Process control of polystyrenes

Application

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Polystyrenes are widely used for the production of packaging materials, household goods, cases of electronic equipment, toys, and insulation materials. Polymerization can be performed with pure styrene or by copolymerization with butadiene, acrylonitrile, rubber and methylstyrene. The properties of the product strongly depends on the monomers used, the molecular weights and the molecular weight distribution.

Figure 1 shows an overlay of 3 chromatograms of a technical polystyrene – the original granulate, one after 1st injection moulding and one after second injection moulding. After the first injection moulding there is almost no change in the chromatogram and therefore the molecular

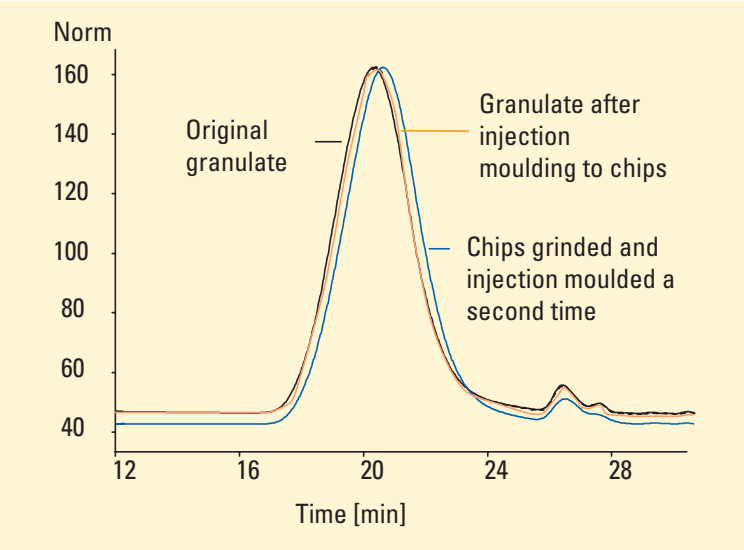

Figure 1
Overlay of three chromatograms of a technical polystyrene

Conditions

Sample preparation
Sample was dissolved in THF. Polystyrene EasyCal Vial standards (Agilent p/n 79911-60500 and 79911-60501) were used for narrow standard calibration.

Column
3 x PLgel mixed B, 7.5 x 300 mm, 10 µm (Agilent p/n 79911GP-MXB) in series

Mobile phase
Tetrahydrofuran

Flow rate
1.0 mL/min

Column compartment temperature
20° C

Injection volume
10 µL

Detector
Refractive index detector, alternatively VWD, 254 nm

weight distribution. After grinding the chips, and injection moulding a second time there is a significant change which will have an effect on the properties. The visual information is supported by the number average molecular weight, M_n, as calculated by the ChemStation data analysis software:

M_n (original granulate): 59000
M_n (after second process): 55000

To characterize such small differences in polymers reliably a GPC-SEC instrument with excellent precision, such as the Agilent 1100 Series GPC-SEC system, is required. Further information on the precision of this system is given in application brief “Precision in GPC-SEC analysis”, Agilent publication number 5988-0109EN.

HPLC performance

RSD of M_w	< 1%
RSD of M_n	< 2%

Equipment

Agilent 1100 Series GPC-SEC system
consisting of

- vacuum degasser for efficient degassing of the mobile phase
- isocratic pump with large solvent cabinet
- autosampler with single valve design
- thermostatted column compartment for precise column temperatures
- refractive index detector with automatic recycle valve
- ChemStation Plus with GPC-SEC data analysis software

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