Molecular Weight Distribution Of Poly(ethylene terephthalate) Using Conventional Gel Permeation Chromatography With HFIP

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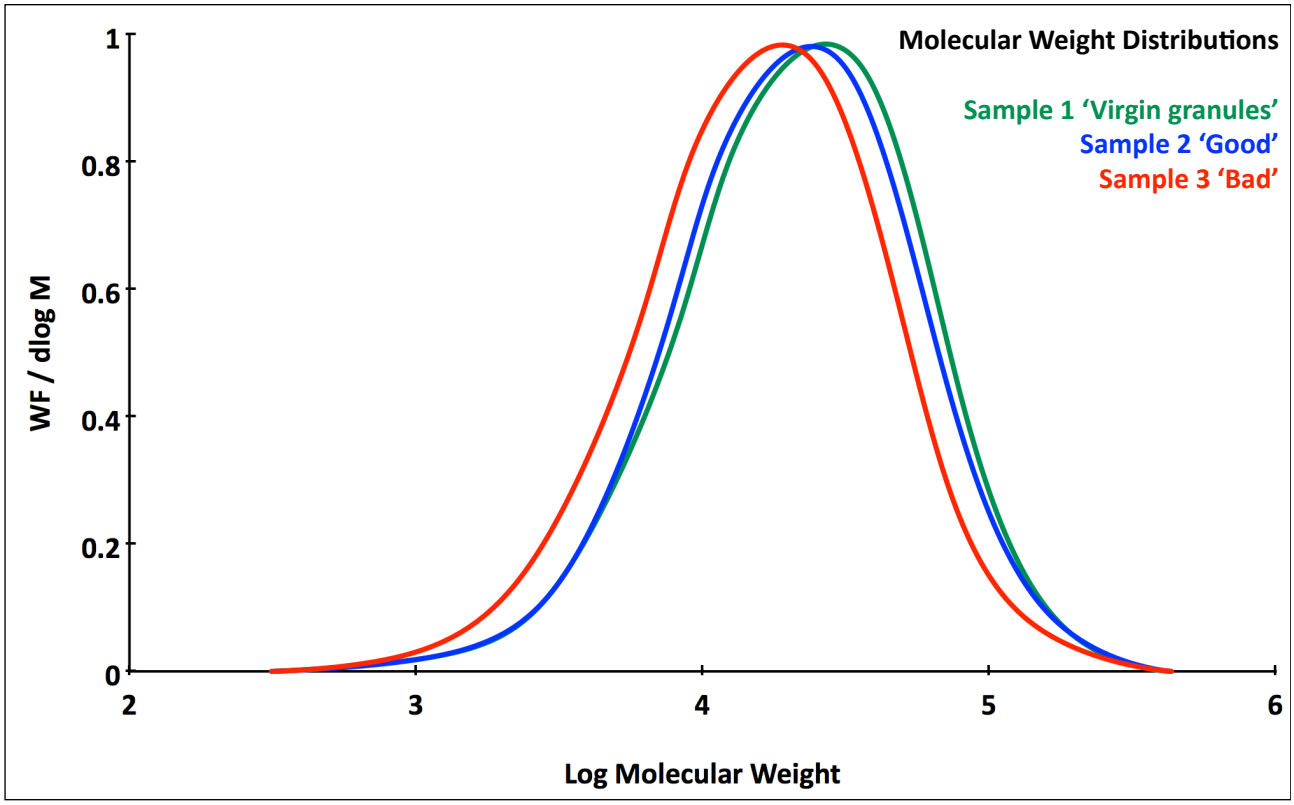
Columns:	Agilent PL HFIPgel guard plus 2 x PL HFIPgel 300 x 7.5 mm, 9µm
Eluent:	1,1,1,3,3,3-hexafluoropropan-2-ol with 25mM NaTFAc
Flow-rate:	0.8 mL / minute (nominal)
Temperature:	40℃ (nominal)
Detector:	Differential refractive index



Plots for duplicate runs of three samples - results expressed as 'PMMA equivalent' molecular weights.

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Discussion

Poly(ethylene terephthalate), or PET, is a polycondensate commonly used in food and beverage packaging applications and the textile industry.

Historically, gel permeation chromatography (GPC) of PET was carried out using meta-cresol or ortho-chlorophenol as the eluent at high temperature. However, the quality of the data obtained was typically poor.

With development of instrumentation and fractionation column technology more suitable for use with 1,1,1,3,3,3-hexafluoropropan-2-ol (HFIP), the quality of data obtained is greatly improved. Conventional GPC is carried out using a concentration detector. Smithers Rapra use differential refractive index (DRI) as the concentration detector, and this is a universal detector for high polymer. The refractive index detector response is a product of polymer concentration and the differential refractive index increment (*dn/dc*). The *dn/dc* of PET in HFIP is strong and therefore a good detector response is expected. Using HFIP as the eluent allows for much better discrimination between PET sample materials of similar molecular weight compared with o-chlorophenol.

In this example we are comparing 'Virgin granules' with 'Good' and 'Bad' samples. A small reduction in molecular weight could be expected during processing. The 'Bad' sample could be over-processed material or an inadvertently supplied lower viscosity material. Whilst intrinsic viscosity testing would provide a viscosity value and rank the samples, GPC analysis provides information on the whole distribution to assist in establishing the story and setting in a context.