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Identification of Environmental Plastics – A Teaching Laboratory Exercise

Background

Plastic pollution poses a significant environmental concern due to its extensive distribution and potential ecological impacts. Environmental plastics, categorized into micro-, meso-, or macro debris based on size, persist in the environment owing to their chemical structure, which resists natural degradation processes. This persistence leads to their accumulation in ecosystems, posing risks to marine life, terrestrial organisms, and human health through bioaccumulation and ingestion. FTIR analysis of environmental plastics enables the identification of their types, abundance, and degradation pathways, offering crucial insights for mitigating their environmental impact through effective pollution management strategies.

Instrument and Measurement Conditions

In this experiment, the IRSpirit Fourier transform infrared spectrophotometer with a QATR-S accessory (shown in Fig. 1) is recommended for analysis. The measurement conditions are listed in Table 1. The *Plastic Analyzer* method package is used which includes proprietary *UV-Damaged Plastics Library*, *Thermal-Damaged Plastics Library*, and *Macro Program for IRPilot™.*

Fig. 1 IRSpirit with QATR-S Mounted

Table 1 Measurement Conditions

Instrument	: IRSpirit QATR-S (wide band diamond crystal)
Resolution	: 4cm^{-1} (default in Plastic Analyzer)
No. of Scans	: 45 (default in Plastic Analyzer)
Apodization Function	: Sqr Triangle (default in Plastic Analyzer)
Detector	: DLATGS
Spectral Library	: UV-Damaged Plastics Library, Thermal-Damaged Plastics Library, Shimadzu Standard Library

Sample Preparation

Students should collect small fragments of discarded plastics from everyday locations, their own gardens, or from the grounds of their university or college.

Operating Procedure

1. Open *IRPilot*™ from *LabSolutions*™ *IR.*
2. On the Start Page, input the desired destination file path for data storage in the [Folder Name] box. Next, input the sample name in the [Sample Name] box. Then, select [Plastic Analysis] from the programs listed.
3. Select [Background Scan].
4. Set the sample on the ATR crystal and secure in place using the clamp.
5. Select [Measurement].
   (The measurement and spectrum search will be automatically performed, and the top 10 matches will be displayed in the Hit List.)
6. Select [Yes] when prompted, to print the report.