Encapsulation efficiency of *Lactobacillus plantarum* microencapsulated in Acrycoat S100

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Introduction

Several studies have attributed health benefits to probiotics, as the contribution to intestinal microflora activity (Khan et al. 2013). However, adverse conditions in gastrointestinal transit can reduce the viability of probiotics as *Lactobacillus plantarum*.

Acrycoat S100 is a co-polymer from methacrylic acid and methyl methacrylate, water insoluble and soluble in pH $\geq$ 7. Therefore, microencapsulation of probiotic in Acrycoat S100 could allow microorganism protection until it reach the intestine. The objective of this study was to determine the encapsulation efficiency of *L. plantarum* microencapsulated in Acrycoat S100.

Materials and Methods

L. plantarum cells lyophilized and previously hydrated, Acrycoat S100 and Tween-80 were suspended in buffer $1 \, mol.L^{-1}$ $NaHCO_3$. Microencapsulation was carried out by spray drying. A Central Composite Rotatable Design (CCRD) 2^2 with 4 axial and 3 central points was used to evaluate the concentrations of Acrycoat S100 (x_1) and microorganism (x_2), respectively, from 1 to 9% (w/v) and from 0.4 to 1.6% (w/v). Encapsulation efficiency (EE) was determined by plate count in MRS agar (Kalschne et al. 2015) comparing the amount of total and encapsulated microorganism by the equation 1.

$$EE = \left(\frac{(N_2 - N_1)}{N2} \times 100 \right) \qquad [1]$$

N_1: Amount of not encapsulated microorganism ($UFC.g^{-1}$).

N_2: Amount of total microorganism ($UFC.g^{-1}$).

Results and Discussion

EE varied from 0.8 to 86.8%. Core-to-wall ratio can influence the coating properties and, consequently, the EE. Central points showed values of EE > 70%, where ratio 5:1 was used. Core-to-wall lower than 5:1 resulted lowest values of EE (< 2%), indicating that polymer content was not enough to cover the microorganism. In contrast, ratios above 5:1 resulted in intermediary EE values; that can be explained by interaction between the polymer groups decreasing the free groups available to bind to microorganism. Significant effects were observed for x_1 linear and quadratic, x_2 quadratic and x_1 by x_2 terms ($p \leq 0.05$). The ANOVA of model was validated ($p = 0.002$; $R^2 = 0.90$) and the mathematic model is presented on Figure 1.

$$y = 81.16 + 13.70x_1 - 24.67x_1^2 - 29.09x_2^2 + 18.70x_1x_2$$
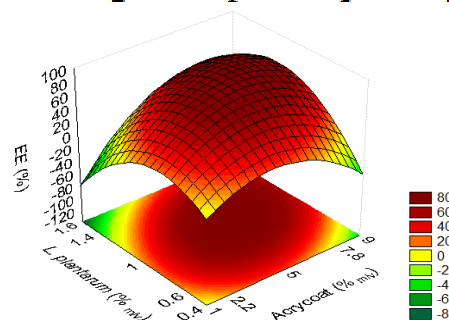

Fig. 1 - Response surface plot for EE (%) of microcapsules.

The response surface methodology allowed identify the optimum region to obtaining higher values of EE. In these experimental conditions, the optimum was located around the central points.

Conclusion

L. plantarum was efficiently microencapsulated in Acrycoat S100 by spray drying. Concentrations of polymer and microorganism closer than central points ($4.5\%_{(w/v)}$ of Acrycoat S100 and $1.0\%_{(w/v)}$ of microorganism) allowed the encapsulation efficiency optimization.

References

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