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SAXS Determination of the Correlation Length of Semidilute Polyelectrolyte Solutions SHICHEN DOU, RALPH H. COLBY, Materials Science and Engineering, Pennsylvania State University — In semidilute solutions, polyelectrolyte chains have a random walk conformation of correlation blobs. The size of those space filling correlation blobs can be measured using Small Angle X-ray Scattering from the wavevector at which there is a peak. In this study we randomly quaternized monodisperse poly(2-vinyl pyridine) (P2VP) and neutralized to make polyelectrolytes with either chloride or iodide counterions. We study a random copolymer for which 60% of the charges are neutralized, at 25 ^{o}C in three solvents: (1) Ethylene glycol (EG) is a good solvent for P2VP, with dielectric constant $\varepsilon = 37$ making the Bjerrum length 15 Å and dielectric spectroscopy measures the fraction of monomers bearing an effective charge $f = 0.17$ for Cl^- and $f = 0.07$ for I^- counterions. (2) Water is a poor solvent for P2VP, with $\varepsilon = 78$ making the Bjerrum length 7.1 Å and $f = 0.25$ for I^- counterions. (3) N-methyl formamide (NMF) is a good solvent for P2VP, with $\varepsilon = 182$ making the Bjerrum length 3.1 Å and $f = 0.60$ for I^- counterions (meaning that all counterions are free in NMF). We find that the correlation length of these polyelectrolyte solutions obeys the power law concentration dependence expected by scaling theory, and the correlation length decreases at a given concentration as the solvent is made more polar, because the polyelectrolyte chain has a larger effective charge.

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