IOCFE 2025 Conference
The 1st International Online Conference on Fermentation
12–13 November 2025 | Online
MDPI

Obtaining a functional food ingredient based on oat bran and fermented by *Lacticaseibacillus casei*.

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INTRODUCTION & AIM

Using agro-industrial by-products as a substrate for the growth of probiotic strains is a sustainable alternative for increasing their added value. In particular, oat bran (OB) has a high content of soluble and insoluble fibers with a positive effect on the metabolism of lactic acid bacteria.

This study aimed to design and optimize the production of a functional ingredient (FI) with *Lacticaseibacillus casei* (ATCC 393) immobilized in OB.

METHOD

OB

Sterilisation 121°C, 15 min.

-1 g OB
-Whey (W)* : 0; 2; 4 g W/g OB
-Hydration level (HL)*: 5; 12.5; 20 mL

Initial inoculum concentration(IC)* : 7.61; 6.61; 5.61 Log CFU/g OB

Incubation 37°C, 24 h

Wash, spin Centrifugation

Viable *L. casei* count **

Supernatant: pH, titratable acidity***

Pellets Vacuum drying 24 h

Functional ingredient(FI)

Storage 25°C

After 10 days of storage

Viable *L.casei* count **

*According to experimental design
** MRS plate count at 37°C, 72 h (log(CFU/g FI))
*** 0.01 N NaOH and phenolphthalein as an indicator (g of lactic acid/L supernatant)

The effects of W, HL, and IC supplementation were analyzed using a three-level Box-Behnken experimental design with the center point measured in triplicate. The analyzed response variables were cell count and growth, pH and titratable acidity of the supernatants after incubation, FI yield, and cell count after dehydration and 10 days of storage. For the experimental design, the correlation study was performed using the Statgraphics Centurion XV version 6.0 program (StatSoft Inc., USA).

RESULTS & DISCUSSION

Table 1. Regression coefficients of the studied effects on the response variables.

Coefficient	Dependent variables					
	Cell count	Cell growth	pH	Titratable acidity	Yield	Post – dehydration cell count
constant	8.41	-0,80	4.45	11.74	0.47	8.50
A: HL	0.10	**0.14**	-0.02	**-0.36**	0.01	-0.03
B: W	**5.01**	**6.78**	**-2.17**	**9.19**	0.90	**0.80**
C: IC	-0.01	**-0.95**	**-0.27**	**3.79**	-0.02	0.65
AA	**-0.0034**	-0.0034	0.0016	0.0022	-0.0002	0,0008
AB	-0.009	-0.125	-0.01	0.736	-0.003	0.024
AC	0,0004	-0.0002	0.0053	-0.1457	-0.0017	-0.0009
BB	**-6.79**	**-6.89**	**3.03**	-14.34	-0.89	4.53
BC	-0.09	0.08	-0.29	-1.31	0.13	0.84
CC	-0.007	0.008	-0.039	0.137	-0.013	0.15
R^2	95.00	97.72	93.05	94.82	83.32	87.25
R^2 adj	85.99	93.61	80.55	85.49	53.31	64.29
Lack of fit	0.13	0.14	0.35	0.14	0.86	0.26

The regression coefficients highlighted in bold have a significant effect ($p < 0.05$) on the response variable.

- All response variables fitted to the proposed model, except cell count after 10 days at 25°C.
- Significant Pearson correlations were observed between cell count and pH, titratable acidity, and IF yield (-0.5941, p = 0.0251; 0.7699, p = 0.0013; 0.6202, p = 0.0180 respectively).

The independent variables were optimized to maximize cell count and growth during the fermentation process and to maximize cell count after dehydration. The optimal conditions found were: for HL: 15 mL of water/g OB; for whey: 0.3 g/g OB; and for the IC: 5.79 log(CFU/g OB).

Table 2. Estimated statistical and experimental values for the different responses variables of the optimal system.

Responses Variables	Statistical estimate for the optimal system	Experimental value
Post fermentattion cell count log(UFC/gIF)	10.04	10.11 ± 0.10
post fermentation cell growth logN-logN$_0$	4.07	4.43 ± 0.06
Post –dehydration cell count log(UFC/gIF)	8.20	8.36 ± 0.09

CONCLUSION

This result demonstrates the feasibility of optimizing the production of a dried FI based on OB as a substrate for *L. casei* . The obtained FI has potential for new food development.

El departamento de industrias de la FCEyN adhiere al Programa Nacional de Reducción de Pérdidas y Desperdicios de Alimentos.
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