

Analysis of medium-density fiberboard (MDF) using pyrolyzer

Part 1: Identification of constituents by Heart-Cut EGA-GCMS

[Background] MDF (medium-density fiberboard) is made from wood chips, which are steamed and decomposed, and then thermoformed by adding adhesives (such as urea and melamine resins) and water-repellent additives. The volatile organic compounds from MDF cause sick building syndrome, and it is necessary to analyze the constituents other than wood. In this note, the analysis of the composition of MDF by evolved gas analysis (EGA) and heart-cut EGA-GC/MS is described.

[Experimental] The surface of an MDF sample was scraped off with a cutter knife and placed in a sample cup. Measurements were done using a GC/MS system with a Multi-Shot Pyrolyzer (EGA/PY-3030D) directly interfaced to the GC injector. In the EGA-MS analysis, a deactivated metal tube was connected between the GC injector and a quadrupole MS, and the furnace was heated at 20 °C/min from 100 °C to 700 °C to obtain EGA thermograms. In the heart-cut EGA-GC/MS, the deactivated metal tube was replaced with a separation column, and the furnace was heated at 20 °C/min from 100 °C to 260 °C, 260 °C to 400 °C, and 400 °C to 500 °C, respectively for the temperature zones A, B, and C (Fig. 1), followed by heart-cutting using a Selective Sampler. The volatiles generated were temporarily cryo-trapped in each temperature zone and then analyzed separately.

[Results] The EGA thermogram of the MDF surface is shown in Fig. 1, and the chromatogram of each zone (A, B, C) is shown in Fig. 2. The gases generated in Zone A were mainly saturated hydrocarbons of a water repellent, pyrolyzate (isocyanic acid) derived from the adhesive (urea resin), and melamine. Pyrolyzates of wood and melamine-derived compounds were observed in Zone B, and pyrolyzates of styrene methacrylate copolymer, presumably originated from the surface paint, in Zone C. In summary, the heart-cut EGA-GC/MS of the MDF surface revealed that water-repellent, wood, and surface paint were used as the major constituents.

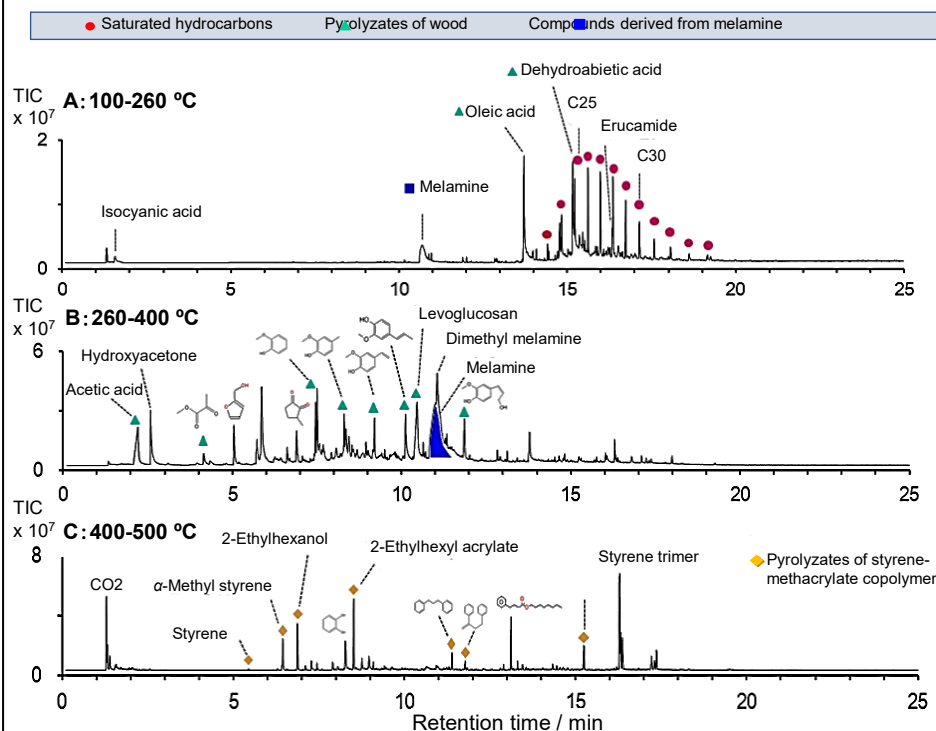


Fig. 2 Chromatograms obtained by Heart-Cut EGA-GC/MS

TD temp.: 100-260 °C (20 °C/min, 1 min hold), 260-400 °C (20 °C/min, 1 min hold), 400-500 °C (20 °C/min, 1 min hold), Cryo-trapped by MicroJet Cryo-Trap
 GC Oven: 40 °C (2 min hold) - 320 °C (20 °C/min, 14 min hold)
 Separation Col.: UA⁺-5 (5 % diphenyl 95 % dimethyl polysiloxane, L=30 m, i.d.=0.25 mm, df=0.25 μm, Column flow rate: 1 mL/min, Split ratio: 1/50)
 MS scan range: m/z 29 - 600, Sample amount: 0.20 mg

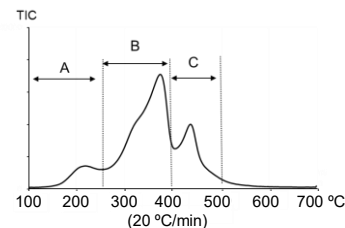


Fig. 1 EGA Thermogram

Py temp.: 100 °C - 700 °C (20 °C/min),
 EGA tube: UADTM-2.5N,
 Split ratio: 1/50, Tube flow rate: 1 mL/min,
 MS scan range: m/z 29 - 600,
 Sample amount: 0.20 mg.

Keywords : Medium Density Fiberboard, MDF, Wood, EGA, Thermal Desorption-GC/MS, Heart Cut EGA-GC/MS

Products used : Multi-Shot Pyrolyzer, UADTM-2.5N, UA⁺-5, Vent-free GC/MS adapter, MicroJet Cryo-Trap, Auto-Shot Sampler, F-Search

Applications : General polymer analysis, Plywood industries

Related technical notes : [PYT-030E](#)

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