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Celery and Apple Pomace Flour as a Carrier of Cheese Starter Cultures

Danka Radić[1,*], Milica Mirković[2], Ivana Perić[2], Mihal Đuriš[3], Snežana Zlatanović[1] and Stanislava Gorjanović[1]

[1]*Institute of General and Physical Chemistry, University of Belgrade, Serbia*
[2]*University of Belgrade, Faculty of Agriculture, Serbia*
[3]*Institute of Chemistry, Technology and Metallurgy—National Institute of the Republic of Serbia, University of Belgrade, Serbia*

Abstract

The zero waste concept, focused on reducing and repurposing waste, is becoming both a necessity and a growing trend in modern lifestyles. This is particularly relevant to the fruit and vegetable processing industry, which generates significant amounts of by-products that, if properly valorized, can serve as raw material in functional food production. This study aimed to apply apple and celery pomace flour (APF and CPF) as carriers of cheese starter cultures by employing fluidized bed granulation. This approach could lead to the development of a functional ingredient that enhances nutritional value and preserves the microbiological viability of the starter cultures. Microbiological analysis of APF and CPF included determination of total aerobic mesophilic bacteria, yeast and molds and Enterobacteriaceae according to ISO method 4833:1, 21527-2 and 21528-2, respectively. Yeast and mold, as well as Enterobacteriaceae, were not detected in CPF, while APF contained 2.17 Log CFU/g yeasts and molds and Enterobacteriaceae. APF and CPF contained 3.12 and 4.55 Log CFU/g of aerobic mesophilic microorganisms, respectively. Upon sterilization of APF and CPF in the preheated fluidised bed dryer column at 78 °C for 10 min, the temperature was reduced to 48 °C and granulation with 5 % of lactose as binder, containing the starter culture Flora Danica (Chr Hansen, Denmark), was conducted. The pressure through a two-fluid nozzle was 1.8 bar. The mean fluid flow rate and air flow rate were 5 mL/min and 35 m3/h, respectively. The granulated APF and CPF were dried by fluidization at 40 °C for 15 min, cooled to room temperature, transferred into food-grade sterile polypropylene zip lock bags, and maintained at 4 °C. Granulation led to an increase in particle size and a notable improvement in flowability, as indicated by Carr's index and Hausner ratio. The viability of the starter cultures applied on APF and CPF was checked at 7, 14, 21 and 28 days using the plate count method. Appropriate dilution was plated on M17 agar and incubated at 30°C for 48 h. The level of starter cultures' viability immediately after granulation of CPF and APF (6.9 and 6.42 Log CFU/g) remained the same after 7 days, while after 28 days was 6.37 and 6 Log CFU/g, respectively. Granulated CPF and APF were added to pasteurised milk at a concentration of 1 % and 2 %, and after 18 hours of fermentation, the milk was coagulated. The presented concept enabled the formulation of a from-waste-to-functional-food product, a premix intended for home and artisanal production of cheese enriched with bioactive substances of fruits and vegetables. It redirects and reuses waste and facilitates the preparation of an innovative food product that may contribute to the maintenance of the gut microbiome.

Keywords: Zero waste, anti-grain flour, granulation, viability, cream cheese

References

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