

# EVALUATION OF *TOONA SINENSIS* WATER EXTRACT ON PHYSICO-CHEMICAL CHARACTERISTICS OF PORK PATTIES DURING STORAGE

F.J. Tan\* and S.Y. Lu

Department of Animal Science, National University of Science and Technology, Pingtung, 912, Taiwan.  
Email: tanfj@mail.npust.edu.tw

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## Introduction

Recently, antimicrobial and antioxidant properties of plant and spice extract have been widely reported. *Toona sinensis* (TS) is a perennial tree that has become widely grown in Taiwan and China (Edmonds and Staniforth, 1998). Its tender buds have a special aroma and are often consumed in Taiwan. In addition, TS has also been reported to have some antimicrobial activity (Shi, 2003). The objective of this study was to evaluate the qualities of pork patties which had *Toona sinensis* water extract added in the formula and then were stored at refrigeration temperatures.

## Materials and Methods

Lean tissue from fresh pork legs and pork back fat were ground twice through a 6 mm plate. The formula included 80% fresh legs, 20% pork back fat, 2.4% sugar, 2.0% corn starch, 2.0% yam starch, 1.2% salt, 1.0% monosodium glutamate, 0.2% garlic powder, 0.2% onion powder, 0.2% dried celery powder, 0.2% black pepper powder, and 0.1% polyphosphate. Lean tissue was first mixed with salt and phosphate for 5 min. After adding fat and other ingredients, it was mixed for another 6 min. For those samples containing TS, water extract was added at the rate of, 0.4, 0.6, or 0.8% (v/w) and mixed with the meat mixture. Then, the mixtures were manually formed into patties that had approximate thickness of 1.5 cm and a diameter of 8 cm and an average weight of  $90 \pm 5$ g. Pork patties were packaged in polyethylene film, and stored at 4°C for 14 days, and analyzed at day 0, 7, and 14. Fresh tender buds of TS were washed, dried in an oven at 60°C for 8 hrs, and ground into powder. Ten grams of TS powders were mixed with 200 ml distilled water, heated in a water bath at 50°C for 24 hrs and then filtered. The filtered residues of water extract were mixed with another 200 ml distilled water, heated, filtered, collected and added to the meat mix. Moisture and ash contents were measured according to the AOAC (1990) method. Crude fat was measured using a fat extractor. Crude protein was measured using the Kjeldahl method. The Hunter L\*, a\*, and b\* values, and pH values of the samples were measured. TBA values of the samples were determined according to the methods described by Salih *et al.*, (1987). Volatile basic nitrogen was determined by the Conway micropipette diffusion method. The data was analyzed using the SAS software.

## Results and Discussion

Adding TS water extract in the formula up to 0.8% did not significantly affect the proximate composition of the pork patties (Table 1). The pH values of the products decreased significantly and reached approximate 5.7 after 14 days of refrigerated storage (Table 2). Adding TS water extract up to 0.8% did not significantly affect the pH values of the pork patties. During refrigerated storage, the L\* colour values remained stable or slightly increased but with only small changes in values (Table 3). Adding more TS water extract, especially adding 0.8% extract, tended to decrease the L\* colour values of the products. After refrigerated storage for 7 days, the samples had significantly lower a\* colour values which indicated less red colour when compared with the samples at day 0. Samples that had more TS water extract tended to have lower L\* and higher a\* colour values, which indicated samples had a darker and a redder color. The TBA values significantly increased as the storage time increased which indicated more fat rancidity occurred as expected (Table 4). Adding more TS water extract tended to decrease the TBA values of the products. This decrease of TBA values was more obvious when adding more than 0.6% extract and stored under refrigeration for 14 days. Hsieh *et al.* (2004) indicated that methyl gallate which was extracted from *Toona sinensis* was an effective antioxidant compound. The VBN values increased significantly especially after storage for 14 days (Table 4). Adding more TS water extract tended to decrease the VBN values of the products especially when 0.8% extract was added.

## Conclusions

In conclusion, adding *Toona sinensis* water extract up to 0.8% did not significantly affect the proximate composition and pH values of pork patties. Samples with more extract had darker and redder colors. Adding more extract tended to decrease the TBA and VBN of the products.

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**Table 1:** Proximate composition of pork patties containing *Toona sinensis* leaf water extract.

Parameter	Extract added (v/w)			
	0%	0.4%	0.6%	0.8%
Moisture (%)	58.88 ± 1.11	59.02 ± 1.42	58.57 ± 0.80	59.85 ± 1.18
Ash (%)	3.33 ± 0.30	3.32 ± 0.20	3.10 ± 0.40	3.40 ± 0.32
Crude fat (%)	11.26 ± 1.06	12.02 ± 1.66	10.18 ± 0.24	10.98 ± 0.46
Crude protein (%)	21.06 ± 0.39	20.79 ± 0.33	21.29 ± 0.58	21.04 ± 1.03

No significant differences ( $P > 0.05$ ) were found due to added extract

**Table 2:** Changes in pH values of pork patties containing *Toona sinensis* leaf water extract during refrigerated storage.

Storage time (day)	Extract added (v/w)			
	0%	0.4%	0.6%	0.8%
0	6.06 ± 0.26 <sup>a</sup>	6.09 ± 0.24 <sup>a</sup>	6.13 ± 0.19 <sup>a</sup>	6.12 ± 0.18 <sup>a</sup>
7	6.11 ± 0.19 <sup>a</sup>	6.11 ± 0.13 <sup>a</sup>	6.18 ± 0.06 <sup>a</sup>	6.19 ± 0.02 <sup>a</sup>
14	5.67 ± 0.20 <sup>b</sup>	5.66 ± 0.26 <sup>b</sup>	5.67 ± 0.28 <sup>b</sup>	5.67 ± 0.30 <sup>b</sup>

<sup>a-b</sup> values within a column that have different superscripts are significantly different ( $P < 0.05$ ).

**Table 3:** Changes in colour values of pork patties containing *Toona sinensis* leaf water extract during refrigerated storage.

Storage time (day)	Extract added (v/w)			
	0% <sup>a,b</sup>	0.4%	0.6%	0.8%
L* values				
0	56.69 ± 1.49 <sup>bx</sup>	56.68 ± 1.33 <sup>x</sup>	56.03 ± 2.08 <sup>x</sup>	53.69 ± 2.51 <sup>by</sup>
7	58.95 ± 1.01 <sup>ax</sup>	57.41 ± 1.98 <sup>xy</sup>	57.12 ± 2.70 <sup>xy</sup>	55.58 ± 2.45 <sup>aby</sup>
14	59.32 ± 1.65 <sup>a</sup>	56.93 ± 1.60	56.48 ± 1.59	55.88 ± 2.12 <sup>a</sup>
a* values				
0	7.88 ± 0.22 <sup>ax</sup>	7.66 ± 0.45 <sup>ay</sup>	7.56 ± 0.42 <sup>axy</sup>	8.49 ± 0.22 <sup>ax</sup>
7	5.60 ± 0.16 <sup>by</sup>	6.16 ± 0.15 <sup>bx</sup>	6.10 ± 0.21 <sup>cx</sup>	5.83 ± 0.04 <sup>cx</sup>
14	5.48 ± 0.91 <sup>by</sup>	6.40 ± 0.28 <sup>bx</sup>	6.59 ± 0.87 <sup>bx</sup>	6.34 ± 0.15 <sup>bx</sup>
b* values				
0	13.52 ± 0.16 <sup>ax</sup>	13.28 ± 0.12 <sup>ay</sup>	13.33 ± 0.19 <sup>axy</sup>	12.15 ± 0.34 <sup>ay</sup>
7	12.87 ± 0.11 <sup>bx</sup>	12.90 ± 0.20 <sup>bx</sup>	12.85 ± 0.20 <sup>bx</sup>	12.49 ± 0.44 <sup>by</sup>
14	12.82 ± 0.31 <sup>b</sup>	12.68 ± 0.18 <sup>c</sup>	12.72 ± 0.09 <sup>b</sup>	12.66 ± 0.14 <sup>b</sup>

<sup>a-c</sup> values within a column in the same test that have different superscripts are significantly different ( $P < 0.05$ ).

<sup>x-y</sup> values within a row in the same test that have different superscripts are significantly different ( $P < 0.05$ ).

**Table 4:** Changes in TBA and VBN values of pork patties containing *Toona sinensis* leaf water extract during refrigerated storage.

Storage time (day)	Extract added (v/w)			
	0%	0.4%	0.6%	0.8%
TBA (mg malonaldehyde / kg)				
0	0.89 ± 0.63 <sup>c</sup>	0.67 ± 0.49 <sup>c</sup>	0.61 ± 0.45 <sup>c</sup>	0.58 ± 0.43 <sup>c</sup>
7	2.11 ± 0.75 <sup>b</sup>	1.81 ± 0.58 <sup>b</sup>	1.62 ± 0.45 <sup>b</sup>	1.55 ± 0.44 <sup>b</sup>
14	3.25 ± 0.22 <sup>ax</sup>	2.89 ± 0.05 <sup>ax</sup>	2.79 ± 0.02 <sup>ay</sup>	2.26 ± 0.44 <sup>az</sup>
VBN (mg / 100g)				
0	6.58 ± 0.70 <sup>bx</sup>	6.24 ± 0.80 <sup>bx</sup>	3.81 ± 1.33 <sup>by</sup>	3.81 ± 1.33 <sup>y</sup>
7	6.58 ± 0.13 <sup>bx</sup>	6.53 ± 0.70 <sup>bx</sup>	6.24 ± 0.80 <sup>abx</sup>	4.51 ± 0.69 <sup>y</sup>
14	9.01 ± 1.39 <sup>ax</sup>	8.67 ± 0.69 <sup>ax</sup>	9.01 ± 0.80 <sup>ax</sup>	5.54 ± 1.13 <sup>y</sup>

<sup>a-c</sup> values within a column in the same test that have different superscripts are significantly different ( $P < 0.05$ ).

<sup>x-y</sup> values within a row in the same test that have different superscripts are significantly different ( $P < 0.05$ ).

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