Effect of different carrier materials on viability of probiotics in spray dried Mulberry juices

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Abstract

The propose of this research was to produce probiotics mulberry juice powder by spray drying technique. The mix of three probiotics strains including, *Laclobacillus cacei*, *Laclobacillus paracacei*, *Laclobacillus rhamnosus* were added into mulberry juice at 9 logCFU/mL and spray dried with inlet temperature at 150°C, outlet temperature at 80°C and flow rate at 2 min/L . Nutriose and gum arabic were used as carrier to protect the cell from the heat. After spray drying process, the viability of the cell were 8.19, 7.50 and 8.20 logCFU/mL when using nutriose, gum arabic, and mix of nutriose and gum arabic as carrier, respectively. The viability of the probiotics in the powders were reduced to around 6.1 to 6.2 logCFU/mL after 1 month storage at room temperature. Exposition of the probiotics mulberry powder to simulate gastrointestinal tract showed a major loss of viability of the cells since they passed through the simulated stomach condition, pH 2.0, for 1 hour. To explore the survival of probiotics in real condition when the stomach was full with foods, pH 3.0 and 4.0 of simulated stomach condition should be investigate for further experiments.

Introduction

Probiotics are considered as “good buddies” to human health. However, orally ingested probiotics must survive the harsh conditions encountered when passing through the gastrointestinal tract (GIT) and colonizing the gut. Additionally, probiotic strains added into a food system must remain stable through the processingand storage conditions of the food product. Now there are many types of probiotic in foods and fruit juice are good choice. Because the population of all ages drink without loss.

Mulberry belongs to the family Moraceae. Mulberry fruit contains vitamins, minerals, phenolic acids, flavonols and anthocyanins which have been associated with its health benefits. If add probiotics, it will greatly increase the value of mulberry juice.

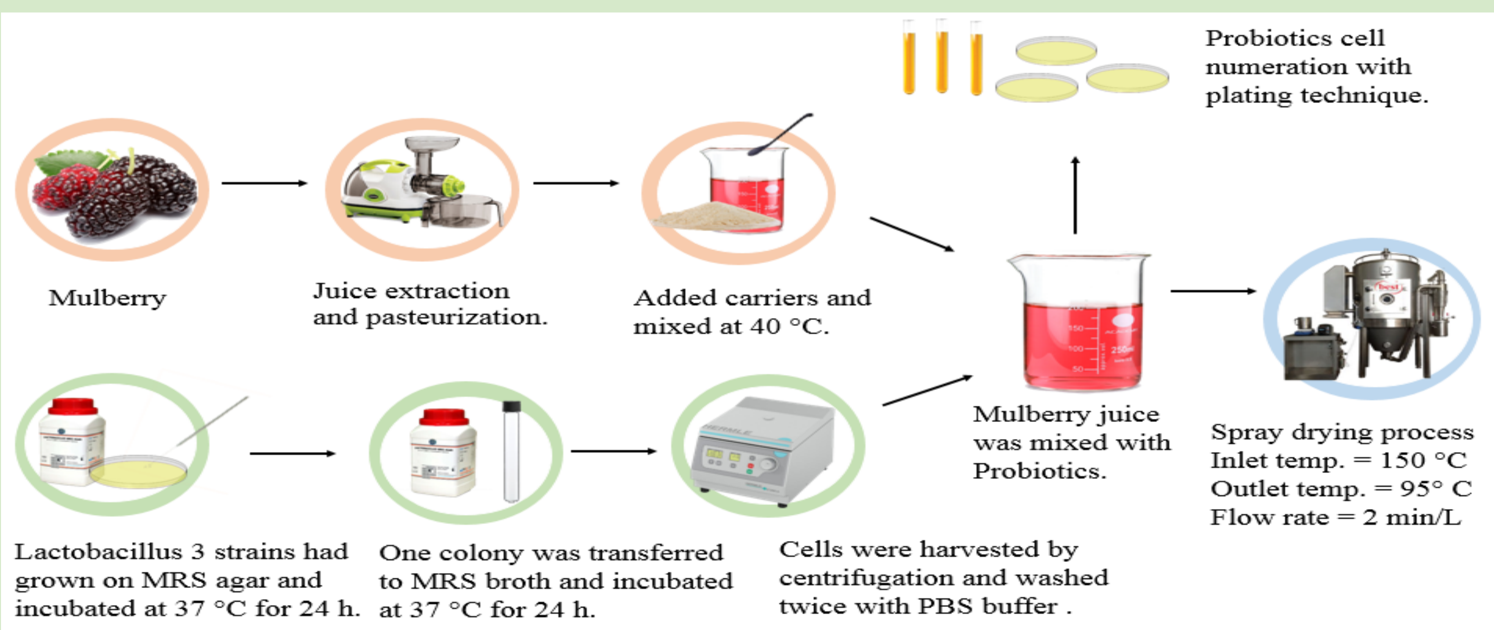
Spray drying have been applied in the microencapsulation of probiotic microorganisms in order to improve their processing and storage stability and to protect them against adverse environmental conditions. The encapsulating agents (or wall materials) form a polymeric matrix in which the microorganisms are entrapped. However, adding the cells directly to the fruit juice may cause the cells to survive less because of the high acidity should use encapsulation to help.

Objectives

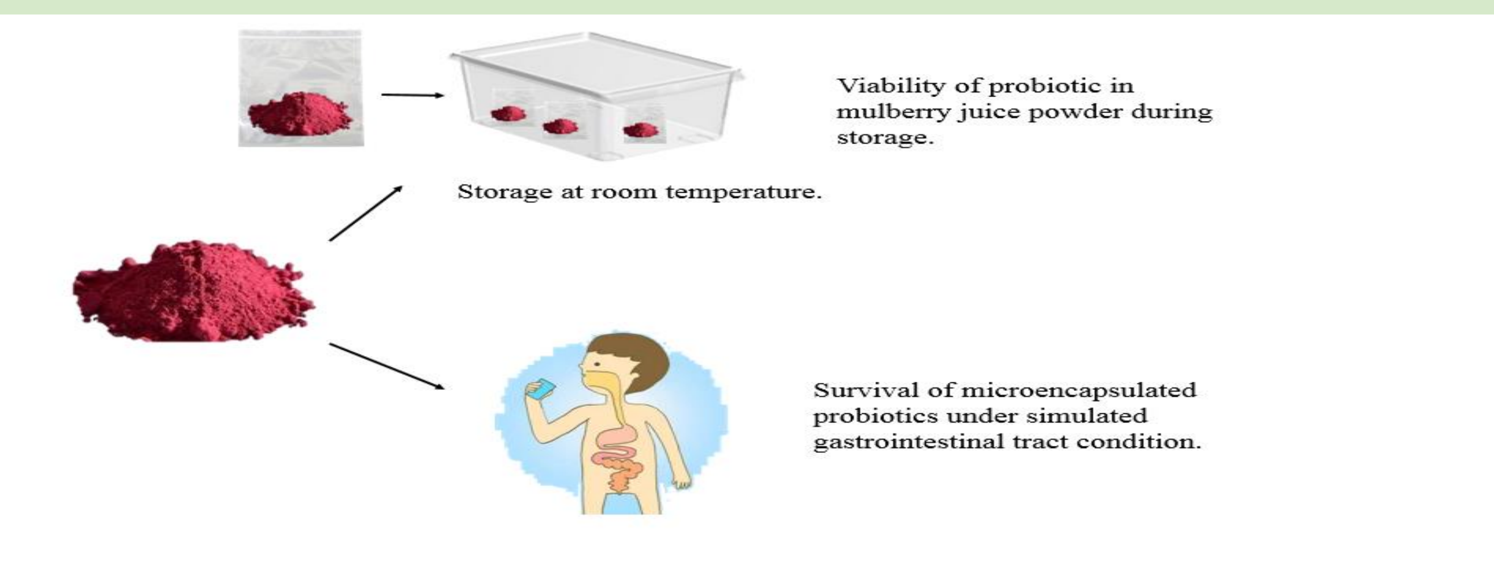
- To study viability of microencapsulated probiotics under simulated gastrointestinal tract condition.
- To study the effect of different carriers on survival of probiotic cells during spray drying process with mulberry juice.
- To investigate the viability of probiotics in mulberry juice power during storage.

Materials & methods

Mulberry juice and Lactobacillus 3 strains preparation



Analysis powder



Result & Discussion

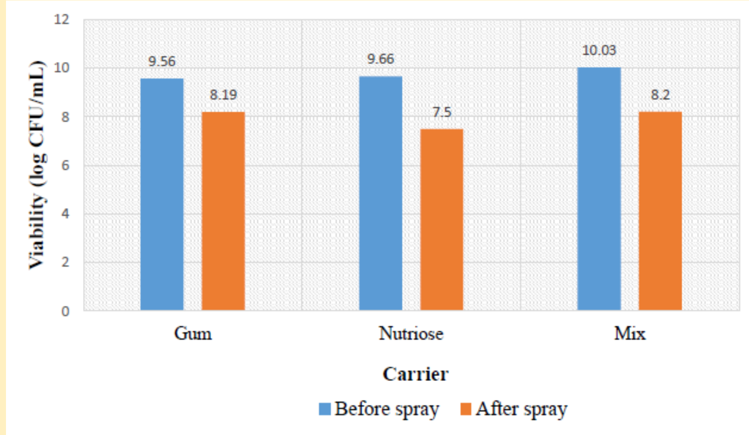


Fig1. Viability of probiotics during spry drying process.

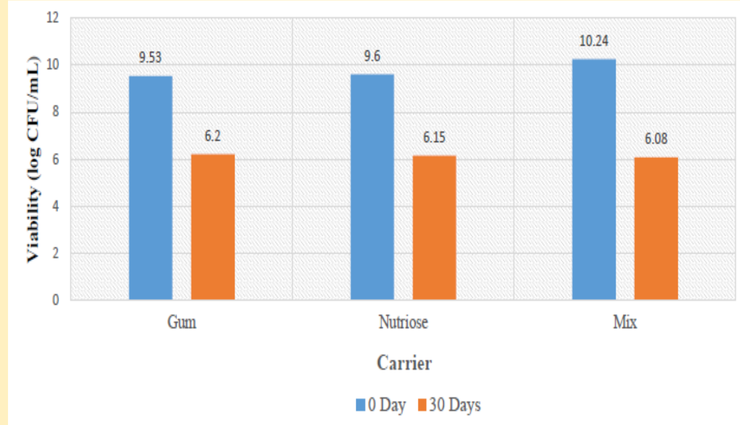


Fig2. Viability of probiotics during storage.

The experiments were carried out by adding three probiotic species include *L.casei*, *L.paracasei*, *L.rhamnosus* to mulberry juice then created the powder form using spray-dry technique. It was found that the survivals of the cells were decreased around 2 logCFU/mL at 150°C . **Barbosa and worker (2015)** reported that when adding *L.plantarum* into orange juice and spray dried at 150°C and used nutriose as carrier the viability of the cells was stay in the same number as they were before drying process**.** However, according to (**Anekella and Orsat (2013)** the spray dry *L.rhamnosus* in raspberry juice at inlet temperature 130 °C and use a nutriose as carrier, only 50% of the cells survived. These reports indicated that probiotic survival was lower when spray dry the cells with red juice. The study of **Nualkaekul and Charalampopoulos (2011)**, reviewed that adding *L.plantarum* into different color of fruit juices showed high rate of viability when the cells were in green, yellow and orange color juices. On the other hand, red color fruit juice caused the loss of viable cells even though the pHs were the same as green and yellow juices. Some compounds in the red fruit juice should induce stress condition on probiotic cells and cause more cell lose during spray dry process.

In our study, probiotic cells in mulberry juice powder encapsulated with gum arabic was survived more than use nutriose and mix. Similar with **Vondel Reyes et al, (2018)** the result showed probiotic solutions mixed with the different wall materials had different mass flow rates (kg/h) which produced as a result different evaporation rate values for the production of the probiotic powders. Gum arabic was better protective agent than nutriose.

Table1. Viability of probiotics cell under GIT conditions

Carrier	Viability (logCFU/mL)		
	0h.	1h.	3h.
Gum arabic	8.19	0	0
Nutriose	7.50	0	0
Mix	8.20	0	0

In this research, the probiotic could not survive in gastric juice. However, **Chaikham and co-workers (2017)** found that viability of probiotic *L.casei* decreased from 8 logCFU/mL to 4 logCFU/mL. They used faster feed rate compared to our work. It was possible that slow feed rate cause more heat damage of the cells and they could die off very quick under gastric condition.

Conclusions

In this study, the viability of the cell after spray dry were 8.19,7.50 and 8.20 logCFU/mL when using nutriose, gum arabic, and mix of nutriose and gum arabic as carrier, respectively. The viability of the probiotics in the powders were reduced to around 6.1 to 6.2 logCFU/mL after 1 month storage at room temperature. Exposition of the probiotics mulberry powder to simulate gastrointestinal tract showed a major loss of viability of the cells since they passed through the simulated stomach condition, pH 2.0, for 1 hour. Gum arabic was better protective agent than nutriose and mix.

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