Rapid identification of day to day plastics

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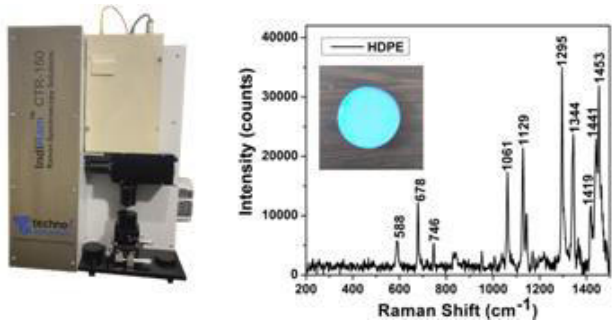

Characterization of plastic used in day to day life using Raman Spectroscopy

Polypropylene, Polyethylene and Polyethylene terepthalate are the identified plastics in the day to day life samples.

1. Introduction

Usage of plastics increases phenomenally over the years due to its various applications in textiles, food industries, modern equipments, electronics, etc. Polypropylene(PP), Polyethylene(PE), Polyvinyl Chloride(PVC) and Polyethylene terepthalate (PET) are among the most commonly used plastics. Recovering the waste plastic from different usage and reprocessing it to a beneficial product is crucial in utilization and to control plastic pollution. Characterization of plastics plays important role in this process and it has been carried out by various techniques such as spectroscopy, chromatography and thermal analysis**.** The vibrational spectroscopy has the advantage over the other techniques since its being rapid and inexpensive. Raman spectroscopy, an inelastic scattering vibrational spectroscopy technique, is one of the quickest and simplest to characterize plastics as it does not involve complicated sample preparation process. In the current study, plastics used in day to day life are collected and characterized using Raman spectroscopy.

2. Materials and Methods

The Raman spectroscopy experiments were performed using an IndiRam CTR-500C Raman spectrometer, TechnoS Instruments Ltd., Jaipur, India. A laser excitation source of 532 nm emission wavelength was used with 25 mW power, exposure time of 5 sec and No. of acquisition is 5. Samples such as water bottle, milk pouch, and biscuit wrapper and soyastick wrappers were used in the current study.

3. Results and discussion

Figure 1 (a-d) shows the Raman spectra acquired from biscuit wrapper, milk Pouch, water bottle, and soyastick wrapper respectively. Biscuit wrapper has been identified as polypropylene in fig.1 (a) from its characteristic peaks at 810 and 843 cm^{-1} which are due to CH_2 vibrational modes[1]. The peaks at 1062 and 1128 cm^{-1} in fig.1 (b) from the spectra of milk pouch are due to C–C symmetric and asymmetric stretch respectively in LDPE[2]. CH_2 twist mode at 1295 cm^{-1} and CH_2 bending modes are observed at 1418, 1441, and 1464 cm^{-1}[2]. Raman spectra of LDPE and HDPE are similar,

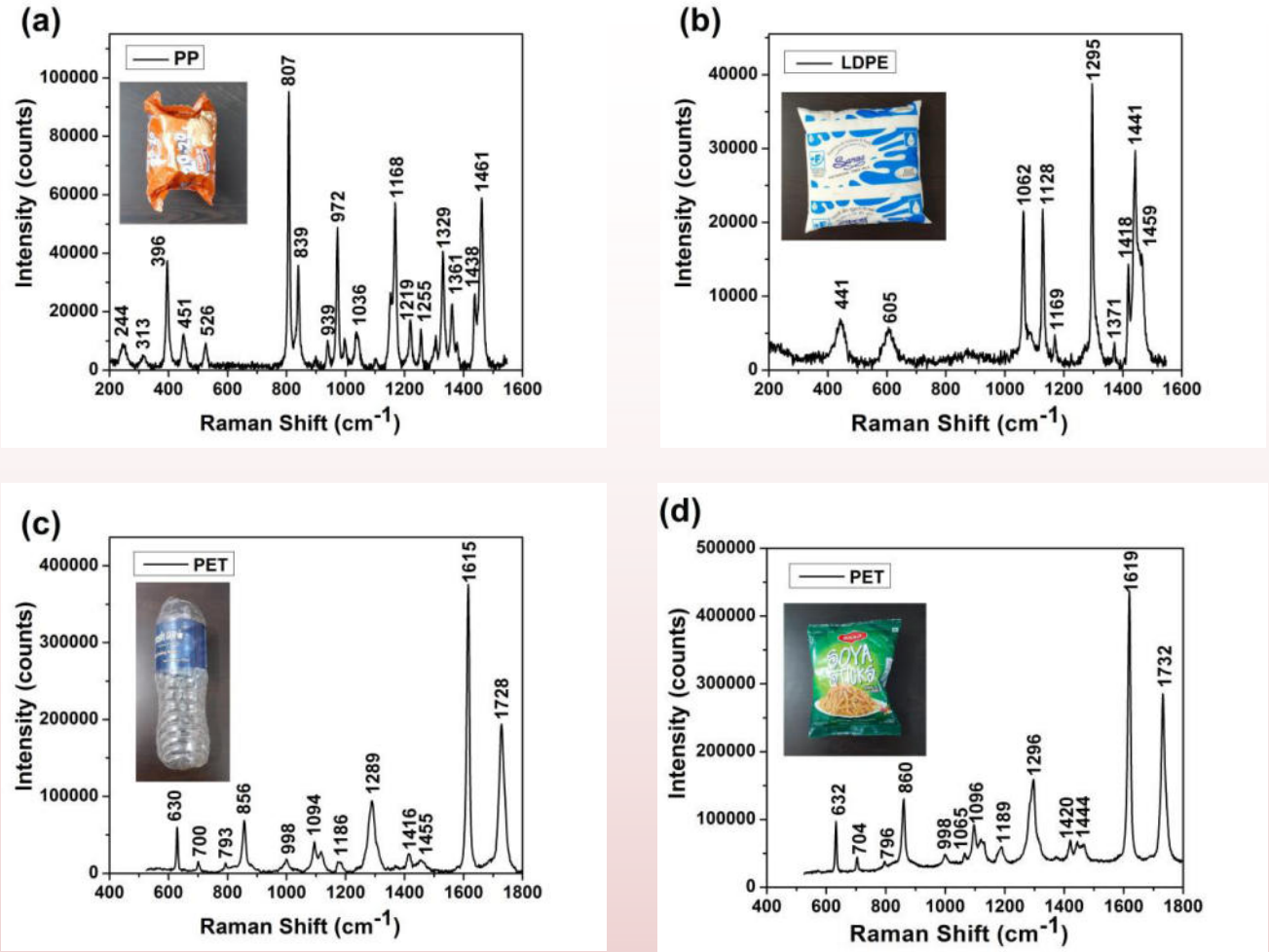

Fig.1 Raman spectra of day to day plastics a) Biscuit Wrapper b) Milk Pouch c) Water bottle and d) Soyastick wrapper

but in literature difference in intensity at 1460 cm^{-1} peak of LDPE and HDPE has been observed[3]. Strong peak of the Raman spectra from water bottle at 1615 cm^{-1} in fig.1(c), corresponds to symmetric stretch of benzene ring of PET[4]. The spectra of soyastick wrapper also found to be PET and it is shown in fig.1 (d). Thus, a very quick identification of plastics is made using the Raman spectroscopy which shows the uniqueness and the strength of the technique.

References:

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Conclusion

In this application note, the vibration modes of commonly used plastics were quickly identified by using Raman spectroscopy.