

## Summary

Because of their manifold applications water soluble polymers and polyelectrolytes are used technologically for example as flow improvers, thickeners and stabilizers. The properties of these polymers depend on molar mass and distribution, as well as solution structure. In order to optimize polymers to specific applications, the knowledge of molar mass, distribution and solution structure is of great importance. The aim of this work was to characterize selected water soluble polymers with regard to molar mass and radii, and also to distribution. Structure-property relationships allow a description of the correlation between the molecular parameters and the macroscopic properties. By the coupling of a fractionation method, like the asymmetrical Flow Field-Flow-Fractionation (aFFFF) or the Size Exclusion Chromatography (SEC) with a Multi Angle Light Scattering detector (MALS) and a Differential Refractive Index Detector (DRI), a relationship between the molar mass  $M$  and the radius of gyration  $R_G$  can be established.

First, particular -uncharged- systems, like narrowly distributed polystyrene latices, bovine serum albumine (BSA) and a protein standard were investigated. Since the properties of these polymers are known and some of them are available as standards, the coupling of the aFFFF with MALS/DRI was tested to identify deficiencies in the new fractionation system. Due to their defined structure, proteins (i.e. bovine serum albumine, BSA) are also very suitable as standards and so they also were fractionated. The mixtures of polystyrene latices and of BSA could be fractionated into the monomer and dimer. The elution diagram of BSA and the shape of the elution curves could give information about irregularities in the separating system. To identify the limits of the aFFFF and to develop working techniques, the following particular, molecular disperse samples were tested: dextrane, hydroxyl ethyl starch (HES), acetyl starch (AS) and others. From the test of the limits of the aFFFF-MALS/DRI using a sample of branched dextrane, molar masses from 23,000 to 640,000 g/mol and radii of gyration from 9 to 22 nm were obtained. These agree well with results of previous works and literature data.

Additionally, selected samples were compared with known methods for the characterization of molecular disperse solutions like SEC and viscosity. Here the restrictions of these established methods according to the technical use of polyelectrolytes became significant. Some of the investigated cationic polyelectrolytes could be characterised by the coupling of aFFFF and MALS/DRI. For a better comparison of the established method of the relative SEC with the aFFFF fractionation method, this system was additionally coupled with a lightscattering- and a concentration detector; a comparison with theoretical and experimental results was made. It could be shown that the aFFFF-MALS/DRI is slightly better than the SEC, with respect to separation. The expanded working range -to include larger molar masses- and the higher flexibility of the aFFFF system are advantageous. The aFFFF offers some additional advantages, short measuring time, lower quantity of test item is required and easy to clean and maintaining the system. To test if technically usable results can be found by the coupling of the new fractionation method with a light scattering and concentration detector, commercially available cationic polyelectrolytes were investigated. Cationic polyelectrolytes are technically used as flocculating agents. First dewatering properties of selected samples were tested on a technically cloudy solution.

It was desirable to establish a connection between the molecular parameters and the dewatering properties of the flocculating agents, because there is currently no reliable knowledge about the relationships between flocculating agents, cloudiness and molecular properties of the sample. A specific dewatering problem, therefore, must be solved by a complicated series of tests. Predictions about the suitability of a flocculating agent for the solid/liquid-separation of an unknown cloudy solution, so often, are not possible. In this work a technically cloudy solution was chosen and flocculated with different cationic polyelectrolytes. For this example a cationic series of samples, which differed in charge,

molar mass and chemical structure, was chosen. To compare the results, a patented flocculating and dewatering device (FEA) was used. The dewatering results obtained were compared with those of the polymer characterization by aFFFF, but no significant relation between the measured molecular parameters and the dewatering results could be found. In short, the coupling of aFFFF and MALS/DRI is able to characterize many water soluble polymers. This work demonstrated, that the molecular parameters for molecular disperse and particular disperse systems could be determined. For some selected polymers the relationships between the radius of gyration and the molar mass ( $R_G$ -M-relationship) could be determined. To further develop these chromatographic methods, an improvement of the accumulation membranes and a better regulation and constancy of the different flows in the system is necessary.