

Identification of monomers with Raman spectroscopy

Polymers are comprised of macromolecules that are in turn comprised of numerous identical or similar structural units that are referred to as monomers. This Application Note shows the convenient identification of conventional monomers within seconds using the portable Mira M-1 spectrometer. Monomers such as

styrol, various alkyl methacrylates, divinylbenzene, ethylene glycol, phenol, terephthalic acid and urea have been investigated. Additives or inhibitors such as benzoquinone can be identified quickly and unambiguously.

INTRODUCTION

Today's industry, but also daily life, cannot be imagined without polymers. With the variety of the available polymers on the market, the number of monomers and especially additives, used to endow the polymers with special properties, is enormous.

Many polymer manufacturers, if not all, use their own special mixtures and additives, commonly carrying proper names, making it hard to get an

idea of the function of certain additives. Nevertheless, all use the same monomers, which also means, that every polymer manufacturer will profit from a quick raw material check before feeding the raw materials into their polymerization process.

In this study, a library of commonly used monomers was built and subsequently used for the identification of unknown monomers.

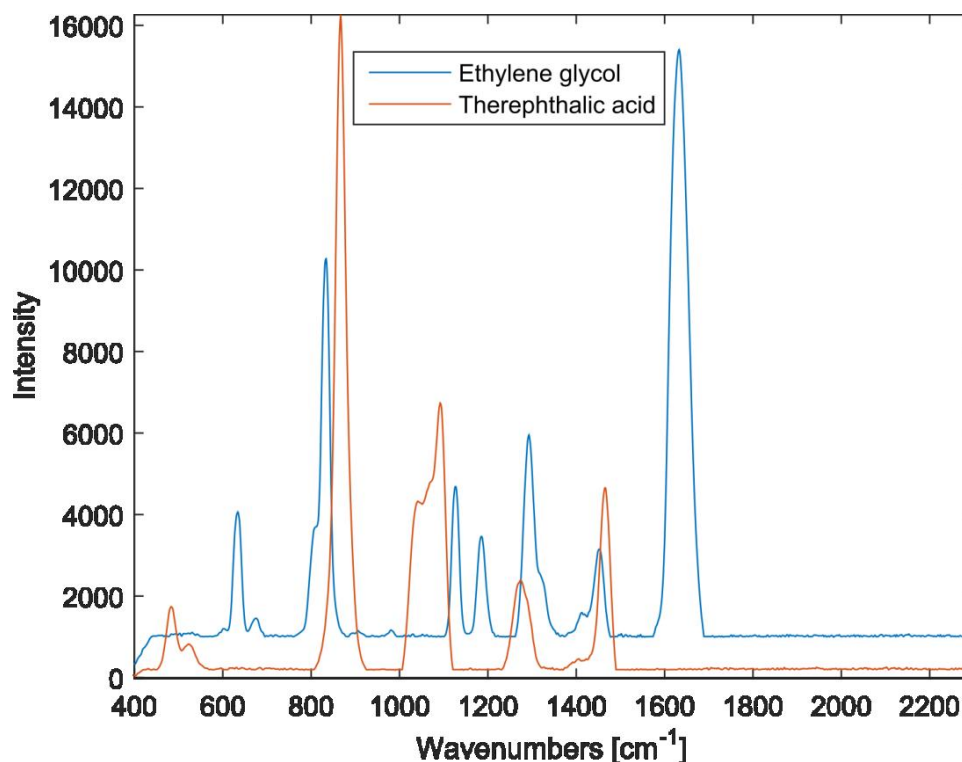


Figure 1. Raman spectra of ethylene glycol and terephthalic acid

EXPERIMENTAL

All spectra were measured using the Mira M-1 handheld Raman spectrometer in auto-acquisition mode, i.e. integration times were determined automatically. A laser wavelength of 785 nm and the Orbital-Raster-Scan (ORS) technique were used. Some of the monomers were filled into vials and analyzed

using the vial holder attachment, while other samples were analyzed directly in their plastic container using the long working distance (LWD) lens.

The following monomers were used in this study:

Monomer	Meas. mode	Usage
Divinylbenzene (DVB)	LWD	Styrene-DVB Copolymer (S-DVB)
Ethylene glycol	vial	Polyethylene terephthalate (PET)
Ethyl methacrylate	vial/LW	Paraloid B-72 (thermoplastic resin used for surface coatings and coservations)
Formaldehyde	vial	Polyoxymethylene (POM), Bakelite, urea-formaldehyde (UF), melamine-formaldehyde (MF)
Urea	vial	Urea-formaldehyde (UF)

Hexamethylenetetramine (HMTA)	vial	Hardening component for phenolic resins
Hydroquinone	vial	Polyether ether ketone (PEEK)
Methyl methacrylate (MMA)	LWD	Poly(methyl methacrylate) (PMMA)
Phenol	vial	Bisphenol-A (a precursor to polycarbonates and epoxide resins)
Styrene	vial	Polystyrene (PS), S-DVB
Therephthalic acid	vial	Polyethylene terephthalate (PET)

RESULTS AND DISCUSSION

To build the library, the samples were measured in vials but also with the LWD lens through amber bottles. Using the Mira Cal software, the

spectra were investigated to check for visible differences between the monomers. **Figure 2** shows an overlay of all the analyzed monomers.

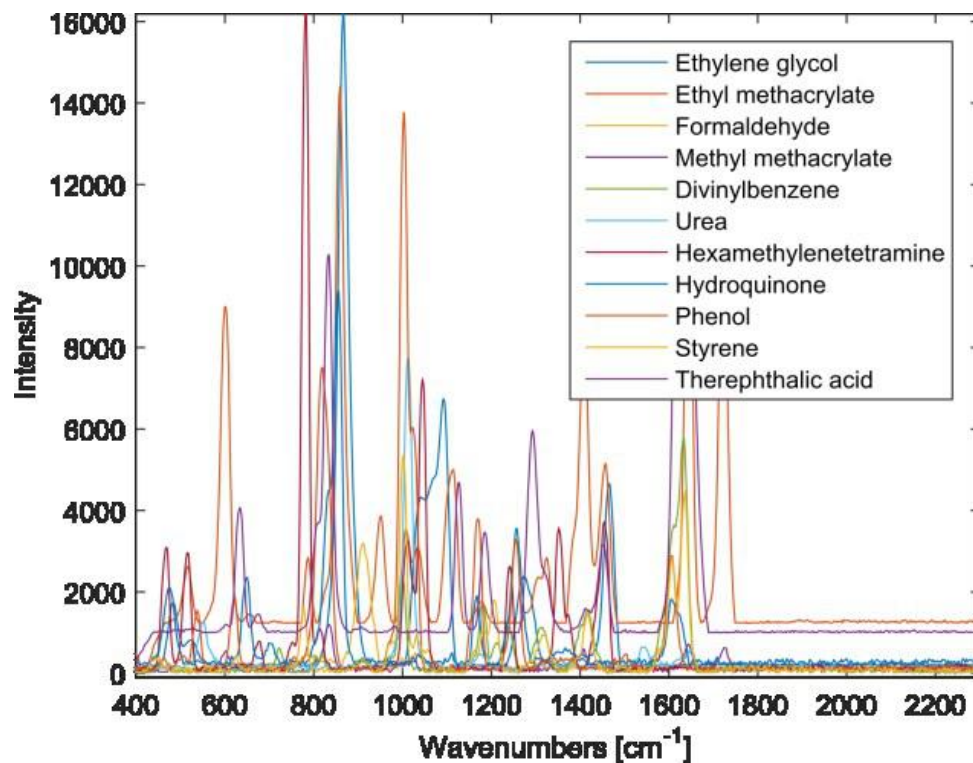


Figure 2. Overlay of the analysed monomers.

When using Mira in its autonomous mode, i.e., mode, without the use of the Mira Cal software, secure identification of the monomers was

achieved, and the correlation coefficients were always greater 0.95.

CONCLUSIONS

This study shows that Mira M-1 can be used to unambiguously identify polymer raw materials used to produce commonly used polymers such as PET, POM and PEEK by measuring their spectra and matching them with a library. The

identification takes just a few seconds. Additionally, additives or inhibitors such as benzoquinone can be quickly and unambiguously identified.

CONTACT

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CONFIGURATION



MIRA P Advanced

瑞士万通快速拉曼分析 (MIRA) P 是一款性能大的手持式拉曼光,可用于各材料的快速无定和,例如物有效成分和形。MIRA P 小而固,具有高效的,配了万通独一无二的逐格描技 (ORS)。MIRA P 符合 FDA 邦法 21 章第 11 款的定

。Advanced Package 包含一个附加透,可用它直接分析材料或者在材料容器中分析(3b 激光器),有一个小管支架套筒用于分析玻璃小管中的本(1 激光器)。