Small Angle X-Ray Scattering from Linear and Branched Polymers Interacting with Lipid Membranes in Solution

B. Angelov[1,2], A. Feoktystov[1], A. Rzeszutek[1] and U. Vainio[3]

[1]Institute of Materials Research, GKSS Forschungszentrum, Max-Planck-Str. 1, 21502 Geesthacht, Germany

[2]Dept. of Chemistry, Aarhus University, Langelandsgade 140, 8000 Aarhus, Denmark

[3]HASYLAB c/o DESY, Notkestr. 85, 22603 Hamburg, Germany

The solution structures of a partially branched polyethylene imine (PEI) and linear polyethylene glycol (PEG) have been investigated by SAXS. These model polymers are commercially available and can be used either for antibacterial or drug delivery applications [1]. Their interaction with lipid membranes could lead to phase transitions or pore formation in lipid bilayers. The experiments were performed at beamline B1 of the DORIS III storage ring at HASYLAB/DESY in Hamburg. The beam size was 1.0 mm × 1.0 mm on the sample. The measurements were carried out at a fixed energy of 10 KeV, corresponding to a wavelength λ = 1.24 Å. The scattered intensity was recorded with a two dimensional (2D) gas detector, the area of which was divided in 256 × 256 pixels. The SAXS data were averaged over the azimuth angle, normalized, background corrected, and calibrated. The samples were liquid solutions filled in holders with openings for the X-ray beam covered with Kapton. The vacuum in the experimental chamber sometimes caused sample leakage. Selected results were compared with measurements by a laboratory SAXS instrument. That allowed for a very precise background subtraction. Pair distance distribution function was obtained via the use of GNOM [2]. The X-ray scattering pattern of 10 mg/ml functionalized PEI (synthesis of derivatives is described in ref.1) measured at room temperature is shown on Fig.1. The obtained experimental atomic pair distance distribution and the modelled one, have similar characteristic shapes like a bell. The model PEI was build by randomly branching a linear polymer chain until its degree of branching become 30%. Further measurements are necessary before the final conclusions are made.

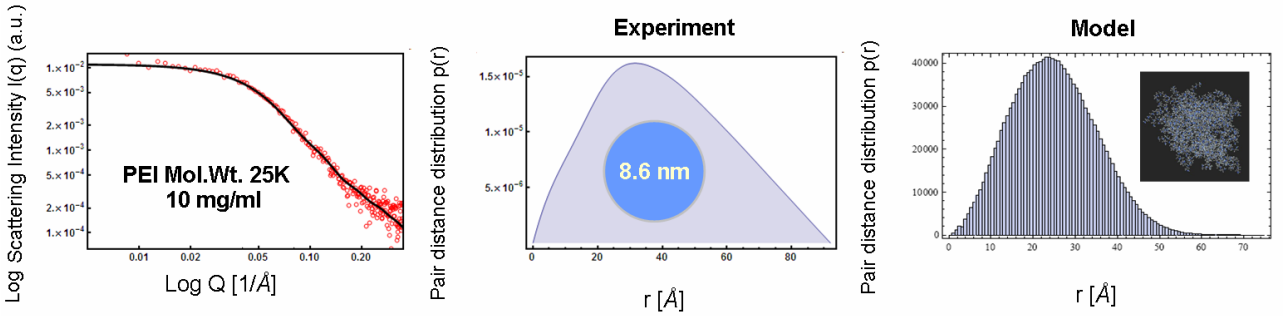

Figure 1: X-ray scattering and pair distance distribution from branched PEI in a water solution.

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References

[1] N. Pasquier, H. Keul, E. Heine, M. Moeller, B. Angelov, S. Linser, R. Willumeit, Macromol. Biosci., **8**, 903 (2008).

[2] D.I. Svergun, J. Appl. Cryst. **25**, 495, (1992).