

Encapsulación de Probióticos de Secado por Spray

Spray-Drying Encapsulation of Probiotics

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Abstract:

The probiotic microorganisms have gained importance in recent years because their consumption has benefits on health mainly of the digestive system. For this reason, the industry is in a constant search of processes for these micro-organisms don't lose their viability and they do their function. Because of that, the microencapsulation has been used as a method of protection in the internal and external climate conditions. In this same vein, probiotics need prebiotic substances, such as malanga and rice starches, to stay viable and perform beneficial functions inside the host. The objective of this work was to assess two prebiotics (malanga and rice starches) as wall material in the viability of a microorganism *Lactobacillus casei* subs. *Paracasei* encapsulated through spray drying. The isolated malanga and rice starches, got 82.60 and 86.68% of starch overall respectively, in the amylose content rice presented 17.34% and malanga 9.44%, the exponential phase of microorganisms was presented at 14 h, aggregates with a popcorn shape were accomplished and finally the encapsulation efficiency was in the order of 10⁸.

Keywords:

Probiotics, spray drying, encapsulation

Resumen:

En los últimos años los microorganismos probióticos han cobrado importancia, su consumo presenta beneficios en la salud, principalmente del sistema digestivo. Por esto, la industria se encuentra en constante búsqueda de procesos para que estos microorganismos no pierdan su viabilidad y cumplan su función, debido a lo cual se ha recurrido a la microencapsulación como método de protección frente a las condiciones ambientales internas y externas que puedan disminuir su viabilidad. En este mismo sentido, los probióticos necesitan de sustancias prebióticas, como lo son los almidones de arroz y malanga, para mantener su viabilidad y cumplir las funciones benéficas dentro del huésped. El objetivo de este trabajo fue evaluar dos prebióticos (almidón de arroz y malanga) como material pared en la viabilidad de un microorganismo *Lactobacillus casei* subs. *Paracasei* encapsulado mediante secado por aspersión. Los almidones de arroz y malanga aislados, obtuvieron 82.60 y 86.68% de almidón total respectivamente, en el contenido de amilosa arroz presentó 17.34% y malanga 9.44%, la fase exponencial del microorganismo se presentó a las 15 h, se lograron formar agregados con forma de palomita de maíz y finalmente la eficiencia de encapsulación quedó en el orden de 10⁸.

Palabras Clave:

Probióticos, secado por aspersión, encapsulado

INTRODUCTION

Currently there is a big problem in the food industry, in relation to the addition of probiotics in food, that is guarantee that such microorganisms arrive to the large intestine alive and in best conditions, no polluted and without variation or mutation, what it means; keep the functional cultivation, to carry this out is necessary to have a concentration of 1x10⁷ UFC/mL at the moment of consumption Ding & Shah (2007), among the different alternatives to avoid the lost and

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deterioration of probiotics, as well as their protection there is the encapsulation, the spray –drying is used to the conservation of acid lactic bacterial culture and is one of the methods that best results has provided to achieve this purpose Avila-Reyes *et al* (2014) consists in introducing the alive microorganisms in a matrix or wall material in the adequate quantities, so that their metabolic stability and functional activity be kept (Kun-Nan *et al*, 2005). On the other hand the prebiotics, help to stablish a suitable native flora that improve the immune defence functions of the host's intestine like others (Gibson & Roberfroid, 1994), both native rice and malanga starch, are formed by small granules, in front of protein tend to form fiberboard microcapsules, so on their arrival to the colon are fermented by the existing microbiota. Are considered prebiotics because their resistance to digestion that can be caused by the limitations of physical accessibility, for the native starch granular structure or the physical modifications of the starches on the drying process, as a result, the objective of this work was to evaluate the prebiotics (rice and malanga starch) as wall material in the viability of microorganism *Lactobacillus casei* subs. *Paracasei* encapsulated by spray-drying.

MATERIALS AND METHODS

The rice starch was isolated in accordance with the reported methodology by Patindol *et al.*, (2007) and malanga starch was gotten following the reported process by Flores-Gorosquera *et al.*, (2004) For starch determination was used a test kit Megazyme for entire starch and amylose content was quantified following the Hoover and Ratnayake methodology (2001). The *Lactobacillus casei* subs *paracasei* exponential phase was established in accordance with Alvarez methodology *et al.* (2010). Previous to micro-encapsulation the microorganism reactivations were carried out, taking the aliquot to encapsulate in the exponential phase, in accordance with the mentioned before. The drying conditions used were: Inlet temperature: 70 °C, outlet temperature: 42.5°C power flow of 10 mL/min. Subsequently were morphologically characterized the microcapsules through scanning electron microscopy following the Paredes-Lopez methodology *et al.*, (1989), and it was determined the efficiency of encapsulation for both encapsulated.

RESULTS AND DISCUSSION

The total starch content for malanga simple (AM) was of 86.68% showing higher purify in comparison with rice starch (AA) (82.60%). Subsequent to extraction process doesn't get 100% due to isolation efficiency as well as botanical sources where by obtained starch shows a remaining certain amount of lipids and proteins that were drawn with the process of isolating. On the other hand amylose content help us to classify the starch, the results showed that AA contained a 17.34% in accordance with the proposed classification by Juliano (1992) for rice starch is waxy, if contains 0-2% amylose, very low in amylose of 5-12%, low in amylose 12-20%, intermediate in amylose of 20-25% and high in amylose of 25-33%, related to reported is low in amylose. For the AM was quantified an amylose content of 9.44%, at being a tuber it may be classified as waxy starch, because it has been reported that contain less of 20% of amylose (Tester *et al.*, 2004).

Lactobacillus casei subs. *Paracasei* growth kinetics (Fig. 1) was performed during 25 h, taking measure every 5 h. Related to the results gotten it was observed that exponential phase was at 15 h with an approximate population 2.43×10^9 UFC/mL, this results are similar to the ones reported by Jurado-Gómez *et al.*, (2014) who performed the *Lactobacillus casei* growth kinetics. getting the exponential phase at 16:48 h, with a population of 7.3×10^8 UFC/mL.

In the microencapsulation the capsules formations depends on several facts among them the physicochemical properties of wall material, the micrographies gotten from the microcapsules next to the microorganism (Fig 2) through spray drying, with the different wall materials, were observed by scanning electron microscopy (SEM), to evaluate the shape, the surface appearance such as the integrity of the capsules and any damage evidency or rupture. For the micrography made to AA is observed that granule starches suffer any change because of show "deflated", this could happen during the spray drying because the starch could have suffered any type of change which could be produced by

the temperature, nevertheless Gonzalez-Soto *et al.*, (2011) reported that gotten microcapsules for native rice starch through the spray drying have not an spheric shape, similar to the one obtained, for the case of malanga the spheric adding seems more regular little porosity and “popcorn” shape, this is because its low amylose content such as endogenous protein Zhao & Whistler (1994), The obtained results for the viability of microorganisms show that both (rice and malanga starch) belongs to the same order of magnitude (10^8), however malanga increase slightly the viability of *Lacobacillus casei* subs. *Paracasei* with a population 9.62×10^8 UFC/g in comparison with rice (5.23×10^8 UFC/g), nevertheless it can be said that malanga starch forms better spherical aggregates for being of very small granule (2-3 μm) which offer a higher protection to microorganisms in comparison from rice that is considered small (2-10 μm) (Lindeboom *et al.*, 2004).

CONCLUSION

Both rice and malanga starch offer an excellent option for the probiotic *Lactobacillus casei* subs. *Paracasei*, in as much as is carbon source is the glucose, however the viability of microorganism it looks less affected in the malanga starch because the microorganism are found inside the capsule and with less porosity among swarmed, contrary that occur with rice starch, that at the moment of having tow swarmed with small holes can make that microorganisms migrate to the exterior of micropause which will be exposed to the environment and affecting their viability.

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