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Interactions between surfactants and hydrolytic enzymes

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Highlights

- The effect exerted by surfactants differs between the different classes of enzymes
- Nonionic surfactants are more benign to the enzymes than ionic surfactant
- Conformational changes can be induced at sub-CMC surfactant concentration

ABSTRACT

Hydrolytic enzymes are combined with surfactants in many types of formulations, for instance detergents and personal care products. If the surfactant interacts with the enzyme there may be conformational changes that eventually lead to loss of the enzymatic activity. From a practical point of view it is important to understand the nature and magnitude of these interactions.

After an introduction of the topic the review briefly discusses enzyme catalyzed reactions where surfactants are substrates for the enzyme. The rest of the review relates to associations between surfactants and hydrolytic enzymes without the surfactant being a substrate in the reaction. A discussion about general principles for such interactions is followed by a survey of the relevant literature related to four important types of hydrolytic enzymes: lipases, proteases, amylases and cellulases. It is shown in the review that the effect exerted by the surfactant differs between the different types of enzymes; it is therefore difficult to make general statements about which surfactants are most detrimental to the activity of hydrolytic enzymes. However, as a general rule nonionic surfactants can be regarded as more benign to an enzyme than anionic and cationic surfactants. This difference can be ascribed to the difference in binding mode. Whereas a nonionic surfactant only binds to the enzyme through hydrophobic interactions, an ionic surfactant can bind by a combination of electrostatic attraction and hydrophobic interaction. This latter type of binding can be strong and lead to conformational changes already at very low surfactant concentration, often far below its critical micelle concentration.

Statistical summary

7438 words

8 figures

no tables

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Protease

Peptidase

Amylase

Cellulase

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