IONIC LIQUIDS MICROEMULSIONS: THE KEY TO *CANDIDA ANTARCTICA* LIPASE B SUPERACTIVITY

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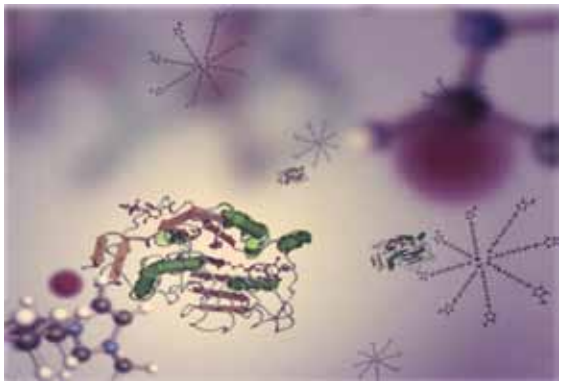
An ionic liquid (IL) system, compatible with the lipase *Candida antarctica* lipase B (CaLB) to enhance its activity, was developed. For the first time, the use of a simple method based on 1-decyl-3-methylimidazolium chloride [C_{10}mim]Cl to increase the lipase activity was reported. The effect of different IL molar concentrations, on the relative lipase activity (Act_{IL}/Act_{Bf}) was investigated and is shown in Figure 1 (green dots). The results show that the lipase activity increases with the IL molar concentration, achieving a maximum six-fold increase for 0.090 M of IL. These results suggest that the activity increment does not result from changes in the reaction mechanism or enzyme structure, since the enzyme activation energy is not affected by the IL presence, but instead may be explained by the formation of microemulsions due to the IL alkyl chain self-aggregation as depicted in Figure 2. In fact, the formation of microemulsions in long chain imidazolium ILs, including this IL, was previously demonstrated. To evaluate if the aggregation of [C_{10}mim]Cl was related with the observed activity increase, the critical micelle concentrations (CMC) of [C_{10}mim]Cl in the potassium phosphate buffer with and without the presence of the substrate *p*-nitrophenyl laurate (*p*-NFL) were determined by electric conductivity ($mS.cm^{-1}$) measurements and are reported in Figure 1. Considering the CMC results in the presence (red diamonds) and absence (blue triangles) of the substrate, it is shown that the *p*-NFL significantly contributes to lower the system CMC. A comparison of the relative enzyme activity and conductivity data, presented in Figure 1, shows that the increase of Act_{IL}/Act_{Bf} is observed for molar concentrations of [C_{10}mim]Cl above the CMC for the system with the substrate *p*-NFL.

The behavior here reported is being studied as the basis for novel methodologies of enzyme activation using aqueous solutions of ILs.



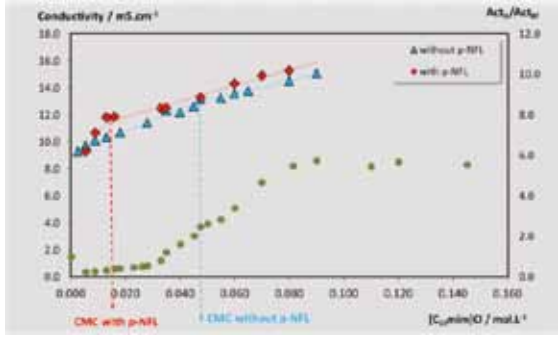


FIGURE 1
Relative enzyme activity of CaLB as function of the IL molar concentration and effect of the substrate (p-NFL) on the conductivity and CMC of [C_{10}mim]Cl aqueous solutions.

FIGURE 2
Illustration of the lipase in a microemulsion environment.