Some Special Factors Influencing Copolymerization Kinetics of a Polyelectrolyte System

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Motivation & Goals

- ✓ Increasing demand for high performance & water-soluble polymers for Enhanced Oil Recovery (EOR) applications
- ✓ Case study: Acrylamide (AAm)/Acrylic acid (AAc)
- ✓ Need to have a clear understanding of AAm/AAc copolymerization kinetics to ‘tailor’ copolymer properties

Chain microstructural properties

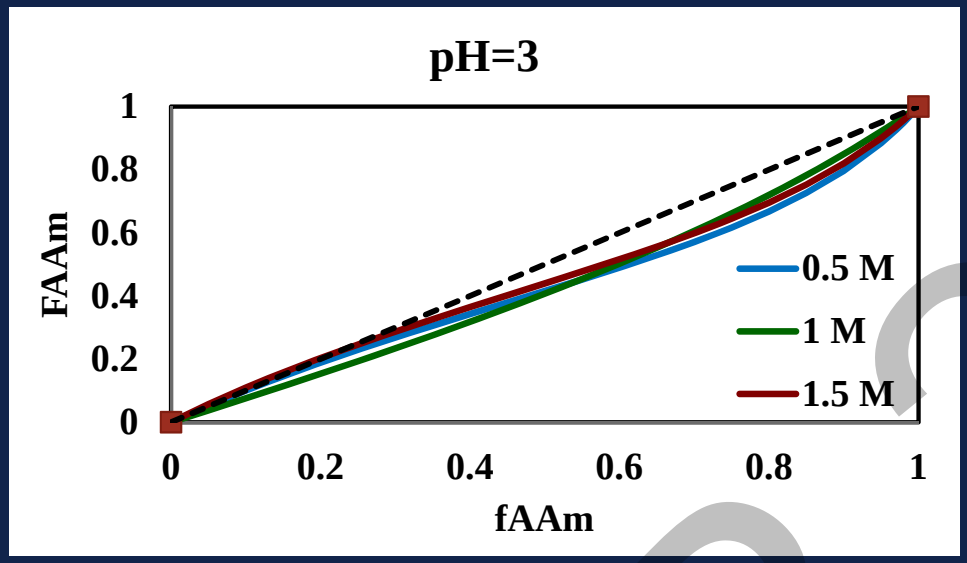
Bulk macrostructural properties

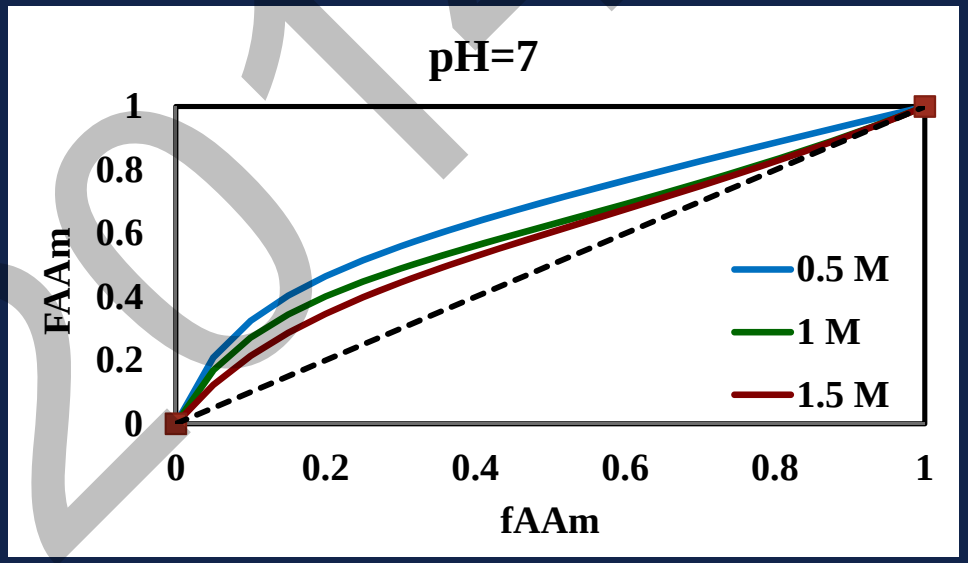
Design of Experiments

Factorial/D-Optimal Design

Main Factors	Responses
Reaction pH	Molecular Weight
Ionic Strength	Monomer Conversion
Monomer Concentration	Copolymer Composition
Monomer Composition in Feed	Monomer Reactivity Ratios
	Monomer Sequence Length

AAm/AAc Copolymerization- pH Effect



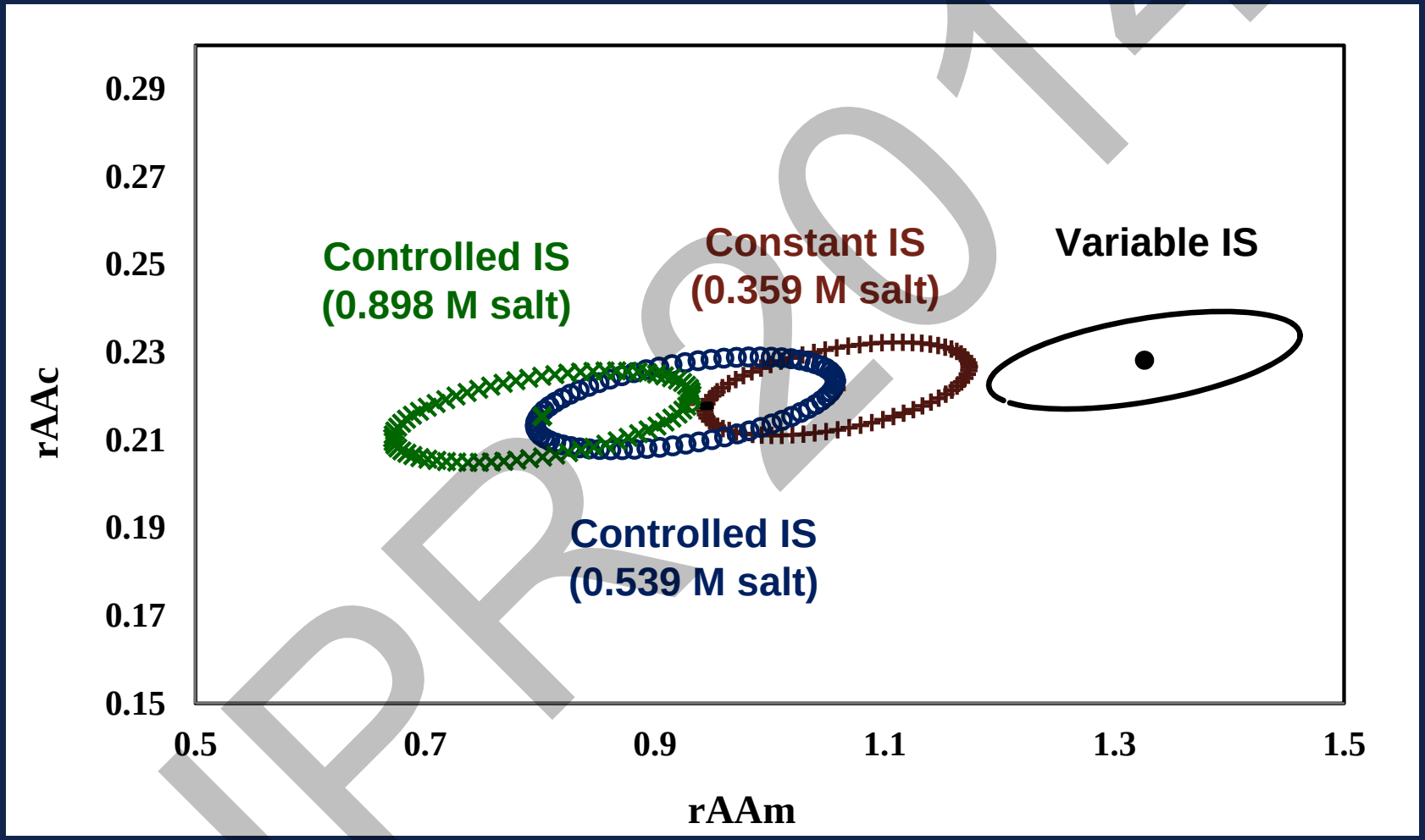


pH<3 : AAc & partially protonated AAm

3<pH<6 : AAc, acrylate anion & AAm

pH>6 : Acrylate anion & AAm

AAm/AAc Copolymerization- IS Effect



Riahinezhad et al., Effect of ionic strength on the reactivity ratios of acrylamide/acrylic acid (sodium acrylate) copolymerization, J. Appl. Polym.

Thank You

Questions?

Experimental

Materials

Acrylamide, AAm and Acrylic acid, AAc (Monomer)

Sodium hydroxide (pH-controller), ACVA (Initiator)

Hydroquinone (Inhibitor), Sodium chloride (salt)

Estimation

Error-in-Variables Model (EVM) &

Direct Numerical Integration (DNI) approach

Characterization

Gravimetry for monomer conversion

Elemental analysis for copolymer composition

Inductively coupled plasma (ICP) analysis for Na content

Polymerization

Temperature = 40 ºC