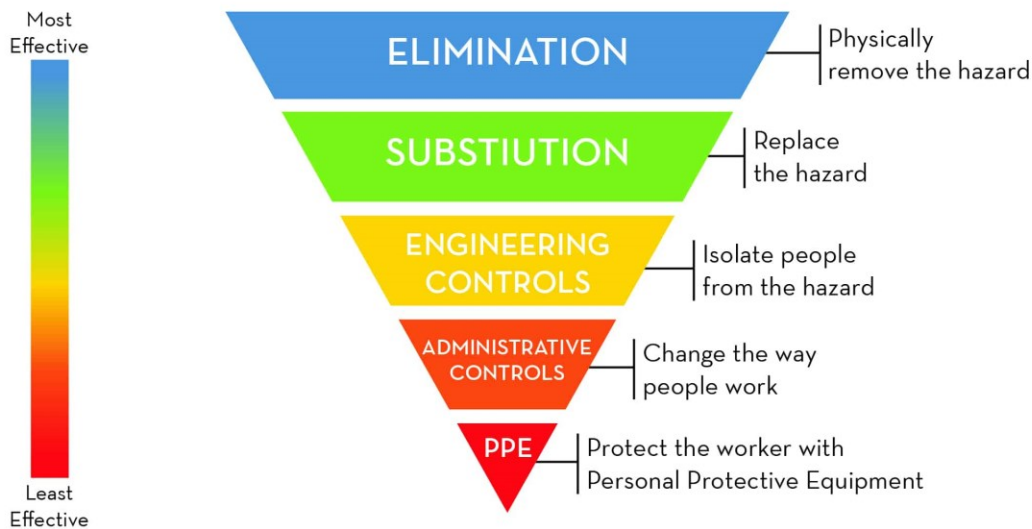
There are no PELs for mold spores, or LPS.

Many growers think that OSHA doesn't apply because cannabis is federally illegal, but this isn't true, workers are protected, and the industry needs to get up to speed, and start putting worker safety first.

Dr. Eidem recommends instituting an environmental monitoring program targeting high risk organisms that are airborne reducing levels to less than 1% frequency of detection. There is no established good sanitizing practice for cannabis, and cannabis operators do not have to follow good agricultural practices or good manufacturing practices, as other plant-derived foods. ATP can be used to monitor cleanliness of production equipment and work surfaces.

Dr. Eidem recommends: "The precautionary principle is a broad epistemological, philosophical and legal approach to innovations with potential for causing harm when extensive scientific knowledge on the matter is lacking. It emphasizes caution, pausing and review before leaping into new innovations that may prove disastrous."
Wikipedia

HIERARCHY OF CONTROLS



Innovations in Cannabis?

The Cannabis Industry is adaptive, practical, capable of doing much with little. The Cannabis Industry's business is Controlled Environmental Agriculture (CEA). Successfully using aquaponics, hydroponics and aeroponics in novel and productive ways that other CEA high-value crops can benefit from

How are odors controlled during growing?

Odor complaints from neighbors are very common. VOCs and terpenes cause the skunky smell. Carbon scrubbers adsorb the VOCs and HEPA filters retain the particulate.

Who are the world leaders in cannabis?

There is a perceived disconnect in the US, where products cannot be shipped across state lines. The US produces the best quality cannabis products.

What are some differences in cannabis regulation between Europe and the US?

In Europe cannabis is regulated by each country, in the US cannabis is regulated by each state. Uniform regulation in Europe results in more consistent products among manufacturers.

In Europe, there are recommendations that cannabis products must be tested for contamination before remediation. In the US there are workarounds: recovery and remediation zapping known contaminated product with radiation or "blind testing" zapping product with radiation before testing—this keeps decontamination

treatments undocumented and unreported to state regulators or even consumers and patients.

Comments by Dr. Eiden:

- The World Health Organization seeks development of more treatments and research for fungal pathogens, specifically those critical priority fungal pathogens.
- Washington State has done the most research on cannabis growing and manufacturing environments and the hazards to workers in these environments.
- The sensory (smell) and terpene content of cannabis products are important differentiating factors for consumers.

Z-Man signing off

Trivia:

Name the scientist who was first to systematically study living and fossil-single-cell organisms with microscopy, and who began what is today the oldest major collection of micropaleontology in the world.

Answer: Christian Gottfried Ehrenberg (1795 - 1876), The Ehrenberg collection

Sorry, there was no correct answer.