Princess Chulabhorn Science High School Phitsanulok

Gummies from Mangosteen Peel Extract to Inhibit *Streptococcus mutans Bacteria* Causing Tooth Decay

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Introduction : Problem

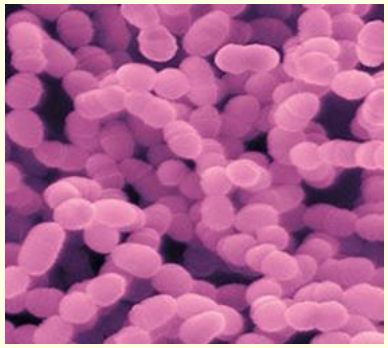
Eating sugar

Cause of tooth decay

Children:Interrupt growth, intelligence and emotion

Adult: tooth sensitivity - when eating or drinking something hot, cold or sweet

Introduction : Review research

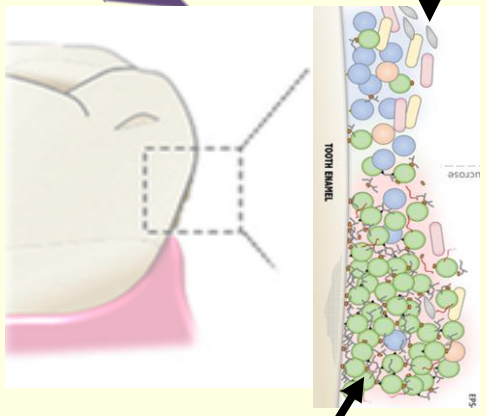


Streptococcus mutans

sugar

tooth decay

acid



Introduction : Prevention

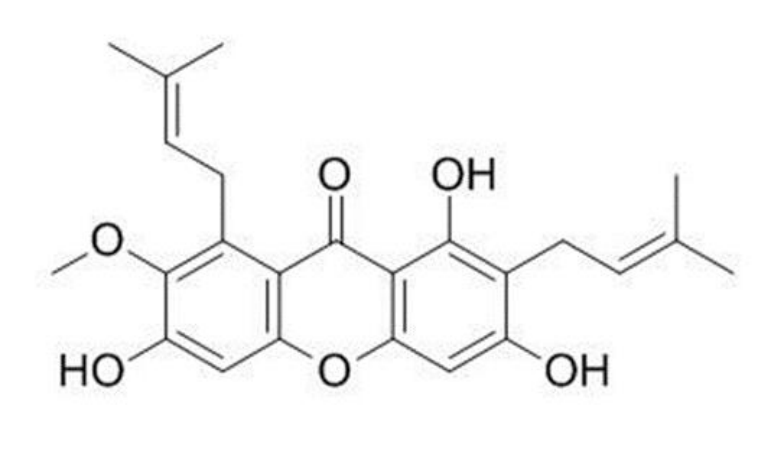
Brush with fluoride toothpaste after eating or drinking

Avoid frequent snacking and sipping

Eat tooth-healthy foods

Visit your dentist regularly

Introduction : Review research



Alpha- mangostin

Streptococus mutans

Introduction : Commercial gummies

Artificial color and flavor

A lot of sugar

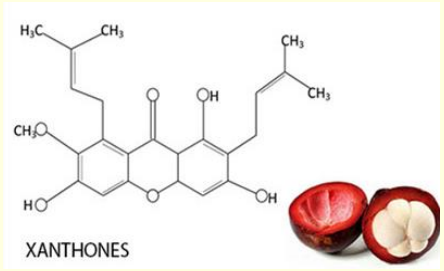
Gummies

high calories

Causing Tooth Decay

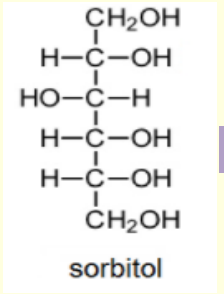
Objective

Mangosteen peels contain xanthones.



Alpha- mangostin

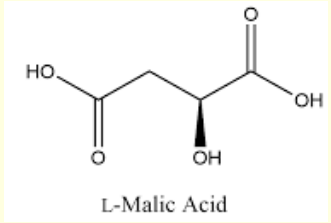
Sorbitol



sugar-free, low-calorie, The bacteria can not digest therefore they do not cause tooth decay

Gummies

Apples contain malic acid.



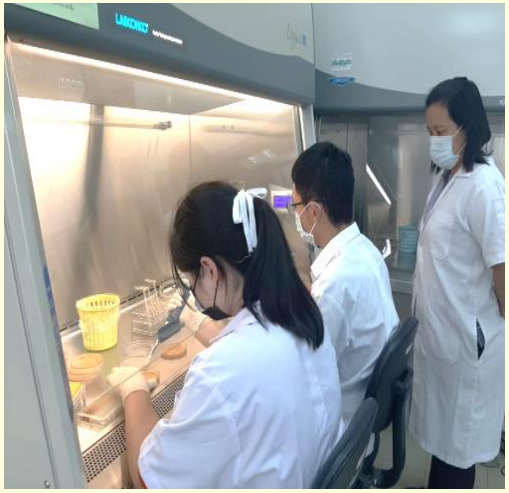
The composition of apple juice was used as a flavor additive.

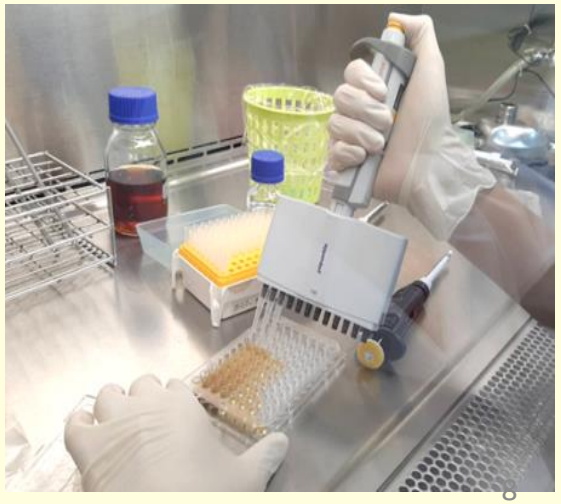
Gummies inhibit tooth decay.

Phase 1

Extraction of Mangosteen Peels and Inhibition Efficiency on *S. mutans*

The MIC and MBC Values of Mangosteen Peel Extract



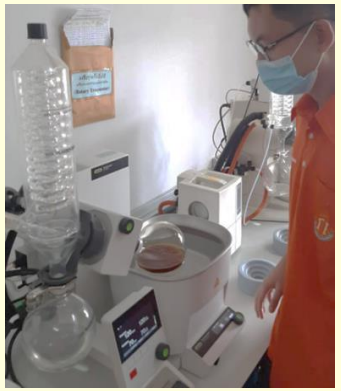


Method : Extraction Process

Mangosteen Peel Powder 50g

Ethanol 95% 500ml

Extraction by Soxhlet extractor



Evaporation by Rotary evaporator

% yield of extract

TLC analysis for standard comparison

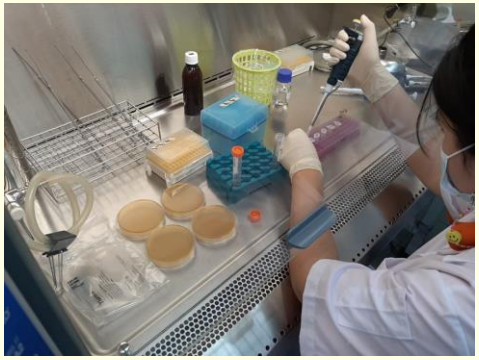
Results

The yield of extract was 13%

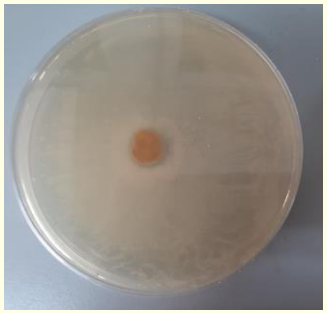
The TLC profile of extract was similar to standard mangostin.

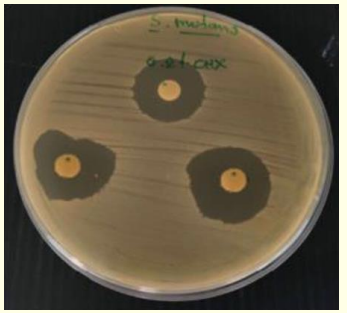
The major component of extract is mangostin.

Method : Inhibition test on *S. mutans*



The culture medium
S. mutans

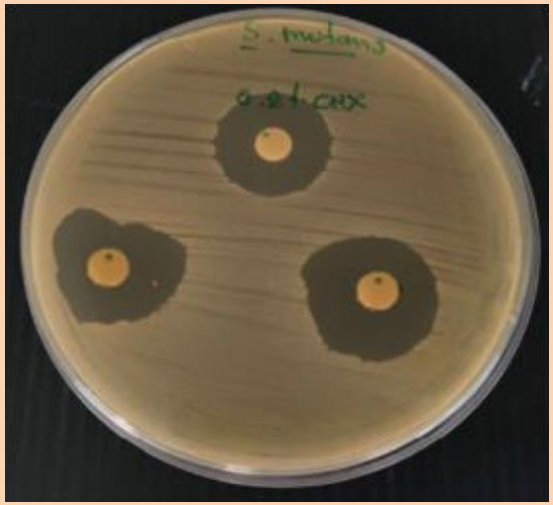




Test extract 100 mg/ml
on bacteria inhibition
by agar disc diffusion

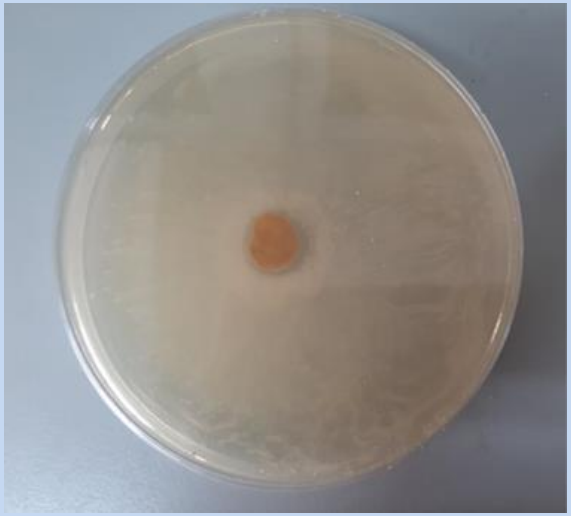
Results

Mangosteen peel extract was more effectively inhibited *S. mutans* than ethanol



Average clear zone of extract

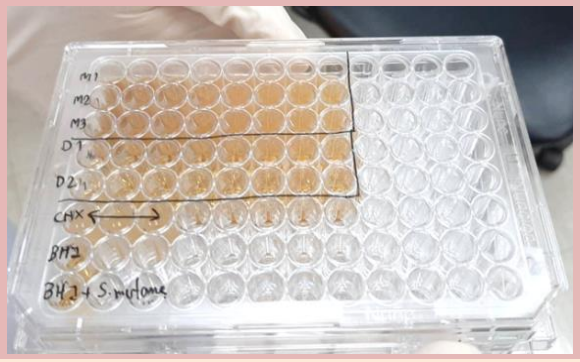
5.93±0.11 mm



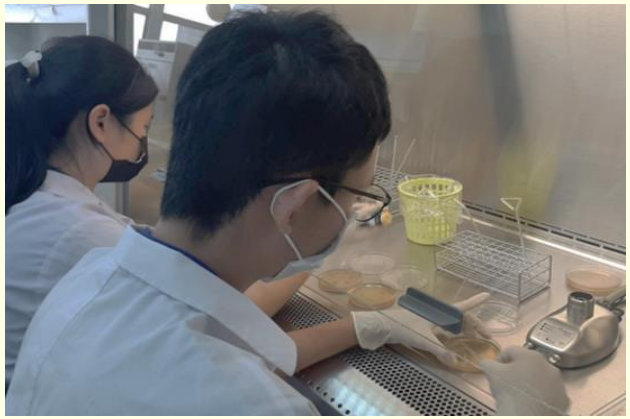
Average clear zone of 95 % ethanol

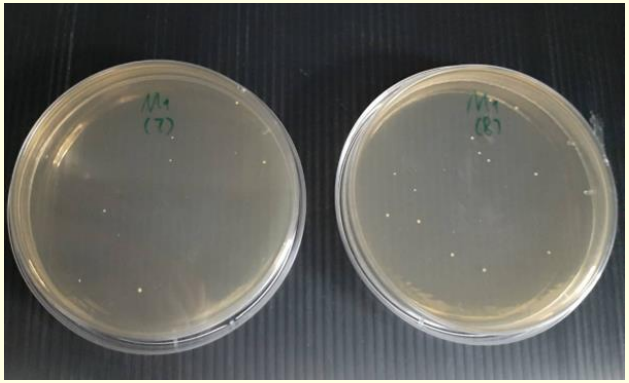
2.35±0.13 mm

Method for the MIC and MBC Values Measurement



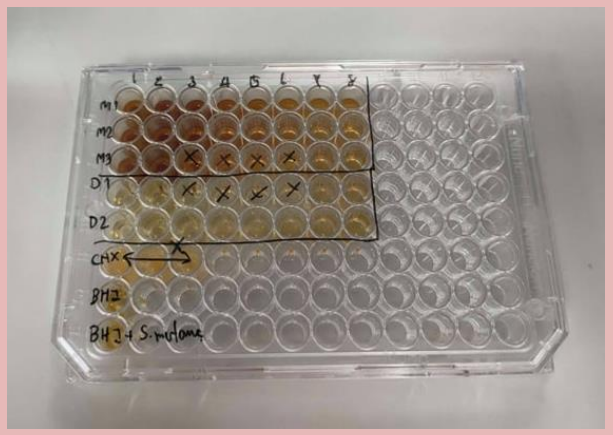
The minimum inhibitory concentration (MIC) by broth dilution technique





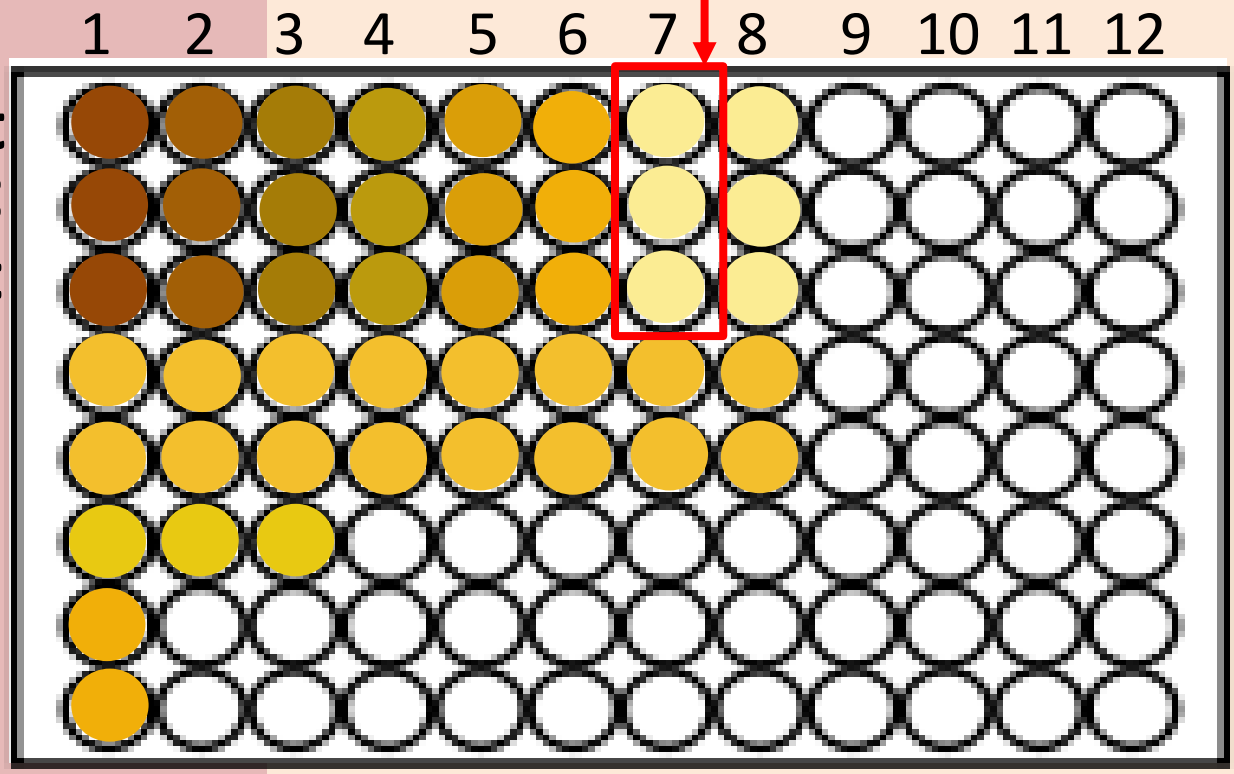
The minimum bactericidal concentration (MBC) by spread plate techique

Results

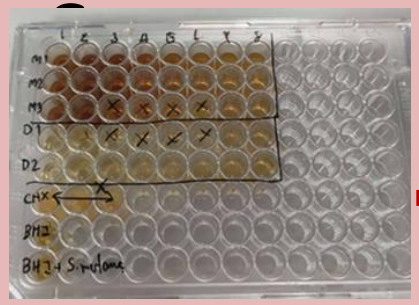


MIC Values

MIC of mangosteen peel extract was 0.78 mg/ml

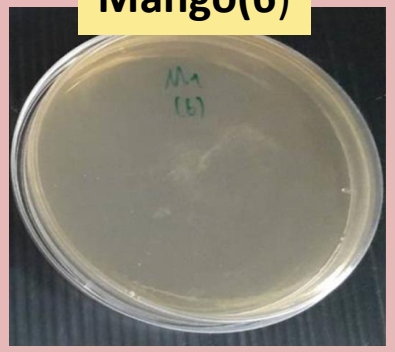


Result



Spread plate on agar

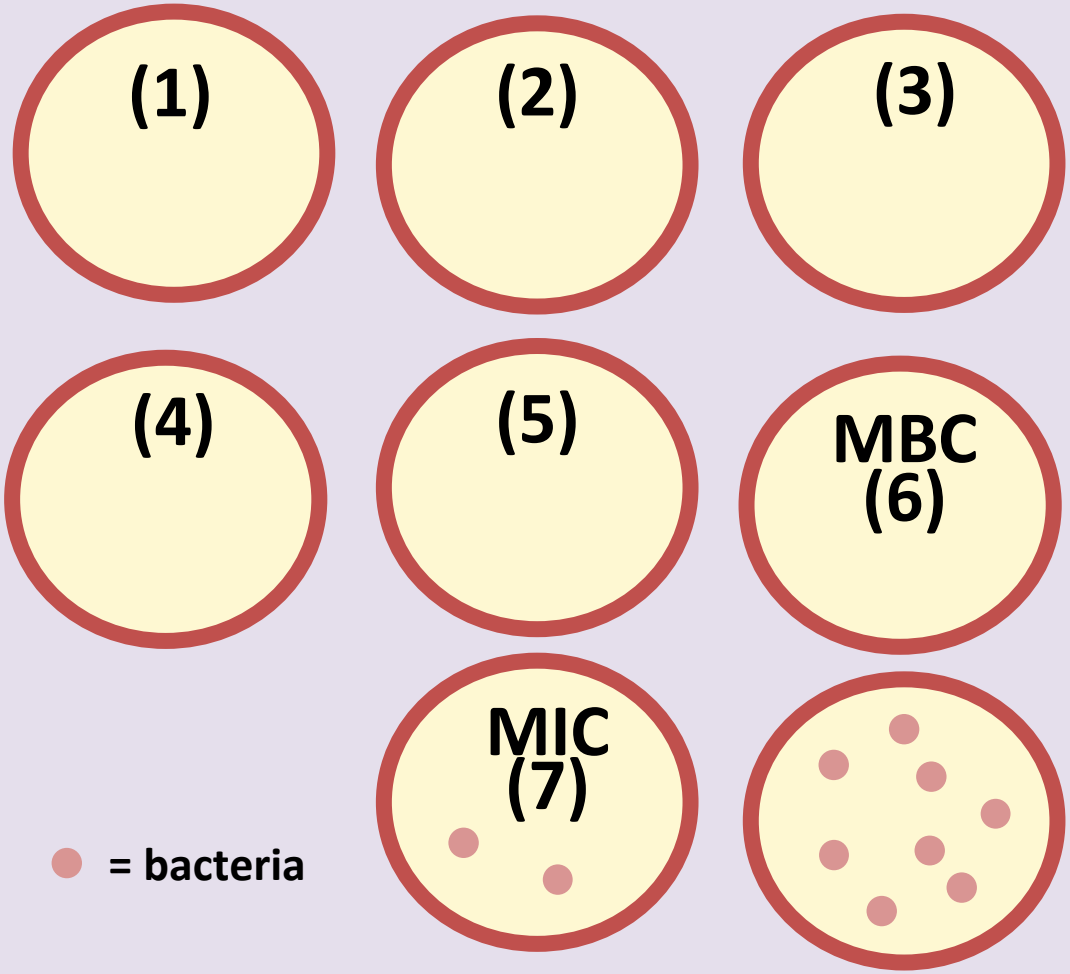
Mango(6)



MBC

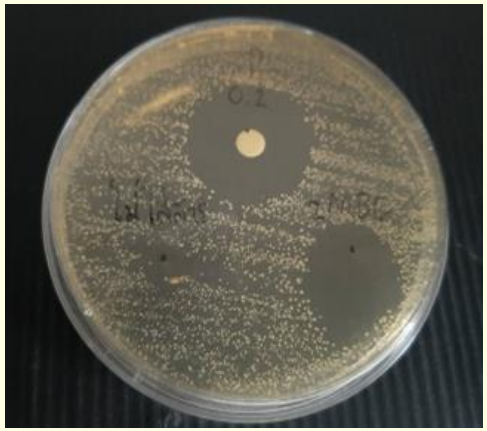
MBC of mangosteen peel extract was 1.56 mg/ml

MBC Values



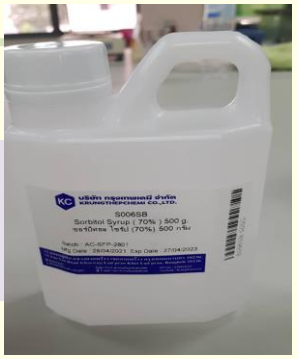
Phase 2

The physical characteristics and product development of sugar-free gummy products inhibit tooth decay-causing bacteria.

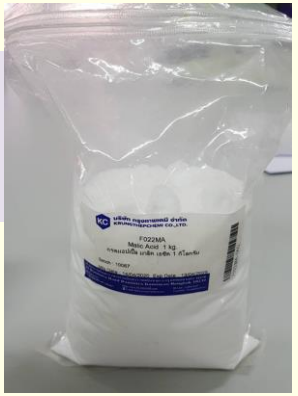


Gummies Development Process

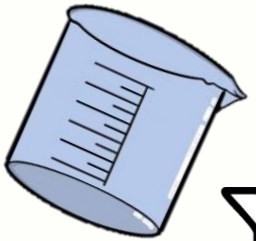
73.5 ml of 70% Sorbitol Syrup

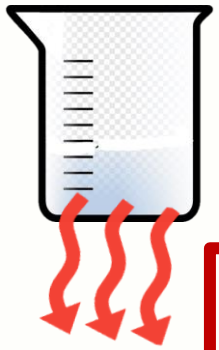


malic acid 2.4 g dissolves
in 15ml of water

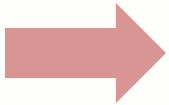


Measure the sweetness
by Brix Refractometer got
the value around 69-70 ° Bx



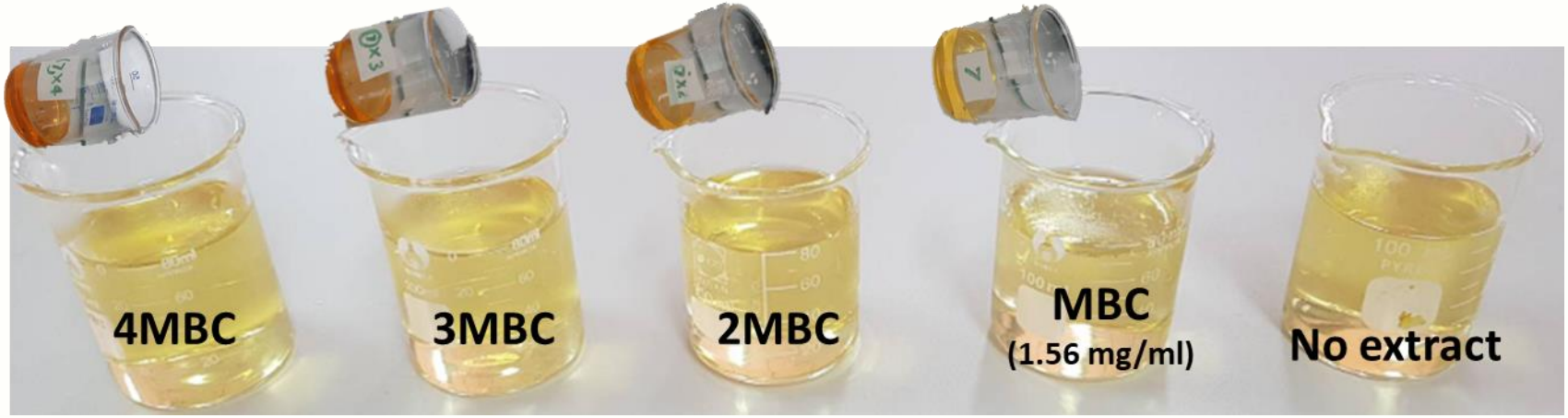


70 °C



Divide the solution out 20 ml and mixed with gelatin

Got a clear solution



6.24 mg | 4.68 mg | 3.12 mg | 1.56 mg

Gummies Development Process

Measure the pH value range is around 2.6-3.5

Each mixture was dropped into each mold. The molds were left in 4 °C for 30 minutes

Quality of gummy observation
-Color by Colorimeter
-Texture by Texture Profile Analysis (TPA) Report

Results

Color

Gummies of different concentrations(mg/ml)	Color value L* a* and b* of gummies		
	L*	a*	b*
Without mangosteen peel extract	84.27±0.46	-5.44±0.16	76.13±0.19
1.56	98.35±0.29	-15.64±0.36	87.59±0.14
3.12	91.59±0.12	-14.41±0.21	88.49±0.19
4.68	89.95±0.16	-8.91±0.36	78.57±0.29
6.25	87.38±0.29	-9.63±0.13	74.32±0.36

The extract made gummies got darker.

Results

texture

Gummies of different concentrations (mg/ml)mmy	Hardness (g)	Adhesiveness (g.sec)	Cohesiveness
Without mangosteen peel extract	2363.46±321.79	-261.58±86.54	0.72±0.09
1.56	2364.59±322.34	-267.44±81.54	0.70±0.09
3.12	2369.72±327.38	-264.58±79.54	0.72±0.09
4.68	2364.64±330.21	-269.34±75.32	0.71±0.09
6.25	2367.37±329.37	-267.55±83.41	0.72±0.09
Commercial gummies	2365.54±330.87	-266.75±84.27	0.71±0.09

commercial gummies
(Pipo Gummy Brand)

gummy products

The developed gummies have the hardness, adhesiveness and cohesiveness similar to the commercial gummies and not significant difference.

Results

The table shows gummies of various concentrations with their ability to inhibit *S. mutans*.

Gummies of different concentrations (mg/ml)	Growth of bacteria
0	+
1.56	+
3.12	+
4.68	-
6.25	-

Lowest concentration to inhibit the growth of *S. mutans* (3 times of MBC

+ means bacteria grow
- means no bacteria found

Unique Selling Points

Sweet and sour flavor

Alpha mangostin gummies

Sugar-free

Everyone will love it!!!

No artificial color-added

with herbal extract

$1/50G

Prevent tooth decay

Conclusions

Percent yield of mangosteen peel extract was about 13.

Mangosteen peel extract could inhibit *S.mutans*.

MIC and MBC values of extract were 0.78 and 1.56 mg/ml, respectively.

Gummies : color in the yellow zone
: texture similar to commercial gummies

Gummies containing mangosteen peel extract could inhibit *S. mutans* as well.

Suggestion : Our gummies should be tested toxicity and ask for certificate from authorized person.

Food and Drug Administration

Public Health

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Acknowledgement

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