

PSYCHEDELICS 101: Emerging Trends, Applications and Advances in Psychedelics Quality Testing

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Embarking on a journey that blends the ancient allure of psychedelics with the precision of modern scientific inquiry, Shimadzu Scientific Instruments stands at the vanguard of a groundbreaking exploration into the therapeutic potential of magic mushrooms. This venture is more than a pursuit of knowledge; it's a commitment to the safety and well-being of consumers worldwide. As the field of psychedelic study continues to mature, Shimadzu remains committed to provide the research tools to ensure proper investigation to elucidate answers whether in general research, clinical trials, or across research disciplines.

To this end, the Pittcon 2024 San Diego, California symposium, titled 'PSYCHEDELICS 101: Emerging Trends, Applications, and Advances in Psychedelics Quality Testing', represented a significant gathering of minds and expertise in the field of psychedelic testing and handling [1]. This event provided a comprehensive overview of the latest trends, applications, and technological advancements critical to the quality testing of psychedelics. Experts from diverse backgrounds shared their insights and findings, contributing to a rich tapestry of knowledge that underscores the complexity and potential of psychedelic compounds in therapeutic applications. The symposium brought together a diverse audience for scientific collaboration, drawing researchers, clinicians, and industry professionals together to explore the nuances of psychedelic science. It is a privilege that Shimadzu was able to lead the way to bring together a network of stakeholders to trade and expand ideas to truly make the symposium greater than the sum of its participants. Through presentations, discussions, and collaborative initiatives, the symposium set the stage for future advancements in psychedelic research, paving the way for new discoveries and applications that could revolutionise mental health treatment.

While the need for a psychedelics workshop is largely due to more modern legalisation efforts, the field of psychedelics is decades in the making. The narrative of psychedelics is steeped in human history, weaving through the spiritual practices of indigenous tribes and the cultural revolutions of the 20th century, to emerge within the contemporary landscape of medical research. In the modern world, psychedelics arguably began with the discovery of lysergic acid diethylamide (LSD) by Albert Hofmann in 1943. In 1957, the term 'magic mushrooms' was coined by LIFE magazine, thereby bringing the term readily into the public consciousness. The use of psychedelics continued to gain interest and trials began, albeit with mixed opinions on psychedelics use. While some would argue that the uncertainty surrounding the use of psychedelics should have been addressed with more research, all work on its potential benefits abruptly stopped in 1970 with US President Nixon's listing psychedelics as a Schedule 1 substance. This meant the drug had no accepted medical use and had a high potential for abuse. Research ground to a halt, and it would take decades for research to restart. Certainly, efforts made by the Multidisciplinary Association for Psychedelic Studies (MAPS) and creation of the Johns Hopkins Center for Psychedelic Research in 1986 and 2006, respectively, gave some hope that research experimentation would continue [2,3]. As the publications have grown and research progressed into phase 2 and 3 trials, it is no surprise that there have also been movements to decriminalise and legalise psychedelic substances. In the USA, Oregon decriminalised psychedelics and created a system for the legal use of psilocybin to treat mental health disorders. Denver, Colorado became the first U.S. jurisdiction to decriminalise the possession of psilocybin. While a select few states have recognised the potential of psychedelics, Federal legislation has mostly remained unchanged [4]. However, in June 2023, the Food and Drug Administration (FDA) issued its first draft guidance on clinical trials using psychedelic drugs. Of note was the statement that "Psychedelic drugs show initial promise as potential treatments for mood, anxiety, and substance abuse disorders." This recognition of the potential benefits of psychedelics, while suggesting best practices for further investigation, marked a watershed moment, signaling a shift towards the acceptance and scientific exploration on the efficacy to treat neurological diseases [5].

With the momentum and relevance of psychedelic research established, there remains a need to develop and refine the analytical methodology. At the core of Shimadzu's approach to psychedelic research is our advanced technological arsenal, including mass spectrometry (MS) and liquid chromatography ultraviolet (LC-UV) detection. These tools are indispensable for the accurate and reliable analysis of psychedelic compounds, offering a window into their therapeutic potentials.

Mass spectrometry remains the gold standard in quantitation for its superior sensitivity and selectivity. Using a LCMS-8050 triple quadrupole mass spectrometer, multiple samples can be easily quantified once transitions and collision energies have been optimised.



An image generated by GPT

When combined with reversed phase HPLC, samples are cleaned of salts and elute off the column purified and in ideal solvent for mass spectrometry analysis. While matrix effects can still permeate this point of the analysis, tandem MS helps to eliminate interfering signals, improving limits of quantitation.

While this approach offers excellent data and easier method development, we recognise that an LC-UV approach is more amenable to customers who seek an accurate methodology at a lower cost. At Pittcon 2024, we presented an optimised LC-UV method that represented a significant milestone in our efforts to navigate the analytical challenges posed by emerging psychedelics. This method, enhanced by our Intelligent Peak Deconvolution Algorithm (i-PDeA), showcases our commitment to advancing the field of psychedelic research, with a keen focus on data integrity and safety. While this algorithm has proven effective for the separation of pharmaceutical components, we have extended its utility for removing interfering matrix peaks without the need for sample reinjection. Even in instances where multiple overlapping compounds are present, i-PDeA removed the impurities and improved the quantitation. This feature is freely available on LabSolutions software and must be paired with a compatible detection module. Perhaps of greatest benefit is the ability to reprocess data post-acquisition without the need for costly sample reinjection [6, 7].

Recognising the importance of psychedelics research, the Scottsdale Research Institute, led by key collaborator Dr. Sue Sisley, focuses on exploring psilocybin's efficacy in treating depression, a testament to our dedication to addressing critical mental health issues.

Additionally, we partner with Dr Kevin Schug at the University of Texas at Arlington (UTA), whose analytical expertise enhances the scientific rigor to psychedelic studies. The partnerships with Fritsch USA Milling and MilliporeSigma exemplify our commitment to employing state-of-the-art methodologies and products, ensuring our research adheres to the highest standards of quality and reliability. Utilising the Pulverisette to grind samples, automated settings allow for easy and reproducible sample processing and the option to cryomill samples provides for greater sample processing flexibility as matrixes change. From the mass spectrometry sample protocol developed at UTA [8], our modified protocol followed a similar schema with adjustments to ensure adequate sample concentration for the UV detector's sensitivity change and sufficient water in the sample to better match the mobile phase.

As the psychedelics' market matures, an opportunity to refine and improve old methods and terminology has emerged. A point of contention recognised during the Pittcon workshop was the continued use of the term 'potency' to describe the concentration of psychedelics, which was an error used in cannabis markets. While this may continue, as scientists we can strive to push proper terminology and methods for better written laws and information sharing. Furthermore, it was observed that some edibles are being mislabelled, an issue that has plagued the cannabis industry. Namely, compounds labelled as containing psilocybin and psilocin may actually contain no detectable amounts but may contain other ingredients such as opiates. Furthermore, even when measuring psilocybin, it is important to include a weight-adjusted psilocin content as both contribute to the total psilocin content in vivo.

As we continue to explore the therapeutic potentials of psychedelics, our guiding principles remain steadfast: a commitment to pioneering emerging markets and an unwavering focus on consumer safety. Shimadzu Scientific Instruments is not merely navigating the evolving landscape of psychedelic research; we are setting the course, ensuring that our endeavors are anchored in scientific integrity and a profound commitment to improving human health. Looking ahead, we envision a future where the therapeutic benefits of psychedelics are fully realised and integrated into mainstream healthcare, always with paramount consideration for consumer safety. We stand as active participants in the unfolding story of psychedelics, dedicated to uncovering truths that lie at the intersection of science, society, and safety, contributing to a future where mental health treatments are more effective, compassionate, and accessible.

Shimadzu's extensive expertise and experience across a broad spectrum of fields - academia, clinical research, environmental sciences, forensics, and pharmaceuticals - uniquely positions us to bring unparalleled clarity and standardisation to the realm of psychedelics quality control testing, as well as to pioneer the exploration of new therapeutic benefits. Our deep involvement in academia and clinical research

has honed our ability to navigate the complexities of scientific inquiry and drug development, ensuring the generation of reliable, reproducible data essential for advancing understanding. In environmental sciences, our precision in detecting and analysing minute quantities of substances translates into an unmatched ability to quantify psychedelic compounds accurately, regardless of their complexity. Our forensics experience, dealing with strict standards for evidence analysis, underpins our commitment to rigorous quality control and validation processes, critical for the standardisation of psychedelic testing. Furthermore, our pharmaceutical background ensures that our methodologies not only meet but exceed industry standards for drug safety and efficacy, facilitating the integration of psychedelics into therapeutic regimens. Together, these diverse areas of expertise allow Shimadzu to spearhead advancements in psychedelics research, bringing scientific rigor, innovation, and safety to the forefront of this emerging field.

Our journey through the psychedelic domain is just one example of our broader mission to harness the power of science for the betterment of humanity. Our work in the psychedelic space is a testament to our ability to adapt, innovate, and contribute to the evolving landscape of medical research, always with an eye towards the future and the health and safety of those we serve.

References

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