

EFFECT OF SURFACTANT STRUCTURE AND PROPERTIES ON ENZYME-SURFACTANT INTERACTIONS

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Objectives: Develop compatible enzyme-surfactant systems

Challenges: Minimize enzyme function loss by modifying surfactant systems without sacrificing performance
Correlate structure and properties of surfactants with their interactions with enzymes to predict compatibility

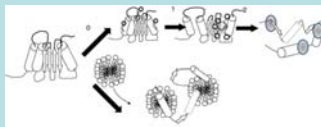
Intellectual Motivation: Investigate impact of surfactant structure and properties on enzyme function (activity), structure (stability), and dynamics

Industrial Relevance: Home and Personal Care, Cosmetics, Foods, Pharmaceuticals, Renewable Energy, Biotechnology, Bioremediation

Broad Appeal: Enzyme-Surfactant Formulations, Enzyme Activity/Stability, Colloidal Interactions, Mixed Surfactants

Background / Problem

- Enzymes increasingly used with surfactants in industries
- Enzyme activity lost in oppositely charged surfactants – unfolding / denaturation occurs mainly due to:
 - **electrostatic repulsion of charges of bound surfactants**
 - penetration of surfactant hydrocarbon chain into nonpolar regions of protein

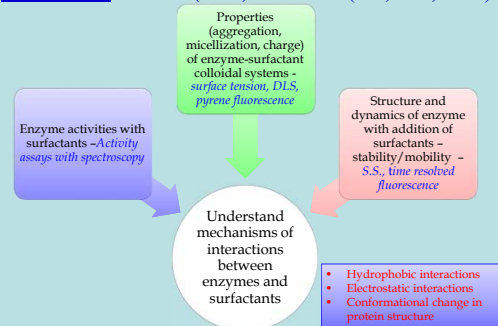


Hypothesis

Interactions between an enzyme and mixed surfactant system will be strongly dictated by the ability of nonionic surfactant to form mixed micelles with ionic surfactant and inhibit electrostatic interactions

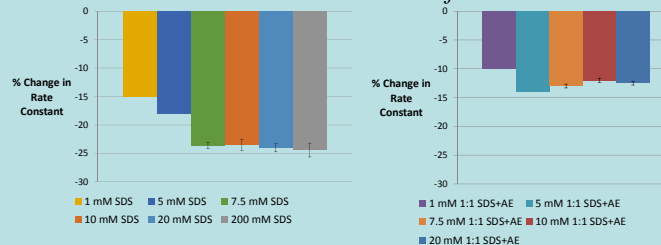
Materials / Methods

Enzymes: protease (positive charge), peroxidase (neutral charge)
Surfactants: anionic (SDS) / nonionic (AE, DM, APG)



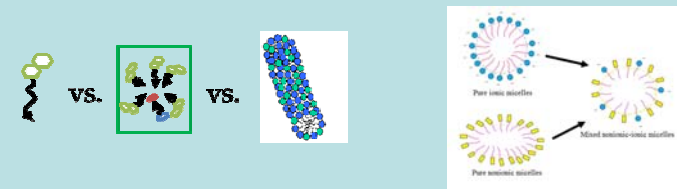
Results

Protease Activity Change with Addition of Anionic and Mixed Surfactants



Summary

1. Ionic surfactant – Enzyme activity suppressed by surfactant monomers
2. Nonionic surfactant – Enzyme activity unchanged and even enhanced at surfactant concentrations where loosely packed micelles are formed → Disorder in water structure → Greater enzyme flexibility → Higher activity
3. Mixed ionic-nonionic surfactant – Enzyme activity loss lessened compared to single anionic surfactants



Future Plans

1. Investigate enzyme activity changes with various surfactant systems
2. Investigate effects of surfactant properties on enzyme structure and function and evaluate interaction mechanisms
3. Examine enzyme structural and dynamic changes with addition of surfactants

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