



INFOGRAPHIC

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Tác giả:

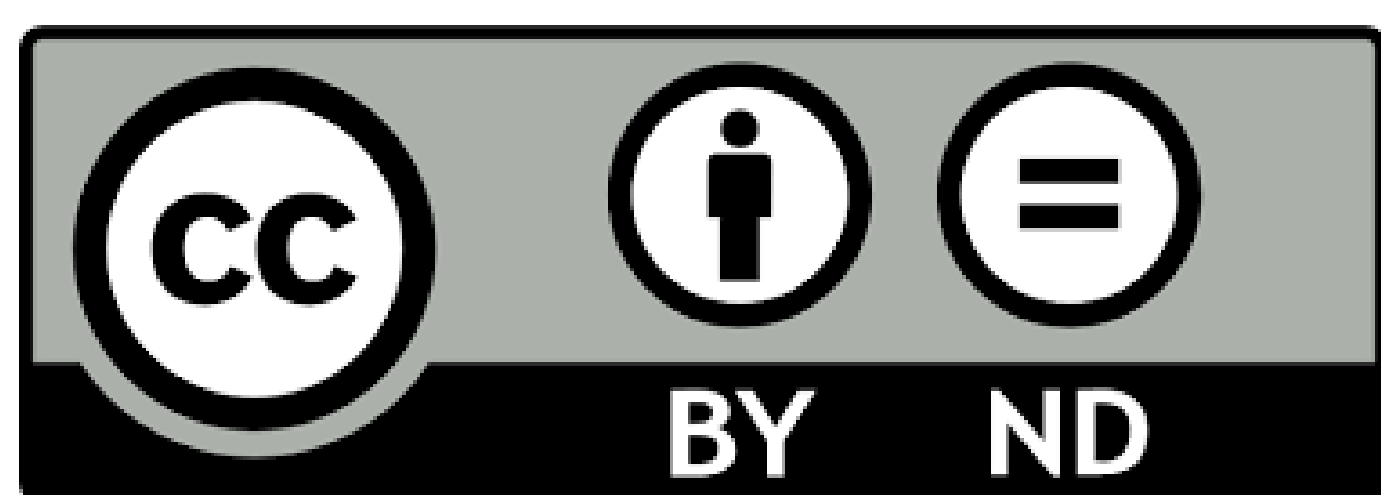
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Đơn vị:

Khoa Khoa học Ứng dụng & Công nghệ

Năm xuất bản:

2026



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THE EFFECT OF FACTORS ON THE CHARACTERISTICS OF INVERTED MANGO YOGURT

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Abstract

This study evaluated the effects of mango puree ratio, stabilizer system, gelatin concentration, and fermentation time on the quality of inverted mango yogurt. Among the tested levels, 5% mango puree and 0.3% gelatin were selected based on the highest sensory scores (7.93/9 and 8.67/9, respectively). The selected product showed comparable texture to a commercial benchmark, higher L* and b* values, and a higher presumptive LAB count (8.64 vs. 6.85 log CFU/g). E. coli was not detected at the method detection limit. These findings support the potential use of Cat Hoa Loc mango in value-added yogurt products.

Introduction

Cat Hoa Loc mango is a specialty fruit with high economic value but is highly perishable after harvest, with losses exceeding 50% during peak season (Owino & Ambuko, 2021). Developing processed products from mango, especially inverted mango yogurt, can add value to raw materials and diversify products. However, incorporating mango puree into yogurt poses challenges regarding gel structure, water-holding capacity, and product stability (Priyashantha et al., 2025). This study aimed to evaluate the effects of mango puree ratio, stabilizer system, gelatin concentration, and fermentation time on the physicochemical, textural, color, water-holding, and sensory properties of inverted mango yogurt, and to compare the selected product with a commercial benchmark.

Materials and methods

Item	Description	Experiment	Factor	Levels	Fixed Conditions
Mango	Cat Hoa Loc (Tien Giang), 80–85% ripeness; peeled, deseeded, blended, heated 85°C/5 min, stored 4°C	Exp 1	Mango puree ratio	5%, 10%, 15%, 20%	0.3% gelatin; 42°C; 7 h
Milk base	Vinamilk fresh milk (UHT) + Ong Tho condensed milk			Control (0%), G (0.4% gelatin), P (0.4% pectin), GP1 (0.3%G+0.1%P), GP2 (0.2%G+0.2%P)	
Starter	L. delbrueckii subsp. bulgaricus + S. thermophilus, 0.1% (w/v)	Exp 2.1	Stabilizer system		5% puree; 42°C; 7 h
Stabilizers	Gelatin; low-methoxyl pectin (LMP)				
Processing	Stabilizer dissolved in milk → heated 90°C/5 min → cooled 42°C → inoculated → poured over puree layer → fermented 42°C → cooled 4°C → stored 24 h	Exp 2.2	Gelatin concentration	G0 (0%), G1 (0.2%), G2 (0.3%), G3 (0.4%), G4 (0.5%)	5% puree; 42°C; 7 h
Design	Completely randomized design (CRD), n = 3 independent batches	Exp 3	Fermentation time	5 h, 6 h, 7 h, 8 h	5% puree; 0.3% gelatin; 42°C

Parameter	Method	Replication
pH	pH meter (Milwaukee MI 150), calibrated pH 4.0/7.0/10.0, 25°C	n = 3
TTA	Titration with NaOH 0.1 N, phenolphthalein; expressed as % lactic acid	n = 3
°Brix	Refractometer, 25°C	n = 3
Viscosity	Brookfield DV1M, spindle LV-2, 60 rpm, 25°C	n = 3
TPA	Brookfield CT3, probe TA4/1000, 2 mm/s, 30% deformation, 2 cycles	n = 3
Color	CIE L*a*b*, handheld colorimeter BGD 551	n = 3
WHC	10 g sample, centrifugation 4500×g, 20 min, 4°C	n = 3
Syneresis	30 g sample, drainage on filter paper, 4°C, 2 h	n = 3
Sensory	30 untrained panelists; 9-point hedonic scale; JAR 5-point scale; randomized serving at 10–12°C	n = 30
Microbiology	LAB: MRS agar, 37°C/48 h, anaerobic; E. coli: CCA, 37°C/24 h; detection limit < 10 CFU/g	n = 3
Statistics	One-way ANOVA + Tukey HSD (or Games-Howell); Friedman + Wilcoxon for sensory; independent t-test for SCX vs SCTM; SPSS 24; p < 0.05	—

Effect of Stabilizer System

Table 2. Effect of stabilizer on texture and color

Parameter	Control	G	P	GP1	GP2
pH	4.46 ± 0.03 ^a	4.72 ± 0.02 ^b	4.96 ± 0.04 ^d	4.90 ± 0.02 ^c	4.89 ± 0.02 ^c
Hardness (gf)	17.60 ± 8.88 ^a	8.00 ± 1.00 ^a	89.80 ± 7.26 ^d	85.00 ± 7.81 ^d	63.60 ± 2.30 ^b
b*	10.56 ± 0.30 ^a	14.25 ± 0.12 ^c	12.99 ± 0.34 ^b	13.73 ± 0.50 ^{bc}	12.96 ± 0.93 ^b
Overall liking	7.87 ± 0.35 ^d	8.90 ± 0.31 ^c	5.20 ± 0.85 ^c	4.47 ± 0.51 ^b	3.70 ± 0.84 ^a

Note: Values in the same row with different superscript letters indicate statistically significant differences ($p < 0.05$).

Among the tested stabilizers, 0.4% gelatin (G) achieved the highest overall liking (8.90/9) and the highest b* value (14.25), indicating greater yellowness. Pectin and gelatin-pectin combinations produced harder gels but lower sensory scores. Therefore, gelatin was selected for further optimization of concentration.

Table 3. Effect of gelatin concentration on product quality

Parameter	G0	G1	G2	G3	G4
pH	4.46 ± 0.03 ^a	4.92 ± 0.02 ^d	4.71 ± 0.02 ^b	4.70 ± 0.01 ^b	4.84 ± 0.01 ^c
TTA (%)	0.82 ± 0.01 ^{bc}	0.83 ± 0.01 ^c	0.82 ± 0.01 ^{bc}	0.82 ± 0.01 ^{bc}	0.75 ± 0.01 ^a
Hardness (gf)	12.00 ± 0.71 ^a	14.80 ± 0.84 ^b	11.60 ± 1.52 ^a	20.60 ± 0.55 ^c	12.40 ± 1.55 ^a
Overall liking	5.10 ± 0.61 ^a	6.63 ± 0.49 ^b	8.67 ± 0.55 ^d	7.30 ± 0.60 ^c	6.37 ± 0.56 ^b

Note: Values in the same row with different superscript letters indicate statistically significant differences ($p < 0.05$).

Among the tested gelatin concentrations, 0.3% (G2) achieved the highest overall liking (8.67/9). This concentration produced a gel with moderate hardness (11.60 gf), which was preferred by panelists. Higher gelatin concentrations (G3, G4) produced harder gels with lower sensory scores. Therefore, 0.3% gelatin was selected for further experiments.

Effect of Fermentation Time

Table 4. Effect of fermentation time on product quality

Parameter	5 hours	6 hours	7 hours	8 hours
pH	4.53 ± 0.16 ^a	4.70 ± 0.01 ^b	4.46 ± 0.01 ^a	4.43 ± 0.02 ^a
TTA (%)	0.74 ± 0.01 ^a	0.78 ± 0.01 ^b	0.80 ± 0.01 ^c	0.80 ± 0.01 ^c
Hardness (gf)	11.40 ± 0.89 ^b	7.40 ± 1.52 ^a	7.60 ± 0.89 ^a	8.40 ± 0.89 ^a
b*	12.67 ± 0.63 ^b	11.68 ± 0.29 ^a	11.85 ± 0.15 ^a	13.05 ± 0.42 ^b
Overall liking	4.00 ± 0.45 ^d	5.47 ± 0.50 ^c	8.23 ± 0.43 ^a	6.93 ± 0.52 ^b

Note: Values in the same row with different superscript letters indicate statistically significant differences ($p < 0.05$).

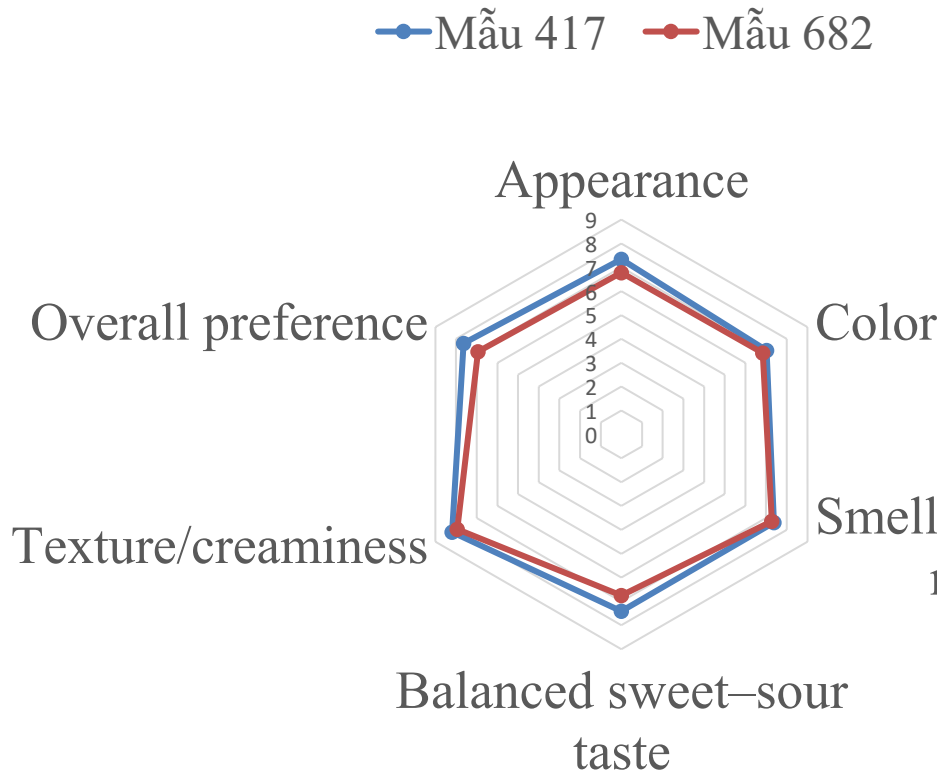
Among the tested fermentation times, 7 h achieved the highest overall liking (8.23/9). The pH decreased and TTA increased with fermentation time, reflecting progressive acidification. The 7-h fermentation produced a product with desirable texture, color, and sensory properties.

Comparison of Optimal Product (SCX) and Commercial Product (SCTM)

Table 5. Comparison of SCX and SCTM

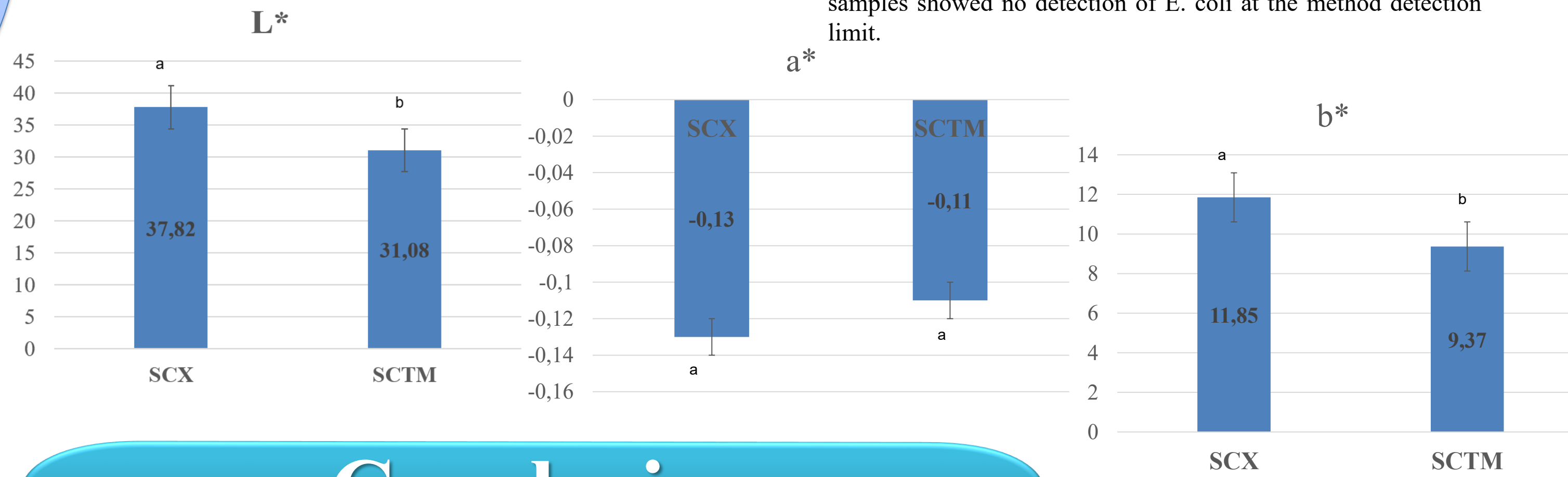
Parameter	SCX	SCTM
pH	4.45 ± 0.01	4.40 ± 0.01
LAB (log CFU/g)	8.64 ± 0.21	6.85 ± 0.09
E. Coli (<10 CFU/g)	Not detected	Not detected
Overall liking	7.72 ± 0.70	7.08 ± 0.96

Sensory Attributes Radar Chart of Sample 417 and Sample 682



Note: Values are means of three independent experimental replicates ($n=3$) ± standard deviation for instrumental parameters; sensory values are means of 30 panelists ($n=30$) ± standard deviation.

Color table of the product (SCX) and the commercial product (SCTM)



SCX showed significantly higher L* and b* values compared to SCTM, indicating greater brightness and yellowness. The presumptive LAB count on MRS was higher in SCX. Both samples showed no detection of E. coli at the method detection limit.

Results and Discussion

Effect of Mango Puree Ratio

Table 1. Effect of mango puree ratio on product quality

Parameter	5%	10%	15%	20%
pH	4.72 ± 0.42 ^a	4.58 ± 0.07 ^a	4.53 ± 0.01 ^a	4.52 ± 0.01 ^a
Viscosity (cP)	17.92 ± 2.96 ^a	17.00 ± 1.97 ^a	20.30 ± 1.69 ^a	21.17 ± 2.31 ^a
Syneresis (%)	22.57 ± 4.76 ^a	22.40 ± 4.55 ^a	21.96 ± 2.19 ^a	22.21 ± 3.21 ^a
WHC (%)	77.43 ± 5.39 ^a	77.60 ± 5.31 ^a	78.04 ± 3.09 ^a	77.79 ± 2.79 ^a
Overall liking	7.93 ± 0.83 ^d	6.90 ± 0.92 ^c	5.33 ± 1.03 ^b	4.50 ± 1.04 ^a

Note: Values in the same row with different superscript letters indicate statistically significant differences ($p < 0.05$).

Among the tested mango puree ratios (5–20%), the 5% level achieved the highest overall liking score (7.93 ± 0.83), significantly higher than all other levels ($p < 0.05$). Viscosity, syneresis, and WHC did not differ significantly among treatments ($p > 0.05$). Therefore, 5% mango puree was selected for subsequent experiments based on sensory acceptance while maintaining acceptable physicochemical properties.

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