Communication orale du Colloque « Encapsulation/vectorisation des molécules actives, une stratégie dynamique en agro-alimentaire et en pharmacie »

Protection of yeast cells in micro-organized shells of natural polyelectrolytes during drying process

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Abstract

Encapsulation has been widely applied in diverse areas and for diverse applications. The layer-by-layer self-assembly (LbL), one of the encapsulation techniques, is built by the electrostatic attraction between oppositely charged polyelectrolytes, and the topmost layer determines essentially the surface properties of the edifice. This technique offers several advantages (low cost, simplicity of process and equipment, biocompatibility and biodegradation…). In this present paper, results of the protection of *Saccharomyces cerevisiae* yeast cells in microorganized shell of natural polyelectrolytes during dehydration process are reported. To apply the LbL method to individually encapsulated cells, β-lactoglobulin and sodium alginate were used as polycation and polyanion. The protective effect against dehydration was evaluated by the measure of cell survival. Moreover, we explored the potentiality of the Fourier-Transform InfraRed micro-Spectroscopy with the synchrotron beam source (S-FTIR) in order to analyze biochemical composition changes of *S. cerevisae* at single-cell level. Indeed, we showed that the survival of the encapsulated cells was higher 1.6 times compared to non-encapsulated cells. The results of S-FTIR revealed the relationship between biochemical changes and the loss of cell viability. According to the principal component analysis of spectroscopic spectra, the membrane damage and disorganization was more pronounced in the case of non-encapsulated cells. An increase of protein amount has been found in encapsulated cells indicating the presence of β-lactoglobulin in the capsule. It could be the major factor influencing the protection of cells during the dehydration stress by constructing a barrier limiting the water loss. These results highlighted the protection of yeast cells in microorganized shells during dehydration process. Therefore, this natural microencapsulation method might be a potential technique for yeasts or probiotics preservation and stabilization.

Key words: yeast, encapsulation, layer-by-layer, β-lactoglobulin, alginate, FTIR, dehydratation

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Protection de la levure par encapsulation au cours d'un procédé de déshydratation

Résumé

Les techniques d'encapsulation sont appliquées dans divers domaines et pour diverses applications. La technique d'auto-assemblage layer-by-layer (LbL), une des méthodes utilisées pour encapsuler est réalisée par attraction électrostatique entre des polyélectrolytes de charge opposée, la dernière couche déterminant les propriétés essentielles de la surface cellulaire. Cette technique présente plusieurs avantages (peu couteuse, simplicité de processus et d'équipement, biocompatibilité et biodégradation,…). Dans cette étude, la protection pendant la déshydratation des levures *Saccharomyces cerevisiae* encapsulées par la méthode LbL a été demontrée. La β-lactoglobuline et l'alginate de sodium ont été utilisés comme polycation et polyanion. L'effet protecteur a été estimé par mesure de la survie cellulaire. De plus, la potentialité d'application de la spectroscopie infrarouge à transformée de Fourier de source synchrotron (S-IRTF) afin d'analyser les changements de composition biochimique de *S.cerevisae* au niveau unicellulaire a été exploitée. En effet, nous avons démontré que la survie des cellules encapsulées est plus élevée (1,6 fois) en comparant avec les cellules non-encapsulées. Les résultats de S-IRTF ont révélé la relation entre les changements spectraux et la perte de viabilité cellulaire. D'après l'analyse en composante principale des spectres infra rouge, la désorganisation de la membrane est plus importante dans le cas des cellules non-encapsulées. Une augmentation de la quantité de protéine indiquant la présence de β-lactoglobuline dans la capsule a également été observée dans les cellules enrobées. Celles-ci pourraient être un facteur important dans la rétention d'eau et la protection contre le stress cellulaire engendré durant la déshydratation. Ces résultats mettent en évidence la protection des cellules de levure par un enrobage de polyélectrolytes micro-organisés lors de la déshydratation. Par conséquent, ce procédé de microencapsulation pourrait être une technique potentielle pour la conservation et la stabilisation des levures ou des probiotiques.

Mots clés : levure, encapsulation, layer-by-layer, β-lactoglobuline, alginate, IRTF, déshydratation

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