

Evaluation of the aged deterioration of PE pipes used for a hot-water heating system (2)

[Background] A variety of additives are added to polymeric materials to suppress the aged deterioration. Information on the degradation of additives over time is useful to evaluate the life of polymer products. Thermal desorption (TD)-GC/MS has been widely used for polymer additive analysis¹⁾, because cumbersome pretreatments, such as solvent extraction, are not necessary. This note describes the results of TD-GC/MS analysis of the additives contained in cross-linked polyethylene (PE-Xb) pipes which have been exposed to hot water.

[Experimental] TD-GC/MS analysis was carried out using a Py-GC/MS system which consisted of a Multi-Shot Pyrolyzer (EGA/PY-3030D, Frontier Labs) interfaced directly to the split injection port of a GC/MS system. TD maximum temperature was based on the EGA-MS thermogram (see Fig. 2 in PYA3-020E). PE-Xb samples were collected by scraping the inner wall surfaces of “new” and “used” pipes, and 1 mg of the sample was placed in a deactivated stainless sample cup.

[Results] The chromatograms of the “new” and “used” PE-Xb samples obtained by TD-GC/MS are shown in Fig. 1. In the “new” PE-Xb pipe, Irgafos 168 (including the oxidized Irgafos 168, phosphate form) and Irganox 1076 are observed, whereas Irgafos 168 and Irganox 1076 are not observed in the chromatogram of the “used” pipe. These results suggest that the additives in PE-Xb pipes are either oxidized or hydrolyzed when exposed to hot water and oxygen over time.

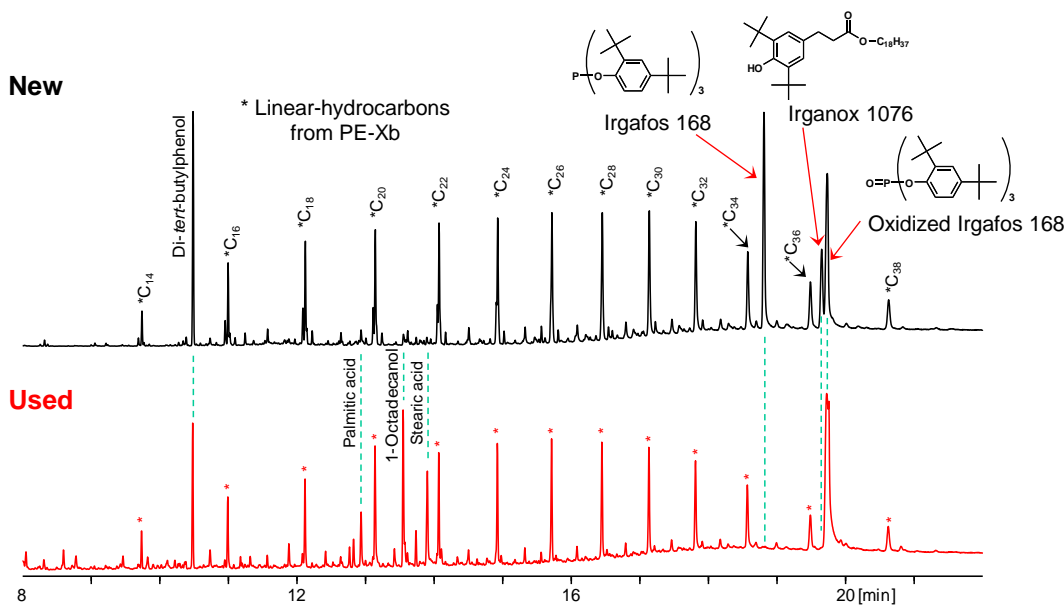


Fig.1 Chromatograms of new and used PE-Xb samples obtained by TD-GC/MS

Furnace temp.: 40 – 350°C (40 °C/min, 1 min hold), GC oven temp.: 40 (2 min) – 340°C (20 °C/min, 13 min hold), separation column: Ultra ALLOY+5 (5 % diphenyl 95 % dimethylpolysiloxane), L=30 m, i.d.=0.25 mm, df=0.25 µm, column flow rate: 1 mL/min He, split ratio: 1/10, sample: 1 mg

Ref 1) K. Yokoe, H. Ohtani, S. Tsuge, *Int. J. Polym. Anal. Charact.*, **1998**, 4, 547–563.

Keywords : Thermal desorption, additives, antioxidant, Irganox 1076, Irgafos 168, additives MS library, deterioration

Products used : Multi-functional pyrolyzer, Vent-free GC/MS Adapter, UA5, Eco-Cup LF

Applications : Analysis of additives

Related technical notes : PYA1-066E, PYA1-080E, PYA3-020E

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Phone: (81)24-935-5100 Fax: (81)24-935-5102
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