

## POLYMER CHARACTERIZATION USING GPC

### Quality testing for plastics

#### TASK

Even if polymers are made up of the same monomers, they can differ in their properties. The polymer strands of a material have different chain lengths or masses. The resulting mass distribution has a decisive influence on the properties of the final plastic. Conscious or unconscious deviations in the manufacturing process can therefore result in undesirable changes and lead to processing difficulties or quality defects. Unsuitable parameters of molding processes can also lead to thermal degradation and thus to a decrease in chain lengths in the product.

#### SOLUTION

Analytik Service Obernburg offers polymer analyses using GPC (gel permeation chromatography). In this technique, a sample of the test material is dissolved in a solvent, placed on a separation column and pumped towards the detector. Thanks to a special separating material, the sample molecules are retained to varying degrees depending on their size (their hydrodynamic volume to be precise) and thus reach the detector with a time delay (see Fig. 2).

#### Industries

Chemical companies  
Plastics processors  
Medical technology

#### Analysis objectives

Assessment of product quality

#### Materials

Plastics  
Polymers

#### Analysis method

Gel permeation chromatography

#### Similar questions

Release checks  
oligomer content



## SOLUTION

With the help of suitable reference materials with a known molecular size, the average molar mass for the sample is finally obtained. This can be calculated in different ways ( $M_n$ ,  $M_w$ ,  $M_z$ ) and thus provides several statistical values for production control. Furthermore, the polydispersity  $D$ , which describes the width of the molecular mass distribution, is determined. By comparing the above-mentioned variables on two batches of a product, deviations and process errors can be quickly identified if necessary.

## ADVANTAGE

Analytik Service Obernburg can analyze the most common THF-soluble polymers (e.g. PMMA, PS, PC, SAN). This simple procedure provides prompt and meaningful values for quality control or product development.

**FIG. 1: ACRYLATE COMPONENT OF AN EMBEDDING AGENT. AMONG OTHER THINGS, THE FINAL HARDNESS IS INFLUENCED BY THE AVERAGE MOLECULAR WEIGHT OF THE POLYMER**



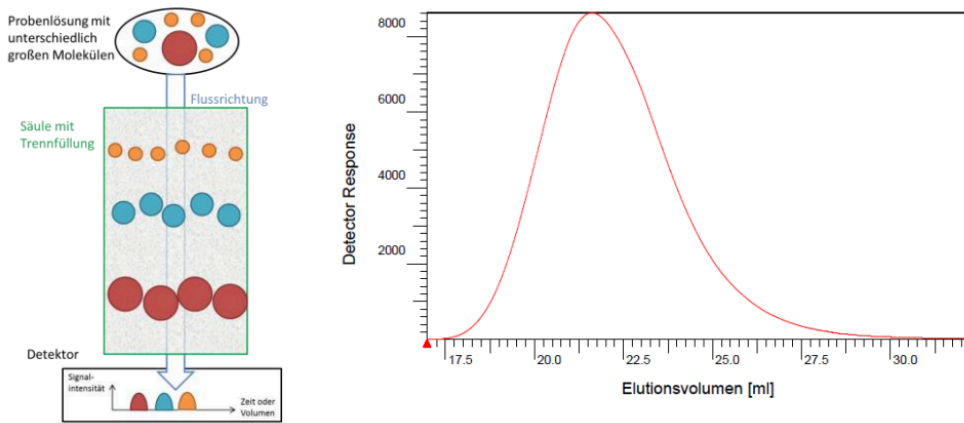


FIG. 2: SCHEMATIC REPRESENTATION OF MOLECULAR SEPARATION (LEFT) AND EXAMPLE OF A DETECTOR SIGNAL FOR A SAN SAMPLE (RIGHT)

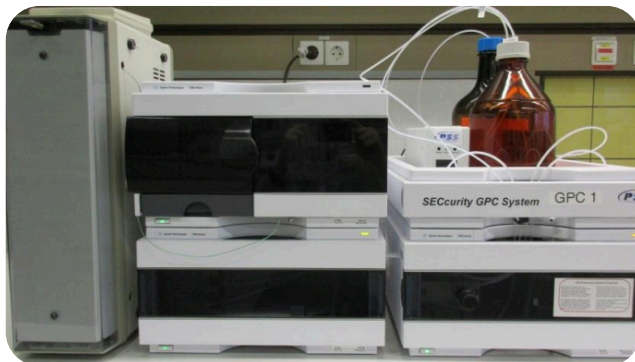
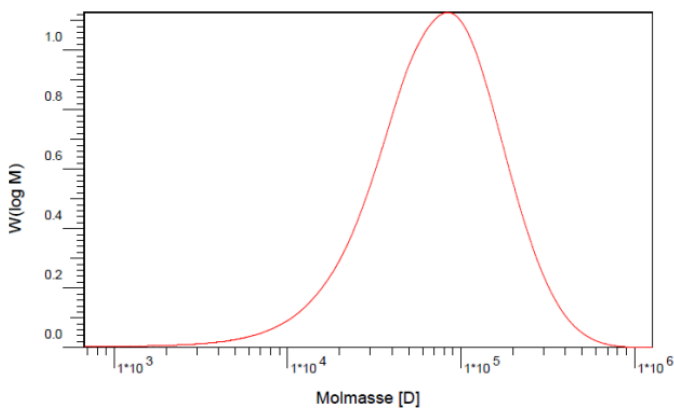


FIG. 3: GPC SYSTEM; LEFT: OVEN CONTAINING THE SEPARATION COLUMN(S); CENTER: AUTOSAMPLER AND DETECTOR; RIGHT: PUMP AND SOLVENT SUPPLY WITH DEGASSING UNIT.



$\overline{M}_n$	42270	g/mol
$\overline{M}_w$	98634	g/mol
$\overline{M}_z$	173230	g/mol
$D$	2.33	

FIG. 4: DIAGRAM OF THE MOLAR MASS DISTRIBUTION OF A SAN SAMPLE AS WELL AS THE MOST IMPORTANT MOLAR MASSES DETERMINED AND THE POLYDISPERSITY D.