

VALORIZATION OF UNRIPE GREEN TOMATO BY LACTIC ACID BACTERIA FERMENTATION: THE FATE OF TOMATINE

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SPOKE 8, WP 8.1, TASK 8.1.2

SPOKE 8: Circular economy in agriculture through waste valorization and recycling

WP 8.1: Producing new products to upgrade waste value

Task 8.1.2: valorisation of the waste by biotechnology processes to obtain for high value molecules or new products



INTRODUCTION AND AIM OF THE WORK

Tomato (*Solanum lycopersicum* L.), a very important plant that gives fruits used as food in fresh form or after processing, is one of the most cultivated crops all over the World, and especially in the Mediterranean basin. Italy, together with Turkey, Egypt, Spain, and Morocco, is one of the main tomato fruit producers (1). A large production may lead to have a huge amount of fruits that are discarded by companies that transform tomato fruits, because they are unripe (green tomatoes). Green or not fully ripe tomato presents a lower concentration of all the components that are characteristic of a fully ripe fruit, mainly represented by sugars, lycopene and ascorbic acid. On the other hand, green tomatoes contain high amounts of glycoalkaloids: a complex named tomatine formed by α -tomatine and dehydrotomatine (2, 3). These compounds, produced by the plant as protection agents against pathogens and parasites, may exert several benefic effects in humans acting as anti-cholesterol, antibiotic, and anti-carcinogenic agent (4). In addition, conversely to solanine, the main glycoalkaloid of potato, tomatine seems to be safe for the consumers (4). Indeed, EFSA stated that the levels of tomatine typically found in food do not present a significant health risk to consumers.

The aim of the present work is to find a strategy to reuse green tomatoes in food sector. To this goal, lactic acid fermentation was applied to green tomatoes, and an UHPLC-MS/MS method was developed to determine the concentration of tomatine in the considered products. In addition, also the possible presence of tomatidine (a component of tomatine), and α -solanine was also considered.



MATERIALS & METHODS

Samples:
Green tomato was submitted to a fermentation step using different lactic acid bacteria (LAB) strains in mono and a coculture

Sample number	Sample code	Description
1	TQ	Green tomato (starting material)
2	Contr	Green tomato incubated, no LAB
3	A	Green tomato incubated with <i>L. rhamnosus</i> 1473
4	B	Green tomato incubated with <i>L. casei/zease</i> 2240
5	C	Green tomato incubated with <i>Weissella cibaria</i> 4253
6	D	Green tomato incubated with <i>P. acidilactici</i> 3992
7	AB	Green tomato incubated with A+B
8	AC	Green tomato incubated with A+C
9	AD	Green tomato incubated with A+D
10	BC	Green tomato incubated with B+C
11	BD	Green tomato incubated with B+D
12	CD	Green tomato incubated with C+D

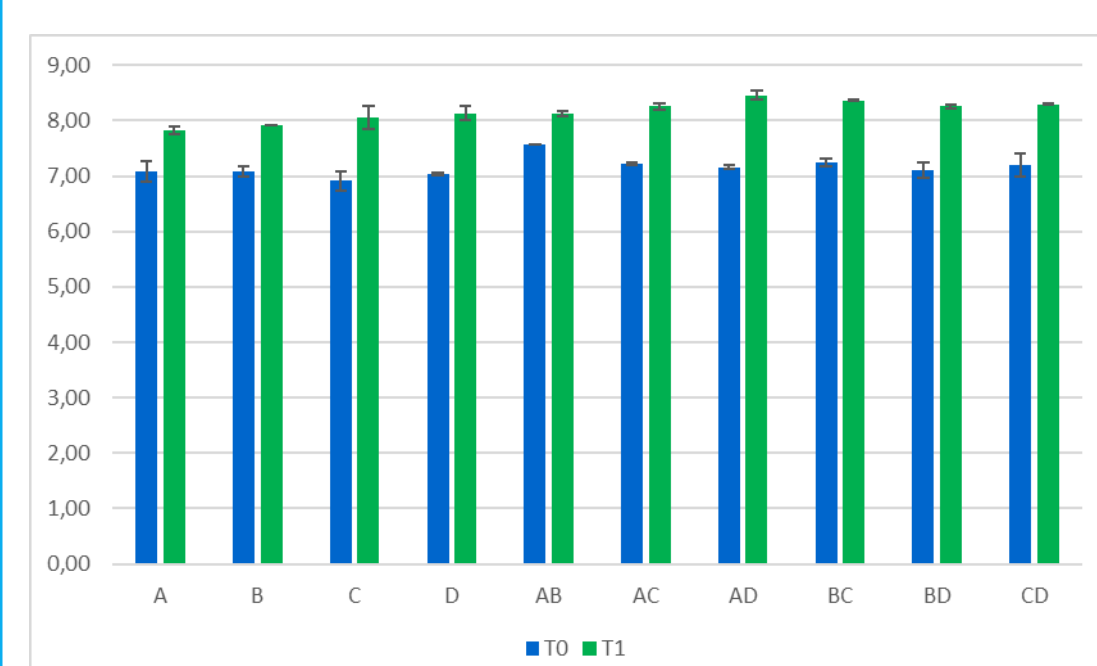
STEP 1:
Sample preparation and extraction (EtOH/H₂O)

STEP 2:
Extraction by shaker and centrifugation (25°C)

STEP 3:
UHPLC-MS/MS method development and analyses

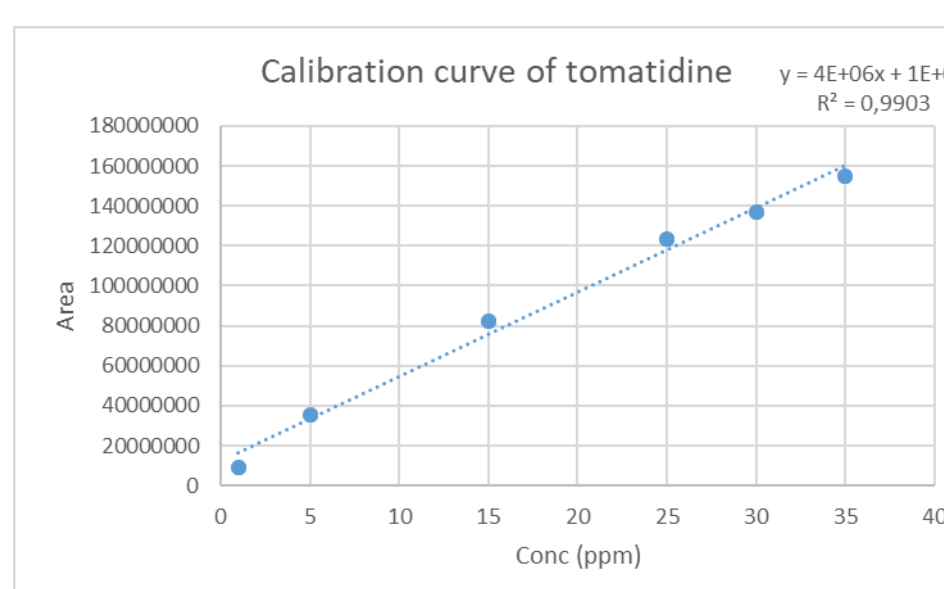
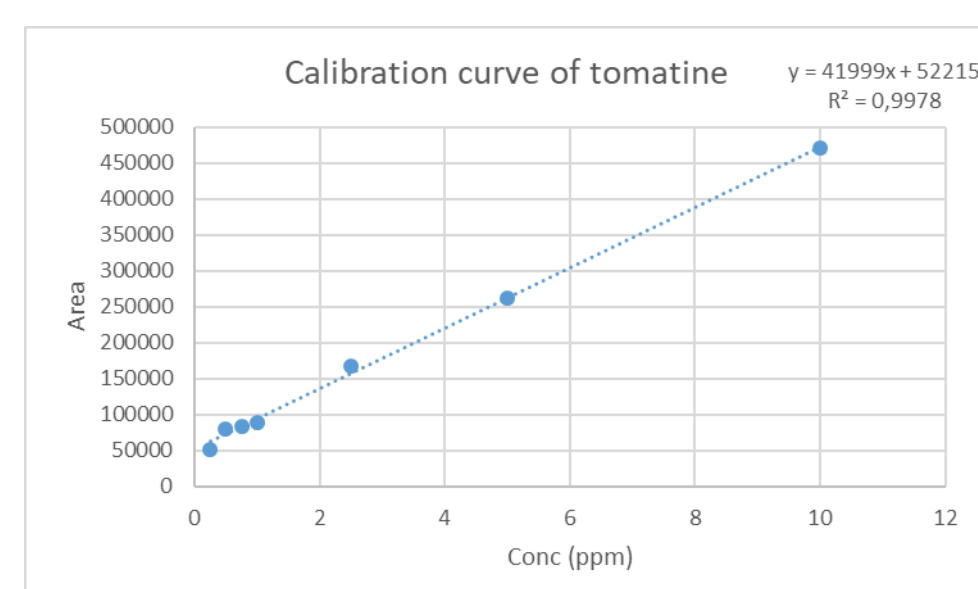
RESULTS, DISCUSSION, REMARKS

Fermentation by LAB:



All the strains were able to grow in this substrate, increase their concentration of about 1 Log cfu/g after the incubation

Method performances:



Good linearity ($R^2 > 0.99$)

	LOD	LOQ
Tomatine	0,10±0,01	0,35±0,02
Tomatidine	0,05±0,03	0,49±0,22
Solanine	0,36±0,09	1,20±0,29

No matrix effect was observed and tomatine recovery was comprised among 80 and 120%

Sample analyses

RESULTS AND REMARKS:

	Sample code	Tomatine (ppm)	Tomatidine (ppm)	Solanine (ppm)
1	TQ	110,05±1,10	205,99±3,84	<LOD
2	Contr	195,74±16,77	20,06±1,05	<LOD
3	A	289,54±68,06	13,31±12,37	<LOD
4	B	142,98±62,19	22,27±5,81	<LOD
5	C	148,24±3,24	24,49±4,86	<LOD
6	D	125,81±12,09	18,82±0,36	<LOD
7	AB	116,39±19,65	23,12±2,32	<LOD
8	AC	115,72±50,41	22,08±4,36	<LOD
9	AD	109,80±68,78	22,64±3,20	<LOD
10	BC	137,93±3,57	25,44±0,04	<LOD
11	BD	126,32±72,94	28,30±3,50	<LOD
12	CD	92,92±26,02	21,78±6,87	<LOD

- α -Tomatine and tomatidine were detected in all the analysed samples; the calculated α -tomatine amounts resulted similar to those reported in literature (3).
- Solanine resulted almost absent
- The fermentation step seems to not affect α -tomatine, but a decrease in tomatidine was observed also in the incubated but not inoculated products

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