

Differentiating plant fibers using Py-GC/MS

[Background] Forensic investigations often must be done quickly and accurately. The analytical method needs to be simple. Evolved gas analysis (EGA)-MS is a simple technique that enables the analyst to differentiate various polymers based on differences in the EGA thermogram and or the average mass spectrum of the major peak in the thermogram - see PYA3-12E. However, fibers having the same or very similar structures are difficult to differentiate using just the EGA results. Py-GC/MS provides information about the sample that can be used to differentiate between fibers with similar chemistries. This technical note describes how Py-GC/MS can be used to differentiate cotton and hemp. Cellulose is the major component of both plant fibers and dominates both EGA thermograms.

[Experimental] Flash pyrolysis (600°C) of cotton and hemp were obtained using the conditions listed below.

[Results] Fig. 1 compares of the results obtained by EGA-MS for cotton and hemp. Both the thermograms and the averaged mass spectra of the main peaks (300-400°C) for cotton and hemp are very similar, making it difficult to unequivocally identify the fiber. Pyrograms obtained by Py-GC/MS are shown in Fig. 2. Both pyrograms are similar; levo-glucosan is the main peak; however, peaks marked by an "●" are different. Also, there are a series of peaks derived from wax are evident only on the hemp. As shown here, samples with the same major component can be differentiated by using Py-GC/MS and focusing on the small differences in the pyrograms.

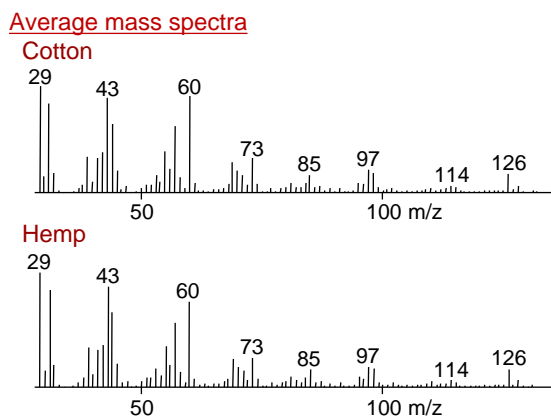
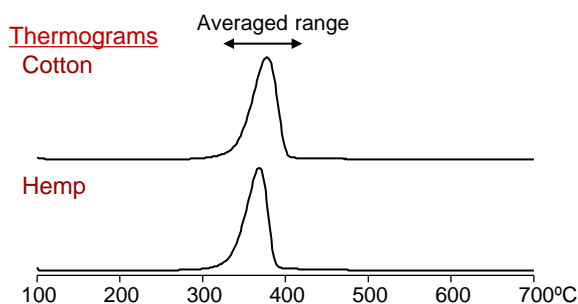


Fig. 1 Comparison of the thermograms and averaged mass spectra

Pyrolysis temp.: 100 - 700°C (20°C/min), GC oven temp.: 300°C
EGA tube: deactivated metal tube, L=2.5 m, i.d.=0.15 mm
Column flow rate: 1 mL/min; He, split ratio: 1/50, sample: ca.300 µg

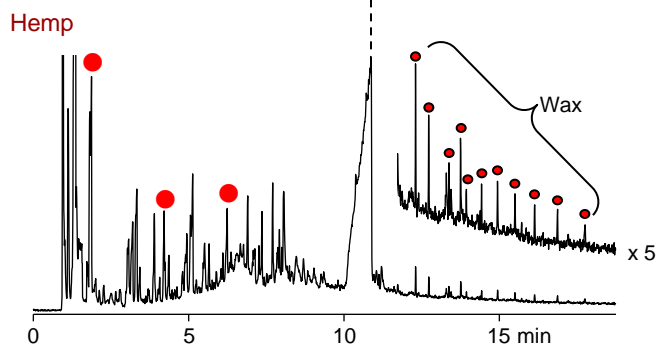
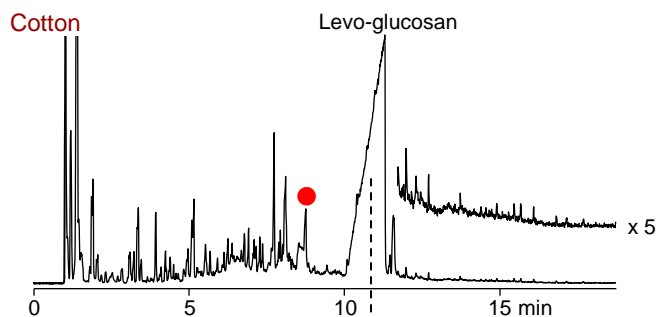


Fig. 2 Comparison of the pyrograms

Pyrolysis temp.: 600°C, GC oven temp.: 40 - 320°C (20°C/min, 6 min)
Separation column: Ultra ALLOY®-5 (5% diphenyl 95%dimethylpolysiloxane)
(L=30 m, i.d.=0.25 mm, df=0.25 µm)
Carrier gas flow rate: 1 mL/min; He, split ratio: 1/50, sample: ca.100 µg

Keywords : fiber identification, evolved gas analysis, Py-GC/MS

Products used : Multi-functional pyrolyzer, Vent-free GC/MS adapter, UA-5, Deactivated metal capillary tube

Applications : Forensic investigation

Related technical notes : PYA3-012E

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