P-004 **Determination of organic acids in fermented whey permeate microcapsule produced by atomization using HPLC as method**

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INTRODUCTION AND ONJECTIVES

The quality of fermented (dairy) products is largely determined by the sensory perception due to carboxylic acids which are important constitutes in many foods, either products such as Swiss cheese, resulting from fermentative processes (Zhang et al., 2008). With this in mind, short chain organics acids, mainly propionic, and acetic acids, produced by *Propionibacterium* sp. fermentation make a major contribution to Swiss cheese flavor (Teixeira et al., 2004).

The industrial production of propionic acid is almost entirely performed by petrochemical routes, but microbial fermentation is an alternative to produce this acid from renewable resources (Paik et al, 1994). The use of whey permeate, a dairy industry byproduct, has been proposed as a cheap media for biological transformations (Colomban et al., 1993). Dried propionibacteria-fermented whey permeate has been suggested as a natural food ingredient in bakery products (Hong et al., 1995). As most liquid food flavorings, short chain organics acids are volatile and chemically unstable in air, light, moisture, and high temperatures, being necessary additional preparation process for maintenance their chemical properties. This way, microencapsulation method has been applied in order to enhance the shelf life of these compounds.

Microencapsulation of active components in post has become very attractive in recent decades. This method transforms a liquid into a solid in order to make easy its handling, transport and formulations. In addition, it promotes the controlled release of encapsulated active, reduces the volatility of liquids, mask taste and odor of certain components, extends the shelf life, and protects of light, moisture and heat (Favaro-Trindade et al., 2008).

The aim of this work was to characterize spray-dried microcapsules containing Swiss cheese flavor produced by *Propionibacterium freudenreichii*, studying the effects of wall systems consisting of modified starch (capsule) and maltodextrin in different temperatures on the retention of organics acids (lactic, acetic and propionic) during microencapsulation.

MATERIALS AND METHODS

Materials and Experimental design

Maltodextrin GLOBE® 1920 - 20 DE, and Snow Flake® E6131 (Modified Starch - Capsule), given by Corn Products, Mogi-Guaçu, Brazil, used as carrier agent.

A rotatable central composite design was used to design the tests for the microencapsulation of fermented whey permeate, considering two factors (independent variables): inlet air temperature (163-187ºC), and modified starch concentration (0-100%). Five levels of each variable were chosen for the trials, including the central point and two axial points, giving a total of 11 combinations (Table 1). The analysis of variance (ANOVA), test for the lack of fit, determination of the regression coefficients and the generation of three dimensional graphs were carried out using the Statistic 8.0 software (StatSoft, Tulsa, USA).

Table 1: Experimental design for the spray drying tests

Tests	Inlet air temperature (ºC)	Modified starch concentration (%)
1	170 (-1)	14,5 (-1)
2	180 (+1)	14,5 (-1)
3	170 (-1)	85,5 (+1)
4	180 (+1)	85,5 (+1)
5	163 (-1,41)	50 (0)
6	187 (1,41)	50 (0)
7	175 (0)	0 (-1,41)
8	175 (0)	100 (+1,41)
9	175 (0)	50 (0)
10	175 (0)	50 (0)
11	175 (0)	50 (0)

Microencapsulation of fermented whey permeate

Modified starch (capsule), and maltodextrin with dextrose equivalent of 20 was added in 100 mL to the fermented whey permeate containing volatile organics acids under magnetic agitation, until complete dissolution. Sample of fermented whey permeate without wall material added was used as control sample. Spray drying process was performed in a laboratory scale spray dryer Labmaq of Brazil, MSD 1.0 model, with feed rate at 0.96 L h^{-1} and air rate of drying at 45 L min^{-1}. The powders produced with different capsule concentrations and at different inlet air temperatures were stored in proper sealed and opaque containers for later analysis of retention of flavors during drying.

Retention of flavors during drying

The organics volatile organic acids analyzed as liquid and as powder of fermented whey permeate were detected by high-performance liquid chromatography (HPLC) (Schimadzu, SPD-M10A), using rheodyne as injector. The column Shimadzu Shim-pack SCR-101H model, 7.9 mm x 30 cm, and pre-column Shim-pack SCR-101H model, 4.0 mm x 5 cm for organic acids and water-soluble organics such as aldehydes was operated at 50 ºC with 0.1 molar of perchloric acid (0.8 mL/min) as eluent. The detection was done by UV absorption at 210 nm. Each diluted extract 40 µl was injected in to the HPLC two times and the average peak area was reported and used for quantification.

RESULTS AND DISCUSSION

The Figure 1 shows the model of the retention of organic acids (acetic, lactic and propionic) after encapsulation process, as function of the inlet air temperature and the modified starch concentration.

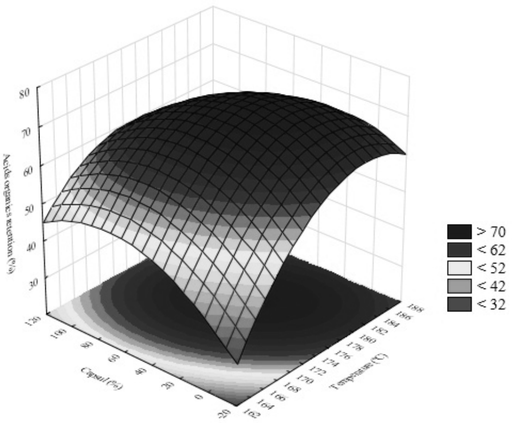

Figure 1 : Response surface for retention of organics acids in microencapsulation of fermented whey permeate

The analyzed statistic results show that the inlet air temperature, as well as the modified starch concentration affected the retention of organics acids. In this way, these factors are significant. Figure 1 exhibit the variations of the retention values of organic acids in the range of 30 to 70 %. The aroma has a relation with the quality of the food and this property is extremely affected by the drying conditions. In this way, according to the results can be observed a great retention of the organic acids approximately 70 % using a inlet air temperature and a modified starch concentration in the range of 172 to 184 ºC and 30 to 80 %, respectively, knowing that the maltodextrin concentration varies with the modified starch concentration adding a 100 % as a total. However, high and low temperatures and modified starch concentration shown a bad retention of organic acids. Teixeira et al. (2004) evaluated the retention of acetic, lactic and propionic acids using wall materials and obtained retention values of 33.78 % of acetic acid and 47.05 % of propionic acid, using maltodextrin as a wall material. Vpadhya & Kilara (1986) shown that the increase of the air temperature of the drying also contribute to increase the retention of volatile compounds, which are lost during the drying.

CONCLUSIONS

According to the conditions using in the planning of this work the better configuration of the spray drying operation is a temperature around 178 ºC and a modified starch concentration around 55 %. Moreover, it was shown that high and low of these two independent variables are not appropriated for the retention of the organic acids.

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