

## Microbial Diversity Assessment in Household Point-of-Use Water Sources Using Spectroscopic Approach

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**Abstract :** Sustaining water quality is critical in order to avoid any harmful health consequences for end-user consumers. The detection of microbial impurities at the household level is the foundation of water security. Water quality is now monitored only at water utilities or infrastructure, such as water treatment facilities or reservoirs. This research provides a first-hand scientific understanding of microbial composition presence in Malaysia's household point-of-use (POUs) water supply influenced by seasonal fluctuations, standstill periods, and flow dynamics by using the NIR-Raman spectroscopic technique. According to the findings, 20% of water samples were contaminated by pathogenic bacteria, which are Legionella and Salmonella cells. A comparison of the spectra reveals significant signature peaks ( $420\text{ cm}^{-1}$  to  $1800\text{ cm}^{-1}$ ), including species-specific bands. This demonstrates the importance of regularly monitoring POU's water quality to provide a safe and clean water supply to homeowners. Conventional Raman spectroscopy, up-to-date, is no longer suited for real-time monitoring. Therefore, this study introduced an alternative micro-spectrometer to give a rapid and sustainable way of monitoring POU's water quality. Assessing microbiological threats in water supply becomes more reliable and efficient by leveraging IoT protocol.

**Keywords :** microbial contaminants, water quality, water monitoring, Raman spectroscopy

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