**Training and evaluating** **machine learning algorithms for microplastics classification through Raman spectroscopy**

Subanaveen P1, Pooja S1, and Rajapandiyan Panneerselvam2\*.

*1Department of Physics, SRM University – AP, Andhra Pradesh, India*

*2Raman Research Laboratory (RaRe Lab), Department of Chemistry, SRM University – AP, Andhra Pradesh, India*

Email: [rajapandiyan.p@srmap.edu.in](mailto:rajapandiyan.p@srmap.edu.in), subanaveen\_p@srmap.edu.in.

**Abstract:**

As emerging pollutants of concern, microplastics have been found in different water environments and have an impact on human health through the aquatic food chain. To advance our understanding of the traceability and environmental fate of microplastics, reproducible and accurate methods, techniques, and analytical methods are necessary for MP type identification and characterization. In this study, a random forest model is utilized for the fast identification and differentiation of Raman spectra for the most common types of microplastics (polyethylene (PE), polystyrene (PS), polycarbonate (PC), and polyvinyl chloride (PVC)) in the environment. The random decision forest input data is reduced to a combination of highly discriminative single wavenumbers selected using a machine learning classifier. This dimension reduction allows input from systems with individual wavenumber measurements and decreases prediction time. Therefore, we demonstrated the potential of using random forests to identify and distinguish microplastics. Our results suggest that the combination of Raman spectroscopy and machine learning holds promise for developing effective microplastic particle detection and monitoring strategies.

**Keywords:** Surface Enhanced Raman spectroscopy (SERS), Microplastics, Machine learning algorithms.