**Description and specification of the modules 32, 33, 34, and 35 that the Polymer Group is responsible for in the course KJM-MENA4010**.

Description of the modules Polymer Group is responsible for:

Module 32) **Sample preparation - Dialysis - Centrifugation - Freeze drying**

Module 33) **Static Light Scattering**

Module 34) **Dynamic Light Scattering**

Module 35) **Densitometry - pH - Turbidity**

**Capacity: 5 students**

***Learning goal and content of practical work are given below***

1. When the polymer has been synthesized it is important to prepare the sample for measurements and to remove rests of impurities, and this can be accomplished by dialysis of the polymer and thereby low molecular impurities , such as salt can easily by removed. If some bigger aggregates are still in the solution, this can be eliminated by centrifugation. After the freeze drying the sample can be recovered by freeze drying. The students will be learned how to use these methods in the preparation of their samples.

1. Static light scattering (SLS) is a method that is used to determine the molecular weight (weight average molecular weight, Mw) and the size (radius of gyration, Rg) of the polymer molecules in dilute solutions. Through this method it is also possible to obtain information about the thermodynamic conditions (the second virial coefficient, A2). SLS is a very important technique in polymer science to characterize the physical properties of the polymer and it is standard in most polymer laboratories. In this module the student learn to prepare dust-free solutions for the measurements, and they will carry out measurements on some of their polymers to determine Mw, Rg, and A2.
2. In order to monitor the relaxation processes in polymer solutions and to be able to estimate size (hydrodynamic radius, Rh) of the molecules in dilute solution, DLS is a powerful technique. This is an important method to understand dynamics in polymer solutions. In this module, the student will carry out DLS measurements on polymer solutions to analyze the correlation functions in detail to be able to utilize the full potential of this technique.
3. Densitometry is an important method to determine the partial specific volume of solutes and the density of solutions itself can often be useful. In addition to knowing the density itself, one can make a calibration curve of solutions of different concentrations, and use this to determine the concentration of an unknown sample. In this way one can for instance check the concentration of filtered solutions, to see if some of the polymer is lost in the filtration process. The pH of a sample can have a pronounced effect on the properties of a sample. Therefore it is often important to know and control the pH. Turbidity is a measure of how opaque the sample is. To measure the turbidity, we use a spectrophotometer. The spectrophotometer sends light through the sample, and measures the intensity of light that goes through the sample. The student will learn how to use these methods by making experiments on prepared polymer.

***Requirements***:

The required background is good knowledge of general polymer chemistry as covered in KJM 5550 (or an equivalent course).

***Evaluation***:

Requirements to have the modules approved:

* Participate in all parts of the modules
* Master the practical work
* Deliver the report within the given deadline
* Approved report

***Teaching personal***:

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