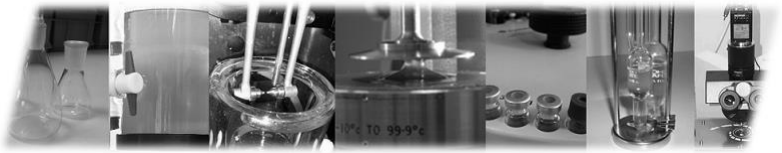
WEE-Solve GmbH



POLYMER FRACTIONATION / PURIFICATION

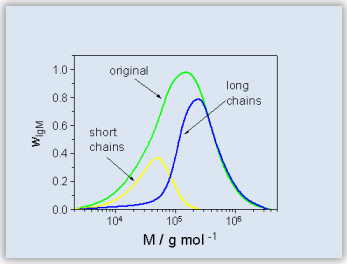
Alteration of the molecular weight distribution

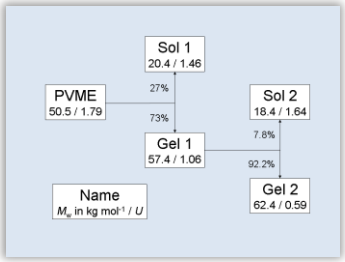
Polymers are increasingly used as high-performance materials and crucial in the areas of medicine, cosmetics and technique. For sophisticated applications it is often harmful that the polymers have a broad molecular mass distribution or contain impurities. By means of fractionation we are in the position to remove unwanted material on a technical scale enabling the optimization of the polymer properties.

Modifiable properties:

- Viscosity
- Density
- Crystallinity, glass temperature
- Purity
- Volatility
- Shelf life
- Refractive index
- Degradation
- Permeability skin / kidney
- Inflammable behavior
- Oligomer content
- etc.

The fractionation method is based on liquid/liquid phase separation and is therefore suitable for almost all soluble polymers. The phase separation is induced by lowering the solvent quality of an initially homogenous polymer solution. Two phases are formed: one containing the long chain material (gel-phase) and the other one contains mainly the short chain material and the low molecular mass impurities (sol-phase).

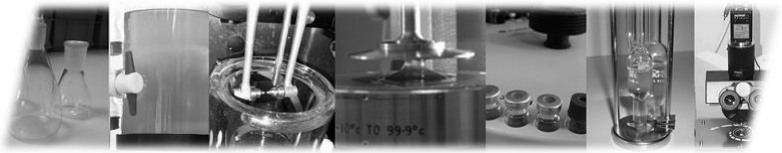




By the choice of the fractionation parameters (temperature, compositions) the "cut" through the molecular mass distribution can be varied. Narrow molecular mass distributions can be achieved by repeated fractionation.

Service provider for polymer fractionation / purification, rheological measurements, and contract research.
WEE can solve your problems!

WEE-Solve GmbH, Auf der Burg 6, D-55130 Mainz
www.wee-solve.de - info@wee-solve.de
Tel.: +49 (0) 6131 / 49 48 644



Case studies

The reasons for fractionation are as divers as the different applications of polymers are. The following examples are therefore taken from very different areas.

Recovery / purification of poylmers produced by means of biotechnology

Fractionation enables the removal of low molecular mass material of polymers stemming from biological sources, yielding products with high purities.

Application in medicine

The short chains as well as the long chains of *hydroxyethyl starch* are troublesome for its use as blood plasma expander. The short chains leave the body through the kidney very fast and are therefore inefficient. The long chains on the other hand remain in the body, are stored in the skin and induce itching.

Another sample is *hyaluronic acid* which is used in eye surgeries as a viscoelastic agent or for the treatment of arthrosis as a natural lubricant. By means of fractionation the properties of hyaluronic acid can be tuned for the application.

Harmful contents in photoresists

Photoresist, like *Novolak*, are used for the production of electronic circuits in the micro- or submicroscale. For this application the oligomers are disturbing, because they are still sufficient volatile and can be deposited at wrong places. Therefore, they impede a further miniaturization. By removing the oligomeric contents this problem can be solved.

Filter dust at the membrane production

During the production of filtration membranes (e.g. from *cellulose acetate* or- *nitrate*) very often filter dust is formed, which is blocking the pores of the membrane and decreasing its performance. Furthermore, the filter dust can leave the membrane and enter the filtrate. The filter dust consists of the short chains of the membrane material and is transported during the production according to the phase inversion process towards the surface of the forming membrane. At this place it precipitates and blocks the pores. A removal of the short chains reduces the formation of filter dust markedly.

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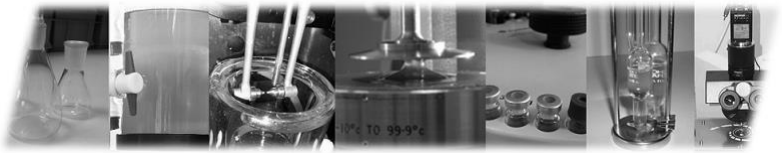

Production of samples with different molecular masses

By means of the fractionation of broadly distributed samples one can obtain fractions differing in the molecular mass. This is for example necessary, if relations between polymer properties and its molar mass shall be examined, but no suitable samples are available. A familiar example for a molecular mass dependent property is the hydrodynamic radius of polymers in solution: The Kuhn-Mark-Houwink relation shows the dependence between the intrinsic viscosity and the chain length.

Shelf life of polymers

Certain components can reduce the shelf life of polymers. This can be e.g. impurities or the short chain material of the polymer itself (as they act as plasticizer or because the end groups have a negative influence). By means of fractionation these components can be removed or reduced to an acceptable amount.

Fractionation according to chemistry

Copolymers (like *Polystyrolacrylnitril, SAN*) often possess not only a distribution of the molecular mass but also in chemical composition. Under certain circumstances it is possible to fractionate these polymers according to chemistry and therefore optimize their properties.

Fractionation according to architecture

During the synthesis of polymers with complex molecular architecture, like branched polymers or stars, it often happens that linear chains or stars with lower number of arms are formed as unwanted side products. By means of fractionation these components can be removed.

Standards for analytics

By means of repeated fractionation of a broadly distributed sample it is possible to obtain samples with narrow distributions. These fractions can be used as standards, e.g. for the gel permeation chromatography (GPC/SEC).

The here mentioned case studies of polymer fractionation were done during the employment as scientific assistant in the working group of Prof. Dr. B. A. Wolf at the Johannes Gutenberg-University of Mainz. These case studies are all already published.

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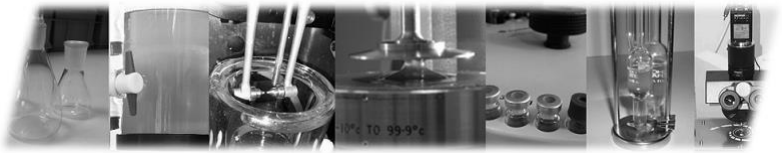

CONTACT

Management

WEE-Solve GmbH
Auf der Burg 6
D-55130 Mainz
Germany

Tel.: +49 (0) 6131 49 48 644
E-Mail: info@wee-solve.de

Laboratories

WEE-Solve GmbH
Wöhlerstr. 2-6
Building B
D-55120 Mainz
Germany

IMPRESSUM

WEE-Solve GmbH

represented by Dr. John Eckelt – General manager

Auf der Burg 6
55130 Mainz
Deutschland

Tel.: +49 (0) 6131 49 48 644
E-Mail: info@wee-solve.de

Commercial Register no. of the Mainz Court: HRB 40955
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