Scientific Brief

Accelerating Cannabis Testing: How Filter Plates Increase Throughput and Productivity

Introduction

States that legalize cannabis sales require that all cannabis products undergo analytical testing before purchase by the public. This trend has driven cannabis testing services to become a $1.1 billion industry in the U.S, and is expected to grow at a compound annual rate of 15.4% from 2020 to 2027.[1]

The leading factor propelling market growth is a rise in contamination cases. As the sale of medical and recreational cannabis products become increasingly popular, it is essential that products are properly tested for safe for consumption. Regulatory agencies have established maximum quantity limits for residual solvents, insecticides, pesticides, heavy metals, microbes, and mycotoxins found in cannabis plants. In recent years, laboratories have adapted a multitude of analytical testing techniques to protect consumers from these dangerous contaminants.

As the demand for testing services grows, in-house and independent laboratories are searching for new technologies that offer significant throughput advantages in cannabis testing workflows.

Five Common Cannabis Tests

There are five common tests that most laboratories perform to ensure cannabis products are safe for consumption.

1. *Potency testing:* this test determines the amount of CBD and THC in a given product. Full cannabinoid profiling requires a filtration step followed by ultra-high-performance liquid chromatography with diode array detection (UPLC-DAD). This workflow allows analysts to directly measure the amount of cannabidiolic acid in a sample.
2. *Pesticide testing:* This testing workflow typically requires extraction and cleanup steps to remove elements that may affect testing results. Then, the sample is analyzed using either liquid or gas chromatography with tandem mass spectrometry (LC-MS-MS or GC-MS-MS) for the qualification and quantification of chemical residues.
3. *Heavy metal testing:* Cannabis plants may extract heavy metals from surrounding soil. Larger labs use ICP-MS analysis, which is capable of detecting metals at sub-ppb levels. ICP-MS offers fast runtimes, high throughput, and superior sensitivity while yielding accurate and reliable results.
4. *Microbial testing:* With medical cannabis growing in popularity, it's critical that the product is free from harmful bacteria that might harm immunocompromised patients. Most laboratories employ qPCR analysis to detect microbial contamination. A filtration step removes plant debris from the sample. A second filtration step isolates the nucleic acid. The process uses polymerase chain reactions to amplify the DNA or RNA characteristic to the target microbes to detect their presence.
5. *Mycotoxin testing:* molds and fungi can release mycotoxins that are harmful to human health. After performing a sample filtration step, laboratories will use ultra-performance liquid chromatography-tandem mass spectrometry (UPLC-MS-MS) analysis to detect mycotoxin presence.

Incorporating Filter Plates Into Sample Preparation Workflows

The quality of your cannabis testing results will largely depend on the quality of the samples. Filtration is essential in preparing diluted cannabis samples for HPLC and LC-MS analysis. The filter removes particulates and buffers that can cause sub-optimal results.

In a typical cannabis sample preparation workflow, the plant is ground up and washed with a solvent or organic. The solution is then filtered through individual large pore sized membrane filters. To speed up this workflow, 24 individual samples can be placed in a 24-well filter plate with a 30-40 µm PP-PE membrane and processed simultaneously. While a 24-well plate is ideal due to its larger sample volume, a 96-well filter plate also can also be used. This filtration step screens out the plant material to provide a clean sample. At this point, specific buffers or extraction agents are added to the sample, depending upon the testing protocol. A final filtration step is required to clarify the sample for analysis by the HPLC or LC-MS instrument. For significantly faster processing, 96-well filter plates with wwPTFE membranes are now available. wwPTFE is a universal membrane that is well suited for identifying chemical residues. The membrane has broad chemical compatibility, resists harsh organics, and processes a variety of extraction buffers. This filtration is the final step before the sample enters the analytical instrument.

For labs performing microbial testing, sample preparation plays an important role in the quality of results. The goal in these tests is to identify yeast or bacteria that could be a contaminant on the plant material. After grinding or washing the plant, a 30-40 µm PP-PE 24-well filter plate can screen out plant debris, accelerating the process and providing a clean sample for subsequent nucleic acid isolation. For higher throughput, a 96-well nucleic acid binding plate could be used to extract the RNA from any contaminants that might be present. RT-PCR would follow to identify a specific set of organisms that represent typical microbial contaminants.

The Benefits of Incorporating Filter Plates in Cannabis Testing Workflows

In conventional cannabis testing, laboratories would employ syringe filters or spin devices to perform sample filtration steps. However, as the demand for testing increases, new processes are needed to achieve higher throughput. Filter plates offer an attractive opportunity to accelerate and optimize processing. From grind to find, totally automated workflows can be created that process both 24-well and 96-well plate formats on the same line. Filter plates can be used in automation systems which offer the following benefits:

- Higher throughput: filter plates and automation enable much faster processing. For example, a syringe filter processes one sample at a time, a spin device filters up to 24 samples at a time but is a manual process, while a filter plate can process 96 samples at a time.
- Increased tracking accuracy: when testing products from different customers and lots, barcoded filter plates allow precise, error-free sample tracking.
- Lower hold-up volume: Small sample volumes require a filter with a small effective filtration area (EFA) to reduce sample loss. The 96-well filter plate's low hold-up volume minimizes sample loss – an important benefit when laboratories are testing precious samples in triplicate for downstream processing.
- Common plate footprint: 24-well and 96-well filter plates have the same footprint dimensions, facilitating the implementation of automated workflows that can handle both plate formats.

Conclusion

The cannabis testing industry is experiencing extreme growth as more states legalize the sale of cannabis products for medicinal and recreational use. This dramatic growth is driving laboratories to develop testing workflows with significantly greater throughput and productivity. The adoption of 24-well and 96-well filter plates in automated workflows is producing exciting advances in cannabis testing processes. The new filter plates enable faster processing, greater tracking accuracy, and minimized hold-up volumes – offering laboratories new approaches to fulfill the growing demand for their services.

References

[1] Cannabis Testing Services Market Size, Share & Trends Analysis Report By Service Type, By End User, By Region (North America, Europe, Asia Pacific, Latin America, MEA), And Segment Forecasts, 2020 – 2027, Grand View Research, May 2020.

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