XXIII SINAFERM
XIV SHEB
XIV ENZITEC
Búzios, Rio de Janeiro, Brasil
28 a 31 de agosto de 2022
XXIII Simpósio Nacional de Bioprocessos
XIV Simpósio de Hidrólise Enzimática de Biomassas
XIV Seminário Brasileiro de Tecnologia Enzimática

BIOMASS PRODUCTION AND SPRAY DRYING OF *Lactobacillus plantarum* USING WHEY

Leda Maria Fortes Gottschalk, Erika Fraga, Sergio Pontes, William Leal, Regina Nogueira, Vanessa Melo, Janine Passos, Karina Olbrich dos Santos

Embrapa Agroindústria de Alimentos, Rio de Janeiro RJ

E-mail: leda.fortes@embrapa.br

1. INTRODUCTION

The delivery of probiotic microorganisms has been shown to be an adequate strategy for the composition of the microbiota and the activity of intestinal health, with relevant health benefits. The market for probiotic cultures for use in food in Brazil is restricted to a few multinational companies, which sell high-cost imported products. A prospection of microorganisms with probiotic properties can lead to the production of lactic ferments, which must have their results proven by scientific studies. Embrapa has a collection of lactobacilli isolated from dairy products identified according to the species level and selected with the function of probiotic potential and properties of technological interest. *Lactobacillus plantarum* is a homofermentative bacterium capable of fermenting sucrose, cellobiose, mannitol, among others. Another important feature was its ability to produce exo-polysaccharides and bacteriocins. Whey is a by-product of cheese making usually managed as a waste that, having a high biochemical oxygen demand, is costly to remove. Spray drying is the lower cost technique and therefore, it is more convenient for producing large quantities of bacterial probiotic cultures. Whey can be used both in the production of biomass as a source of carbon and nitrogen and in spray drying as a protective wall material. Thus, the selected strain *L. plantarum* B12 was used in the production of a lactic ferment powder with probiotic potential using whey as nitrogen and carbon source during fermentation and as a protective wall material during the drying process. The impact and technology of this result expands the knowledge about bacteria from Brazilian biodiversity and generates national agro-industrial input that, once used in food, can provide benefits to the health of consumers.

2. MATERIAL AND METHODS

The strain *Lacbtobacillus plantarum* B12 was cultivated in standard MRS medium or in medium with whey powder diluted in water in different proportions (1:20; 1:30; 1:40 and 1:50) aiming at the production of biomass incubated at 37 °C in a shaker for 24 hours. Subsequently, using the best concentration of whey (1:20) the importance of controlling pH (6.0) in a 2 L fermenter was evaluated. The parameters monitored were pH, reducing sugar concentration and cell growth. The yeast produced in a fermenter was spray dried in a Buchii Spray Dryer. The powder product obtained was packaged in laminated metallized PET packages, vacuum sealed and kept under refrigeration at 6°C for 12 months. Both cell growth and viability of the lactobacilli strain were determined by plate enumeration after deep seeding on MRS agar and incubation at 37°C for 72h, with results expressed in CFU/mL and in CFU/g.

3. RESULTS AND DISCUSSION

The proximate composition showed that whey (WPC 35) used had 30% protein, 56% carbohydrates, 7% fat and 6.5% ash. The culture of lactobacilli was carried out in MRS broth

(standard medium) and medium containing only whey powder as a source of carbon and nitrogen. Different concentrations of whey power in water (1:20; 1:30; 1:40 and 1:50) were used for cell growth of *L. plantarum*. The whey 1:20 was the best for presenting composition in terms of protein and carbohydrate very close to the standard MRS medium. Whey 1:20 was used in the study of the influence of pH control during fermentation (Table 1).

Table 1. *Lactobacillus plantarum* with and without pH control.

Time (h)	pH *pH control*	pH	Reducing sugar (g/L) *pH control*	Reducing sugar (g/L)	Log CFU/mL *pH control*	Log CFU/mL
0	5.97	5.15	18.2	18.0	8.3	8.18
18	5.95	3.85	6.8	9.7	9.15	8.8
24	5.93	3.77	**3.6**	**9.1**	**9.23**	**8.9**
42	5.99	3.59	2.7	7.7	9.32	8.9
48	5.98	3.57	2.6	6.4	9.48	8.95

The pH control resulted in a reduction of the constant reducing sugar up to 24 hours (3.6 g/L) as in an increased of Lactobacillus, measured in log CFU/mL (9.23 in 24 hours). The pH control helped in the physiology of the microorganism by neutralizing the lactic acid formed during the consumption of lactose. When the pH was already lower than 4.0, the physiology of the microorganism is affected, reaching the stationary phase, causing a consumption of only half of the reducing sugar after 24 hours. The results found are in agreement with the study carried out by Manzoor et al. (2017) and Kothari et al. (2020) that with pH around 6 there was an increase in the amount of colony forming units. The lactic ferment powder obtained under the optimized conditions remained stable for a period of six months both when stored under freezing (-15°C) and under refrigeration (6°C), maintaining about 96% of cell viability under refrigeration and 100% in a freezer.

4. CONCLUSION

Through the experiments carried out, it was possible to observe that the strain *Lactobacillus plantarum* B12 is promising in the manufacture of powder. The whey is a good culture medium, capable of presenting cell growth greater than or equal to the standard MRS medium, with superior cell viability after drying in spray dryer, indicating the protective role played by milk protein.

5. REFERENCES

KOTHARI, D., LEE, W.D., JUNG, E.S., NIU, K.M., LEE, C.H., KIM, S.K. 2020. Controlled Fermentation Using Autochthonous Lactobacillus plantarum Improves Antimicrobial Potential of Chinese Chives against Poultry Pathogens. Antibiotics, 9(7): 386.

MANZOOR, A, QAZI, J.I, HAQ, I.U, MUKHTAR, H, RASOOL, A. 2017. Significantly enhanced biomass production of a novel bio-therapeutic strain *Lactobacillus plantarum* (AS-14) by developing low cost media cultivation strategy. J. Biol. Eng., 5: 11-17.

6. ACKNOWLEDGMENTS

The authors are grateful to EMBRAPA project number 23.16.05.038.00.00.