

# Characterization & Detection of Various pesticidal Residues in Different Matrices Using Multimode Raman Signals <sup>†</sup>

Shivam Dwivedi <sup>1,\*</sup>, Anjaneer Kumar <sup>1</sup>, Monika Chauhan <sup>1</sup>, Ajay Kumar <sup>2</sup>, Diwakar Chauhan <sup>3</sup>

<sup>1</sup> Division of Forensic Science, Department of Bio-Sciences, School of Basic and Applied Sciences, Galgotias University, Greater Noida, India, shivamdwwivedi204@gmail.com (S.D.), anjaneekumar634@gmail.com (A.K.), monika0283@gmail.com (M.C.);

<sup>2</sup> Division of Lifesciences, Department of Bio-Sciences, School of Basic and Applied Sciences, Galgotias University, Greater Noida, India; kumarajayitm@gmail.com (A.K.);

<sup>3</sup> Division of Chemistry, Department of Basic Sciences, School of Basic and Applied Sciences, Galgotias University, Greater Noida, India; chauhan.diwakar@gmail.com (A.K.);

\* Correspondence: shivamdwwivedi204@gmail.com (S.D.);

<sup>†</sup> International Conference on Advanced Materials for Next Generation Applications, 29th – 30th September, 2021 (AMNGA-2021)

**Received: 10.09.2021; Revised: 20.09.2021; Accepted: 21.09.2021; Published: 29.09.2021**

**Abstract:** Fruits and vegetables are major components in the human diet as they are required for growth and development, and these commodities are protected by chemical substances called agrochemicals. The residues of agrochemicals present in fruits and vegetables result in various types of ailments on their consumption. Therefore, there is a necessity to develop simple and rapid methods to characterize and quantify these compounds. Though various spectroscopic, chromatographic, and other hyphenated techniques are also being used for their detection, such techniques require comparatively more samples, more solvents, and much time for their analysis. Thus, there is a need for such robust techniques like Raman spectroscopy which can solve out all these troubleshooting as it is a powerful tool that is being used in different domains of sciences such as analysis of fruits, vegetables, and such other edible commodities for the food safety quality management and to analyze chemical and biological hazards. Due to its non-destructiveness, the flexibility of sample preparation, and interpretation of qualitative and quantitative results using fingerprint wavelengths, it is an emerging technique that attracts scientists' attention towards itself. Additionally, this technique resolves the limitations of other techniques and makes this technique more convenient and precise. Different modes of Raman spectroscopy (SERS, TERS, AFM Raman spectroscopy) show more precise results using nano-particles and quantifying the substances up to nano-gram to pico-gram. Therefore, this review article will divulge the characterization and detection of the different pesticides residues using various modes of Raman spectroscopy with their advantages.

**Keywords:** agrochemicals; Raman spectroscopy; vibrational spectroscopy; food safety.

© 2021 by the authors. This article is an open-access article distributed under the terms and conditions of the Creative Commons Attribution (CC BY) license (<https://creativecommons.org/licenses/by/4.0/>).

## Funding

This research received no external funding.

## **Acknowledgments**

We sincerely thank Dr. Arvind Kumar Jain, Dean of School of Basic and Applied Sciences, Galgotias University, Greater Noida for tendering his support and guidance.

## **Conflicts of Interest**

The authors declare no conflict of interest.