



Wachirawit Phosuwan



# The use of tea extracts to extend the expiration date of bread



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**Has palatable taste  
and easy to make**



**Bread is a staple food  
consumed worldwide.**



<https://s.isanook.com/he/0/rp/r/w728/ya0xa0m1w0/aHR0cHM6Ly9zLmlzYW5vb2suY29tL2hlLzAvdWQvMC8zOTA5L2lzdG9ja185MTAwODY2M19sYXJnZS5qcGc=.jpg>



**It is easy to be  
contaminated with  
microorganisms.**



- Lots of nutrients
- Porous texture
- High Moisture



**Find a method to extend  
the expiration date of bread without  
using chemical food preservatives**



[https://sites.google.com/site/mhascrybicha/\\_/rsrc/1467892025535/home/%E0%B8%8A%E0%B8%B2.jpg](https://sites.google.com/site/mhascrybicha/_/rsrc/1467892025535/home/%E0%B8%8A%E0%B8%B2.jpg)

# Tea *Camellia sinensis*

## Tea leaves contain "Tannins"

Tannins can inhibit  
the growth of  
microorganisms  
(Akiyama H., 2001)



[https://upload.wikimedia.org/wikipedia/commons/thumb/3/3a/Tannin\\_heap.jpg/800px-Tannin\\_heap.jpeg](https://upload.wikimedia.org/wikipedia/commons/thumb/3/3a/Tannin_heap.jpg/800px-Tannin_heap.jpeg)



# **Objective**

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To study the use of tea extracts to extend the expiration date of bread.

# Methods



Make 5 sets  
of bread

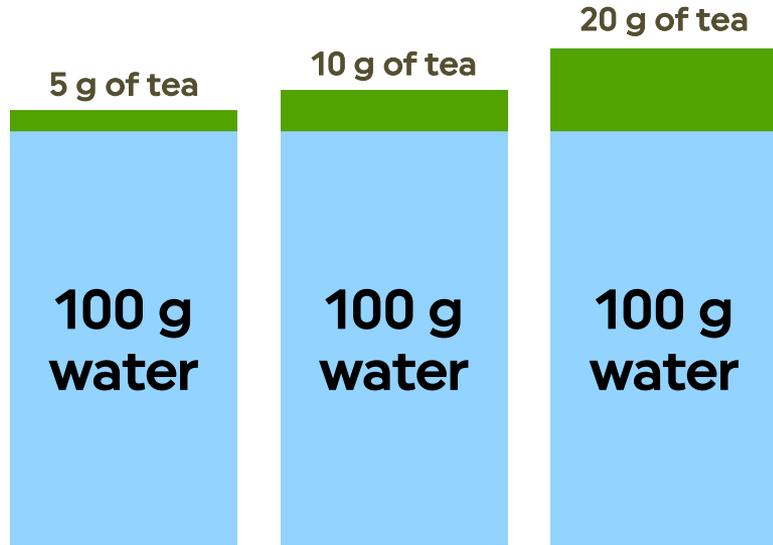


Assess  
consumer  
satisfaction



Observe physical  
appearance and  
microbiology test

# Make 5 sets of bread

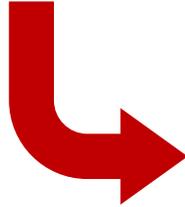


Brew tea  
for 10 minutes



# Make 5 sets of bread

In each set, changes water to tea extractions with different concentrations.



Rest for  
1 hour

Knead for 30 minutes

# Make 5 sets of bread



Divide into 15 g  
per piece

→ Rest for  
1 hour →

Bake in the oven



170 °C 15 minutes



Set 1 - water



Set 2 - tea:water = 1:20\*



Set 3 - tea:water = 1:10\*



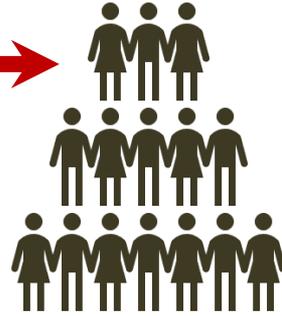
Set 4 - tea:water = 1:5\*



Set 5 - preservative

\*ratio by mass

# Assess consumer satisfaction



26 people



Google Forms

Do a questionnaire

Nine-point hedonic scale

Score analysis



# Consumer satisfaction

Scores are collected from the questionnaire

criteria	Average satisfaction score (Full 9 points) $\pm$ S.D.				
	Set 1	Set 2	Set 3	Set 4	Set 5
color	7.23 $\pm$ 2.29	7.46 $\pm$ 2.00	7.35 $\pm$ 2.02	6.46 $\pm$ 1.88	7.62 $\pm$ 2.30
odor	7.42 $\pm$ 1.84	7.27 $\pm$ 1.97	7.23 $\pm$ 2.10	6.61 $\pm$ 2.17	6.62 $\pm$ 2.45
texture	6.96 $\pm$ 2.14	6.73 $\pm$ 2.15	6.54 $\pm$ 2.25	6.46 $\pm$ 1.94	7.08 $\pm$ 2.19
taste	7.39 $\pm$ 2.10	7.19 $\pm$ 2.26	6.96 $\pm$ 2.34	6.38 $\pm$ 2.50	6.92 $\pm$ 2.21
overall	7.31 $\pm$ 2.07	7.15 $\pm$ 2.19	7.15 $\pm$ 1.91	6.31 $\pm$ 2.20	7.12 $\pm$ 2.14

Mixture in set 1-5 respectively

water, tea:water = tea:water = 1:10, tea:water = 1:5, Calcium propionate (Preservative)

# Microbiology test

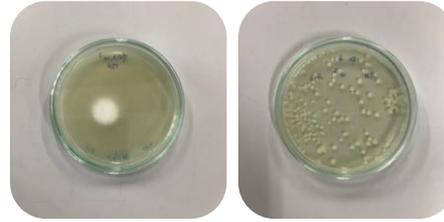
Prepare PDA and PCA



Sterilize Petri dishes

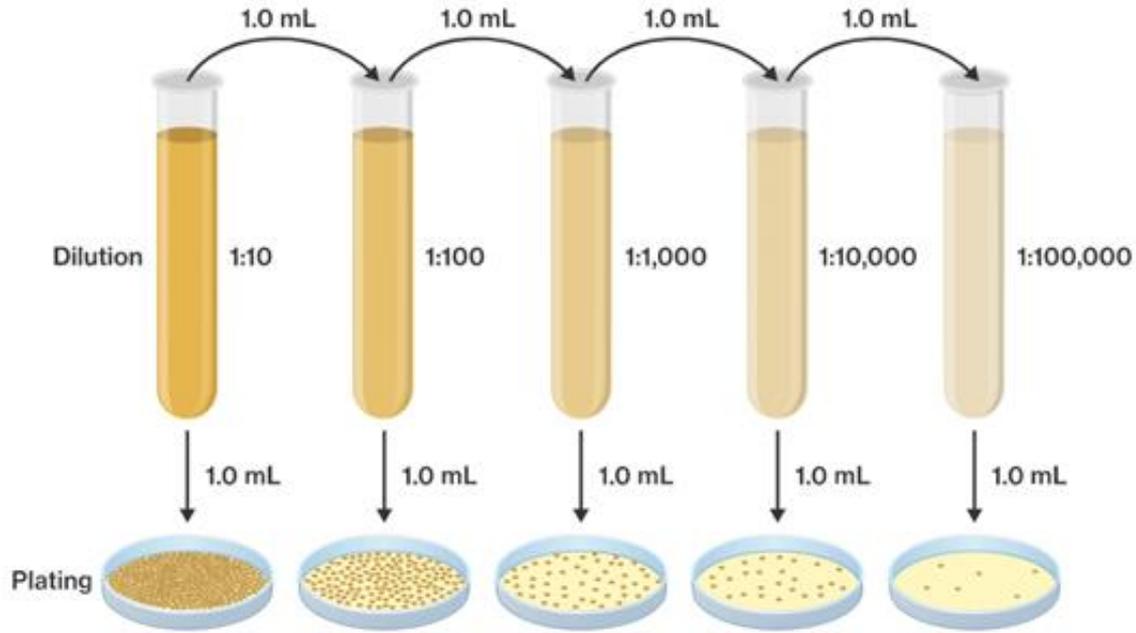


Pour cultural media and wait until they solidify



# Microbiology test

## - Serial dilution



# Microbiology test

- Culture microorganisms in 2 types of cultural media, repeat every other day



<http://www2.nau.edu/~fpm/bio205/Sp-08/Chapter-03.pdf>

Use spread plate method

# Number of bacterial colonies appeared on the Petri dishes

Day	Number of colonies ( $10^3$ CFU)				
	Set 1	Set 2	Set 3	Set 4	Set 5
2	$1.59 \times 10^1$ $\pm 16.30$	$1.65 \times 10^1$ $\pm 15.59$			
4	$3.00 \times 10^{-2}$ $\pm 0.05$	$1.10 \times 10^{-1}$ $\pm 0.12$	$1.55 \times 10^0$ $\pm 1.67$	$8.25 \times 10^0$ $\pm 14.57$	$1.00 \times 10^{-2}$ $\pm 0.01$
6	$2.15 \times 10^1$ $\pm 10.12$	$7.96 \times 10^1$ $\pm 147.06$	$1.50 \times 10^1$ $\pm 17.32$	$1.73 \times 10^1$ $\pm 15.00$	$5.00 \times 10^0$ $\pm 10.00$
8	$4.30 \times 10^3$ $\pm 16.06$	$8.80 \times 10^2$ $\pm 14.23$	$7.70 \times 10^3$ $\pm 14.87$	$1.00 \times 10^3$ $\pm 1358.19$	$5.02 \times 10^3$ $\pm 7069.17$
10	$2.68 \times 10^5$ $\pm 32833.96$	$8.83 \times 10^4$ $\pm 16788.56$	$1.12 \times 10^5$ $\pm 19267.24$	$9.70 \times 10^4$ $\pm 14114.30$	$7.53 \times 10^5$ $\pm 14983.41$

**Mixture in set 1-5 respectively**

water, tea:water = tea:water = 1:10, tea:water = 1:5, Calcium propionate (Preservative)

# Number of fungal colonies appeared on the Petri dishes

Day	Number of colonies ( $10^3$ CFU)				
	Set 1	Set 2	Set 3	Set 4	Set 5
2	$7.25 \times 10^0$ $\pm 9.50$	$2.90 \times 10^0$ $\pm 4.42$	$3.00 \times 10^0$ $\pm 4.69$	$7.90 \times 10^{-1}$ $\pm 1.48$	$3.20 \times 10^0$ $\pm 2.62$
4	$1.85 \times 10^0$ $\pm 3.63$	$2.00 \times 10^{-1}$ $\pm 0.34$	$1.78 \times 10^0$ $\pm 2.85$	$3.00 \times 10^{-2}$ $\pm 0.05$	$3.00 \times 10^{-2}$ $\pm 0.05$
6	$3.78 \times 10^0$ $\pm 4.97$	$8.30 \times 10^{-1}$ $\pm 1.45$	$5.50 \times 10^{-1}$ $\pm 0.97$	$5.80 \times 10^{-1}$ $\pm 0.49$	$7.30 \times 10^{-1}$ $\pm 0.95$
8	$1.23 \times 10^2$ $\pm 188.39$	$2.25 \times 10^2$ $\pm 120.14$	$3.13 \times 10^2$ $\pm 546.71$	$6.50 \times 10^1$ $\pm 92.56$	$4.00 \times 10^2$ $\pm 80.00$
10	$1.85 \times 10^3$ $\pm 2353.01$	$3.25 \times 10^2$ 650.00	$5.25 \times 10^2$ $\pm 984.46$	$6.75 \times 10^2$ $\pm 394.76$	$3.75 \times 10^2$ $\pm 478.71$

**Mixture in set 1-5 respectively**

water, tea:water = tea:water = 1:10, tea:water = 1:5, Calcium propionate (Preservative)

# **Changes of physical appearance**

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Observe the change of...

- color
- texture
- visible microorganisms
- pH

# **Changes of physical appearance**

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**Color: unnoticeable change**

**Texture: tends to be a little harder**

# Observation of visible microorganism

Day	Set 1	Set 2	Set 3	Set 4	Set 5
1 - 9	Unnoticeable change				
10 - 11	-	-	-	Green fungus	-
12	-	Green fungus	-	Green fungus	-
13	Green fungus	Green fungus	Green fungus	Green fungus	-

**Mixture in set 1-5 respectively**

water, tea:water = tea:water = 1:10, tea:water = 1:5, Calcium propionate (Preservative)



The first group of fungus was found on set 4 and then set 2, respectively.

# Day 15



The fungus was not found on set 5 on day 15.



Fungus on set 1 and 3 were found after set 2.

# pH of bread solutions on each day

bread solutions were prepared by pulverizing 0.1 g of bread in 25 ml distilled water

Day	Set 1	Set 2	Set 3	Set 4	Set 5
2	5.50	5.73	5.86	5.67	6.46
4	6.97	6.17	6.03	5.85	5.79
6	6.91	6.46	5.79	5.93	5.72
8	6.82	6.36	5.92	5.99	5.69
10	6.66	6.58	5.77	5.93	5.69

**Mixture in set 1-5 respectively**

water, tea:water = tea:water = 1:10, tea:water = 1:5, Calcium propionate (Preservative)

**Q & A**