Evaluation of medical materials degradation into several chemical agents ~Using ATR FT-IR imaging~

The degradation and elution of plasticizer from several plastics by passing specific drugs through medical devices are well known. ATR FT-IR imaging is a powerful tool for visualization of effect from the surface of various samples.

Polyvinyl chloride(PVC) and polycarbonate(PC) are common plastics used in medical devices.

We investigated degree of effect from these plastics after dipping chemical solutions.

Principle of ATR FT-IR (Attenuated Total Reflection) mode and feature of mapping measurement



Electric-Field Penetration into sample provides information of the sample surface.

- -Collect sample information approximately 1 μ m depth from sample surface.
- Using simple section allow ATR FT-IR imaging
- Spatial resolution: approximately $3 \sim 5 \mu$ m. -Maximum mapping region: 400 μ m × 400 μ m.
- ■Materials for ATR FT-IR imaging
- · Polymeric materials Industrial material, Packaging material,
- Medical material etc A part of the specimen
- Hair, Skin, Tissue etc
- Medicinal drug

Surface

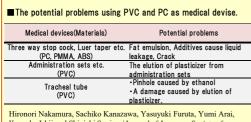
1.2

8.3

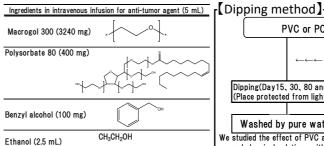
· Foreign object matter

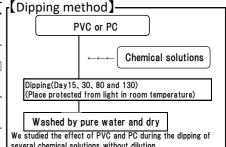
- ■ATR FT-IR imaging provides various
- Information Degradation (structural change)
- Penetration
- (component distribution)
- Adhesive (cure extent)
- Diffusion, Compatibility
- Dispersion

Materials and Methods



Kensuke Ishii and Shinichi Sugiura/Journal of Japanese Society of Hospital Pharmacists/51, 1045-1063(2015)

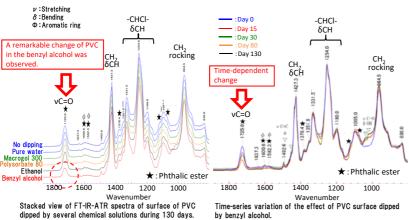


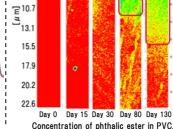


-m

ratio

Elution of plasticizer(Phthalic ester) from PVC caused by chemical solutions

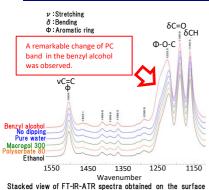




A quantitative depth profiling with elution of phthalic ester was time-dependent.

FT-IR-ATR imaging enables to visualize degree of plasticizer elution in depth.

Structural change of PC due to the dipping of chemical solutions



of PC dipped in several chemical solutions during 130 days.

Effect on the shape of absorption peal 386.5 : Dav 30 1500 1450 1400 1350 1300 1250 1200 1150 Time-series variation of PC band shape dipped in benzyl alcohol.

[1] Philip S. Brown & Bharat Bhushan/*Scientific Reports*/6, Article number: 21048 (2016)

30 50 Ë 70 260 90 around of 110 Ξ ₹130 150 170 190 250 Day 0 Day 15 Day 30 Day 80 Day 130 Time series dependence on crystallization rate in PC.

auantitative depth profiling with structural change of PC was time dependent.

FT-IR-ATR imaging enables to visualize degree of degradation in depth.