

# Determination of methamphetamine and 3,4-methylenedioxy-methamphetamine in hair by thermal desorption-GC/MS

**[Background]** The illegal use and abuse of drugs affect human health and pose serious threats to social stability and safety. Crystal meth is an odorless or slightly bitter transparent crystal and composed mainly of methamphetamine (MAMP). Ecstasy is a type of synthetic drug, and 3,4-methylenedioxymethamphetamine (MDMA) is one of the main active components. In drug abuse testing, hair serves as a unique medium with unparalleled advantages and provides a comprehensive reflection of the history, extent, and types of drug abuse. However, traditional analytical methods for detecting drugs in hair often require large sample sizes and extensive use of organic reagents, making the pretreatment process complex. In this note, thermal desorption (TD)-GC/MS was employed for the determination of MAMP and MDMA in hair, eliminating the need for tedious pretreatment processes.

**[Experimental]** The analytical system consists of a vertical microfurnace pyrolyzer (EGA/PY-3030D) directly coupled with a GC/MS system. Decontaminated hair aliquot of 0.30 mg was put in a sample cup. The sample cup was first mounted on the waiting position of the pyrolyzer held at room temperature, and then dropped into the pyrolyzer furnace preheated at 350 °C, and thermally desorbed gases were separated and detected by GC/MS with a selective ion monitoring mode.

**[Results]** Fig. 1 shows mass spectra of MAMP and MDMA standard solutions and the base peak was observed at  $m/z$  58. In calibration curves for MAMP and MDMA, linearity ranged from 2 to 200 ng/mg in hair with the correlation coefficients larger than 0.9991 for both. The limit of detection was 0.7 ng/mg, and the limit of quantification was 2.0 ng/mg for both. The values of relative standard deviation ranged from 1.49% to 8.31% and the recoveries for spike tests ranged from 89.5% to 112.6%. Five positive hair samples and three negative hair samples were successfully measured. Typical EICs at  $m/z$  58 for negative and positive samples as well as standard solution were shown in Fig. 2. The results on hair samples show that the amounts of MAMP in positive hair samples were 14.8 to 58.7 ng/mg, while those of MDMA were below LOQ. The amounts of MAMP and MDMA in negative hair samples were below 4.5 ng/mg and 3.0 ng/mg, respectively. In summary, negative and positive hair samples were able to be identified easily through the proposed TD-GC/MS method.

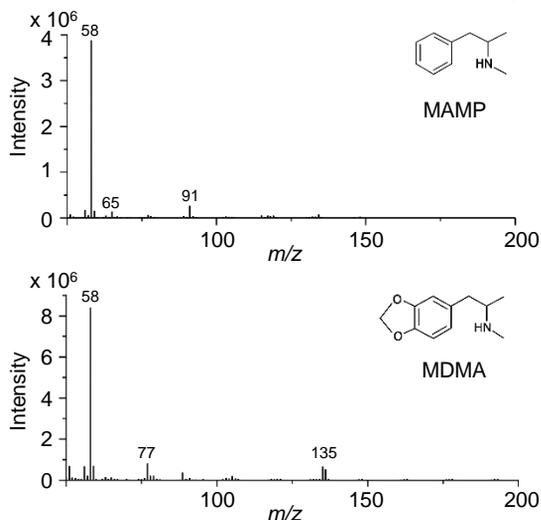


Fig. 1 Mass spectra of MAMP and MDMA standard solutions.

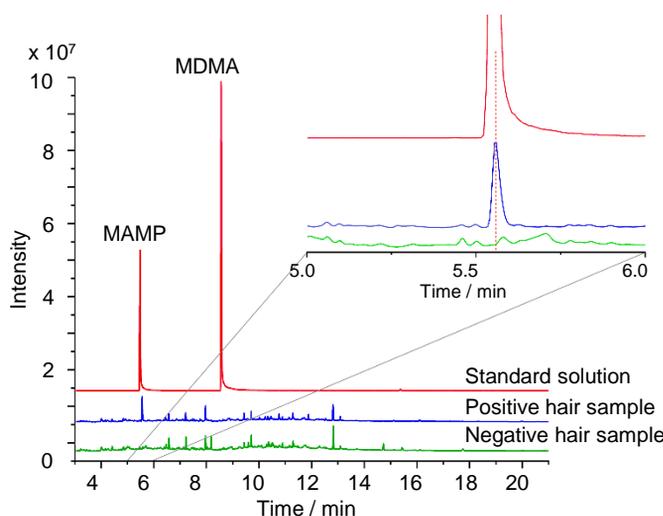


Fig. 2 EICs of MAMP ( $m/z$  58) and MDMA ( $m/z$  58) in standard solution, and TD chromatograms of positive and negative hair samples.

Pyrolyzer temp.: 350 °C, GC inlet temp.: 250 °C, GC oven temp.: 50 °C (20 °C/min) - 150 °C (20 °C/min, 1 mi hold) - 250 °C (10 min hold)  
 Split ratio: 30:1, Column: Rtx-5MS (5 % diphenyl 95 % dimethylpolysiloxane),  $L=30$  m, i.d.=0.25 mm,  $df=0.25$   $\mu$ m  
 Carrier gas linear velocity: 36.3 cm/s (He), MS interface temp.: 250 °C; Ion source temp.: 230 °C, MS scan mode: SIM mode ( $m/z$  58, 65, 91 for MAMP;  $m/z$  58, 77, 135 for MDMA).

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**Product used :** Multi-functional pyrolyzer

**Applications :** Analysis of drugs in human hair

**Related technical notes :** [PYA2-034E](#), [PYA1-137E](#)

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