

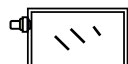
Outgas analysis of the olefin-based polymer under gamma beam irradiation

Various troubles about a resin product (e.g. breaking, transformation, change of color, odor) may be caused under gamma beam irradiation. For these problems, outgas analysis is effective.

The gas sampling and analysis method

Outgas analysis under gamma beam irradiation

Gas sampling bag



Low volatile organic gas
Inorganic gas
(H₂, O₂, N₂, CO, CO₂ etc.)

DNPH cartridge



Aldehydes

HPLC

Trap tube (ex. Tenax)



Middle volatile organic gas

GC, GC/MS,
Thermal desorption-
GC/MS

Liquid trap (ex. Water, solvent)



High volatile organic gas
Organic acid, inorganic gas
(NH₃, Amine, HCN etc.)

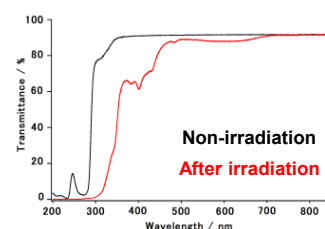
IC

1. A sample enclosure in a gas sampling bag.
2. Gamma beam irradiation.
*Room temperature, 50 kGy (normal sterilization condition)
3. Outgas sampling using trap tube.
4. Outgas evaluation by the thermal desorption-GC/MS.

Sample



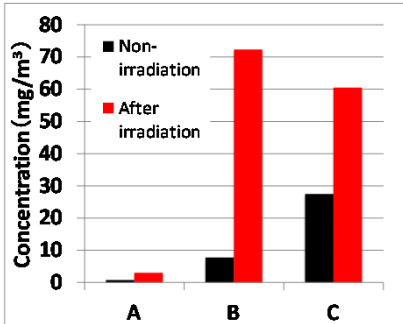
Non-irradiation After irradiation



Transmissivity spectrum

Outgas analysis

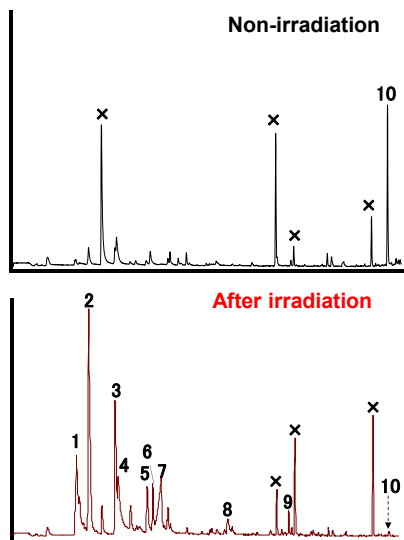
Comparison of the outgas concentrations (Olefin polymer)



•After gamma beam irradiation, the outgas concentrations increased.

•Polymer A had lower outgas concentration than polymer B, C.
⇒ Polymer A is little damaged by gamma beam irradiation.

Outgas analysis using thermal desorption-GC/MS



Decreased:

• Monomer

Increased:

• Polymer decomposition
• Polymer denaturation
• Acid compound
⇒ Deterioration mechanism prediction

• Ingredients of the low odor threshold (peak No. 2, 7)
⇒ Identification of the odor ingredients

Peak No. (Ingredient)	Concentration (mg/m ³)		Odor quality	Odor threshold (mg/m ³)
	Non-irradiation	After irradiation		
1 CO ₂	0.19	2.00	-	-
2 Acetaldehyde	0.30	4.75	Pungent	0.09
3 Acetone	0.21	2.54	Solvent smell	48
4 Formic acid	0.53	1.92	Sour	-
5 Cyclopentene	0.07	0.97	-	-
6 Bicyclopentane	0.23	0.66	-	-
7 Acetic acid	<0.02	1.93	Sour	0.6
8 C ₈ H ₁₈	<0.02	0.43	-	-
9 Cyclopentanone	<0.02	0.23	Mint-like	576
10 C ₁₂ H ₂₀ (monomer)	1.47	0.07	-	-

The useful data for the choice of materials are provided!