

P
oster



Medaka's Face Recognition and Learning Ability ~Do Females Remember Boyfriends?~

Tennoji High School Attached To Osaka Kyoiku University

Sumire Kiyama Shunsho Wakama Miki Yamanaka

Abstract

A medaka is a tiny Japanese fish. According to previous studies, medaka females basically don't accept courtship from all males, but in cases when a male's face was remembered by a female, the female accepts male's courtship quickly. Using this research, we examined memory capacity of medaka. Results showed that female medaka remember male faces for less than 6 days.



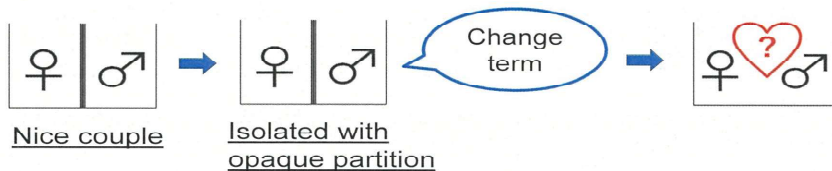
Objective

We measure the medaka's ability of memory through experiments with their sexual instincts.

Principle and Hypothesis

(From a treatise by Dr. Takeuchi) Regarding male medaka that the female is familiar with, it is less common for female medaka to accept a male's courtship. But when the female medaka is across a clear partition from a male for one day, that female accept the male's courtship quickly. When the male later encounters the female that remembers his face, she is more likely to accept his courtship. I separated them for varying periods of time and measured the female medaka's memory capacity.

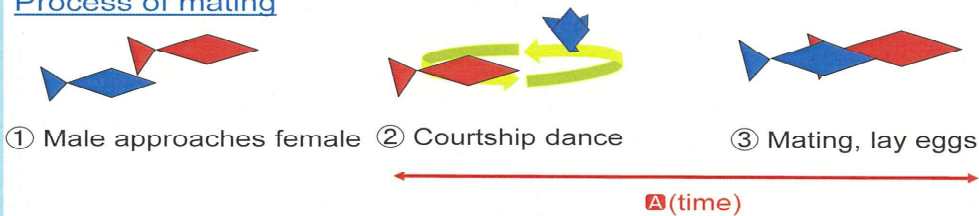
Methods



Research

- ① Female's rejection rate of male's courtship
- ② \bar{A}
- ③ Correlation of ① and ②

Process of mating



Results

Results in which mating began 5 minutes from the start.

Isolated term	First time	1 day	2 days	3 days	4 days	5 days	6 days
\bar{A}	4' 10"	19"	1' 59"	29"	3' 30"	34"	3' 1"
Number of rejections	3 times	0 times	0 times	0 times	0 times	0 times	0 times

Consideration

Medaka females remember the male even after being separated for 6 days. There is no correlation with the time or courtship dance to mating or the number of female's rejections of the male's courtship. Because mating is influenced by the medaka's condition and climate, results may vary depending on the situation.

Next

There is little additional data about this research. We should increase the amount of data. The medaka's memory capacity is very good, so we have to research for longer periods of time.

Reference

Individual recognition and the 'face inversion effect' in medaka fish
Wang MY, Takeuchi H eLife6 July, 2017



How Does Heating Affect

the Offspring of a Parent Generation of *Drosophila* ?

Tennoji High School Attached to Osaka Kyoiku University

II Sakuya Tanimoto I Saya Ito Riko Hayashishita



Research Motivation

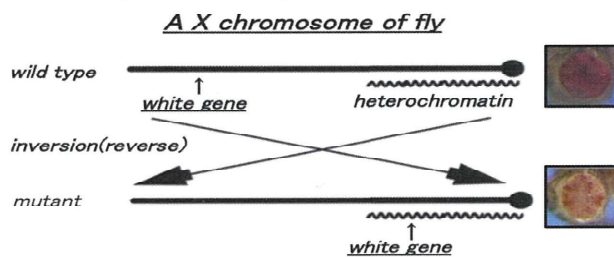
It was thought that traits of a parent were transmitted to offspring only according to Mendel's law, but DNA sequence-independent inheritance has been discovered in recent years. This inheritance is called "epigenetics". We put flies in a heated environment and observed them so that we could examine the mechanism of epigenetics.

Purpose of the Research

Putting flies of various stages in heated environment for varying length of time, observing changes in the eye color of these flies.

Why did we observe the eye color ?

Principle and Hypothesis



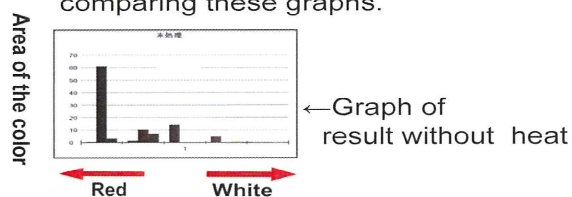
The white gene makes the eye color red, and gene expressions are suppressed in the heterochromatin region.

We used inversion mutant flies whose genes in the X chromosome move. These flies have a small amount of white their eyes.

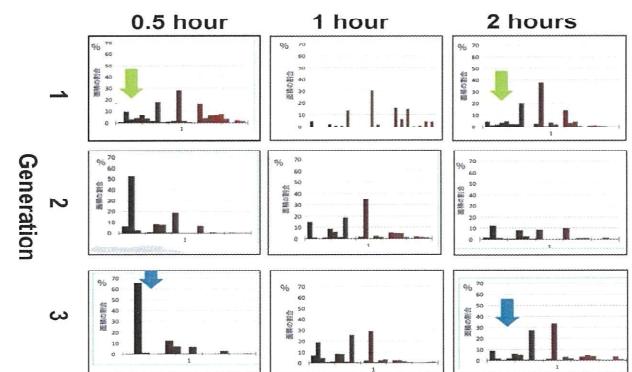
We thought the eye color would change due to the stress of heat for these mutant flies, because heterochromatin is made of proteins.

Method of the Experiment

1. Collecting eggs, larvae, and pupa flies.
2. Putting these flies in a 37°C box.
3. Heating the environment for 0.5, 1, 1.5, and 2 hours.
4. Taking pictures of the eyes of flies from three generations with a microscope.
5. Creating graphs of the color area and comparing these graphs.



Results



We observed that only the larvae changes.

From the figure, we found that white color increased with length of heat. Moreover, we found that the eye color returned with each new generation.

Consideration

We found a relationship between length of heat in and change in area and a relationship when the longer time of spent in heat, the more influence remained on the offspring.

We believe the reason why only larvae were affected is because they were more developed than the other stages.

Reference

- Inheritance of Stress-Induced, ATF-2-Dependent Epigenetic Change (2011)
「A primer of Drosophila」 2018.10.1
<http://www.biol.se.tmu.ac.jp/fly/index.html>
- 「Introduction to Drosophila」
<http://www.biol.se.tmu.ac.jp/fly/index.html>

Acknowledgments

I got these Drosophila from Masatoshi Tomaru, professor in Drosophila Genomics and Genetic Resources.

I got one of the Inversion Drosophila from Ki-Hyeon Seong, researcher at the Institute of Physical and Chemical Research.

I got some advice from Hidenobu Tsujimura, professor at Tokyo University of Agriculture and Technology.



Study of NaCl Density to Promote Growth of Lactic Acid Bacteria

Tennoji High School Attached to Osaka Kyoiku University
Mao YOSHIKAWA Minoru HORITA Kazuki FUKUMORI

Abstract

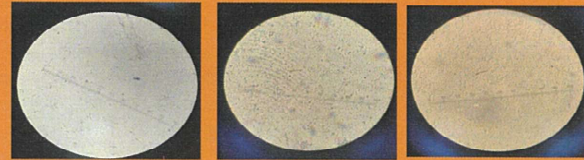
Lactococcus lactis. subsp. *cremoris* is contained in Caspian Sea yogurt, and studies show that growth is promoted by NaCl. We therefore cultured three kinds of bacteria in nutrient mediums with varying NaCl concentration and measured their growth.

Introduction

Previous studies have shown that the growth of the lactic acid bacterium *Cremoris* in Caspian Sea yogurt is promoted by NaCl.

These three kinds of lactic acid bacteria were used in this study.

- ① Animal and bacilli; *Lactobacillus delbrueckii* subsp. *bulgaricus* (Bulgaria)
- ② Animal and coccus; *L. lactis* subsp. *cremoris* (*Cremoris*)
- ③ Vegetative and bacilli; *Lactobacillus brevis* (*Labre*)



Bulgaria

Cremoris

Labre

Hypothesis Concentration that Promotes the Most Growth

Bulgaria → Density is not related

The animal lactic acid bacterium has a high halotolerance, but the food these bacteria are generally used to make has high salinity.

Cremoris → 0.5%

Results will be similar to previous studies.

Labre → 2.5%

This is close to the density of pickles, and last year's findings were similar.

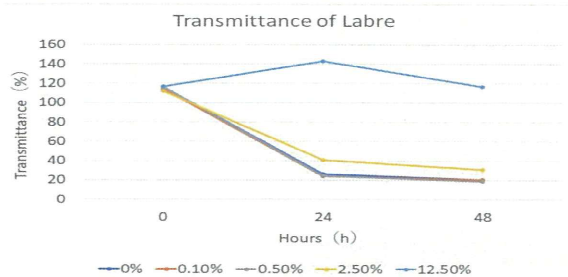
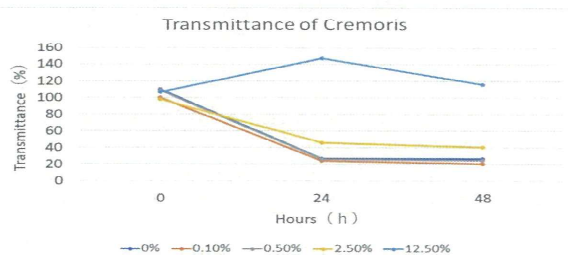
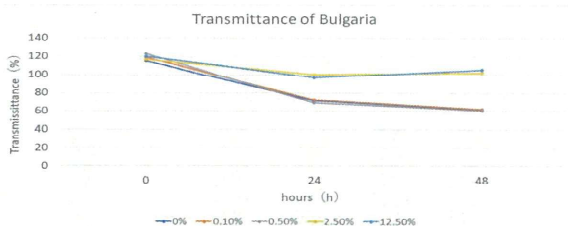
Method [1]

- ① We cultured three kinds of bacteria (Bulgaria, *Cremoris*, and *Labre*) in the TYG nutrient medium at five kinds of NaCl densities (0%, 0.1%, 0.5%, 2.5%, 12.5%)
- ② Transmittance was measured 0 hours later, 24 hours later, and 48 hours later.

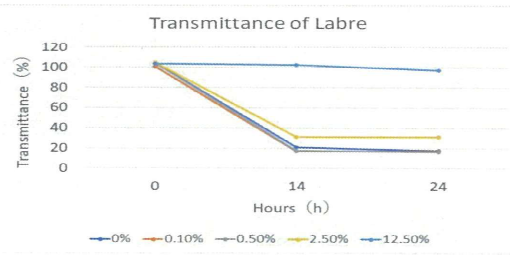
Method [2]

- ① We cultured two kinds of bacteria (*Cremoris* and *Labre*) in the TYG nutrient medium at five kinds of NaCl densities (0%, 0.1%, 0.5%, 2.5%, 12.5%)
- ② Transmittance was measured 0 hours later, 14 hours later, and 24 hours later.

Results [1]



Results [2]



Discussion • Conclusion

Bulgaria → 2.5%, 12.5%

Cremoris • Labre → 12.5%

- NaCl density is too high for each bacteria
- The properties of bacteria are different.

What can grow in higher density

Bulgaria < Cremoris = Labre

- A halotolerant difference was seen between Bulgaria and *Cremoris*.

A difference was not seen growth in the nutrient medium with added NaCl and without NaCl.

- The environment without NaCl is easy to grow up for the bacteria expect the lactic acid bacteria.

Reference

- Morichi, Toshiki. (1997) Characteristics and Utilization of Lactic Acid Bacteria: Progress in Recent Researches
Okada, Mirei. Kubota, Akane. Yoshikawa, Mao. (2018) The Effect that Salinity Concentration has on Lactic Acid Fermentation
Japan Society for Lactic Acid Bacteria (2010) 乳酸菌とビフィズス菌のサイエンス



Improved Salt Tolerance of *Arabidopsis thaliana* with Ethanol

Tennoji High School Attached to Osaka Kyoiku University

Ai Kitanishi Mizuki Kageyama Riku Nakamura

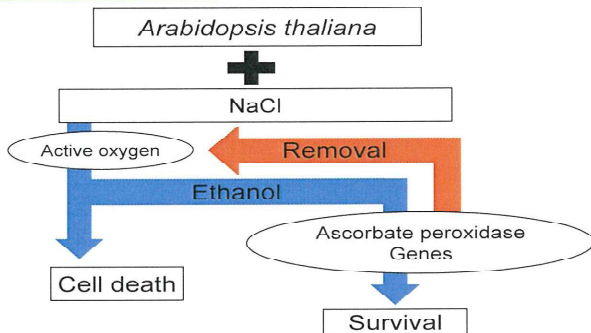
Abstract

Even under salt stress where plants no longer grow, when ethanol is added, increasing the salt tolerance of the plant allows it to grow. In this study, we studied detailed conditions for improving salt tolerance. As a result, it was found that salt tolerance increases more when less ethanol is given to subject plants.

1. Introduction

When a tsunami hits soil, a phenomenon occurs called salt damage that makes it difficult for plants to grow. However, previous studies have shown that *Arabidopsis thaliana* fed with ethanol have increased salt tolerance and can grow under salt stress. We focused on the amount and timing of ethanol, and investigated detailed conditions for developing salt tolerance.

2. Principle



3. Purpose of Research

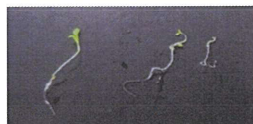
The amount and timing of ethanol is changed to determine how these affect salt resistance.

4. Indicators of Improving Salt Resistance

We focused on the survival rate of *Arabidopsis thaliana* as an index for improving salt tolerance.

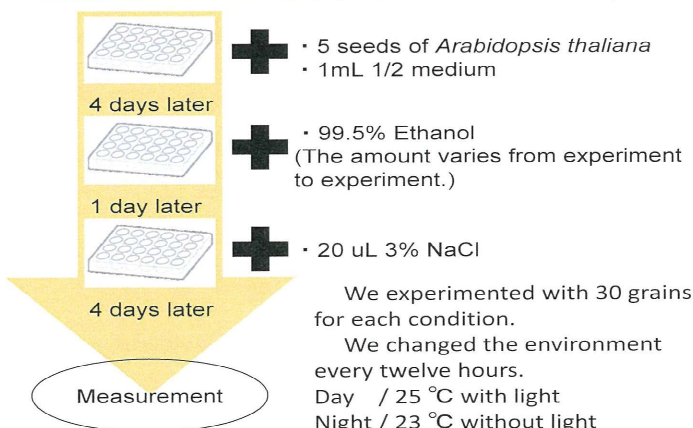
- Why did we choose *Arabidopsis thaliana*?
 - Its growth is very fast.
 - It was used in previous studies (for model plants).
- Measurement of growth

We examined whether the leaf color was green, yellow, or white, and calculated the survival rate for green and yellow individuals.



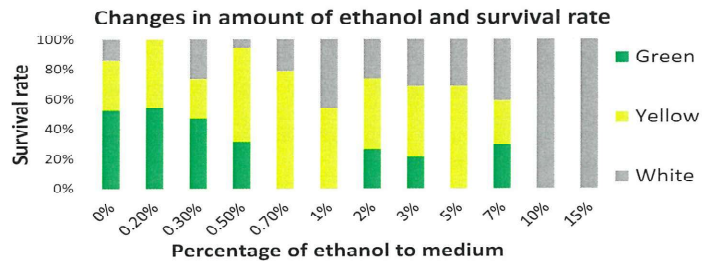
The state of *Arabidopsis* at the time of judgment. ↑
From left to right, green, yellow, white.

5. Experiment Procedure



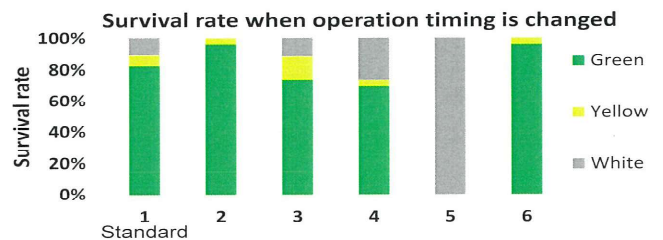
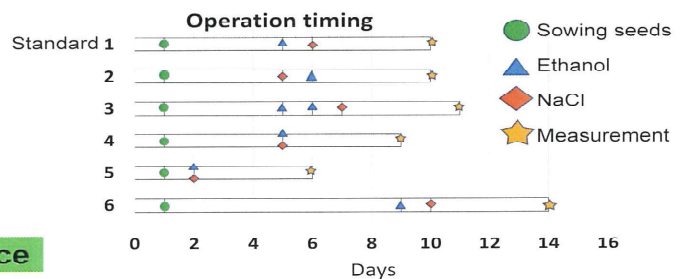
6. Results and Considerations

I Amount of ethanol



It was observed that cell fixation took place because the survival rate decreased when too much ethanol was given.

II Change Order



Salt tolerance varies depending on the number of days since germination. This is because it is believed that ascorbate peroxidase and genes are likely to be expressed with growth. Moreover, it is thought that salt tolerance improves even if the subject is soaked in salt solution.

7. Conclusion

- When ethanol was added at a low rate of about 0.2%, salt tolerance improved.
- Salt tolerance varies depending on the number of days since germination.
- Salt tolerance improves even after soaking in saline.

8. Bibliography

『The duration of ethanol induced high-salinity stress tolerance in *Arabidopsis thaliana*』 (K. Sako, Y. Sunaoshi, M. Tanaka, A. Matsui & M. Seki. 2018)

Development of Mix-Culture for Euglena with *Koji*

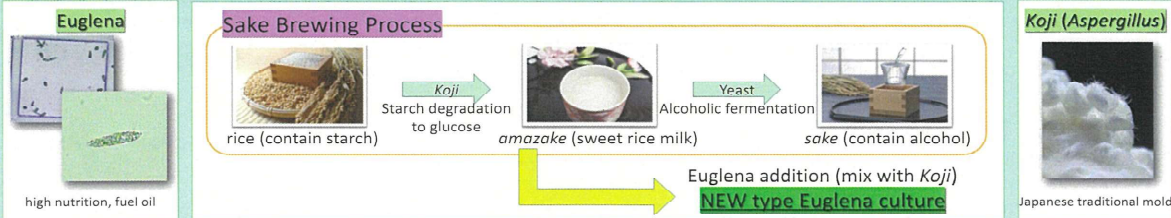


~A Method Learned from Sake Brewing~

Tennoji High School Attached to Osaka Kyoiku University
Kensuke Hamanaka Momoko Takahata Makoto Yamashita

Abstract

Our aim is to develop an efficient mix-culture method for Euglena with *Koji*. *Koji* (*Aspergillus*) is an useful mold for Japanese traditional food culture, such as sake brewing. In sake brewing, *Koji* degrading enzyme breaks down rice starch into glucose, and yeast uses the glucose to perform alcoholic fermentation. Euglena heterotrophic culture contains glucose to be consumed by Euglena. We hypothesized that this process in *Koji* can be used Euglena culture, and we proved that this culture is possible by experiments focusing on the ability of *Koji*.



Introduction

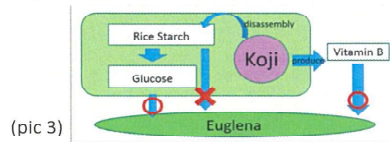
Two points the characteristic of rice *Koji*:

- *Koji* has amylolytic enzymes.
- *Koji* introduces vitamin B not included in polished rice.

From this, we hypothesized that *Koji* is able to make a moderate environment for Euglena to live in.

Method ② Mix-Culture Experiment

We tried mix culture using rice as a medium. The figure below shows the mechanism of this culture. We made sure that Euglena takes the glucose produced by *Koji*.



- Make mediums: DW 100 ml + HYPONeX 0.1 g + rice
 - 1.0 g
 - 1.5 g
 - 2.5 g

Put mediums in 100°C water for 20 min while checking status, and return to room temperature.

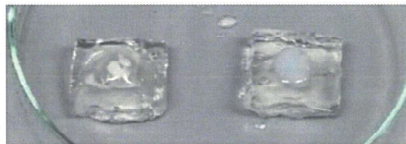
- For each mediums, put 1/10 amount of incubating (pic 4)
- 3 conditions : only Euglena, mix of Euglena and *Koji*, only *Koji*.
- Incubating a total of 9 conditions, observe and count Euglena.
- Compare the amount of glucose in the only *Koji* medium and the mix medium.

Method ① Proteolytic Ability Experiment

Find out how much proteolytic ability *Koji* has.

→ Compare the amount of gelatin dissolved by *Koji* or detergent enzyme(← laundry detergent).

- Make jelly: gelatin 5 g + hot water 250 ml → cool
- Soak *Koji* in 60°C water to make *Koji* work more actively, and return to room temperature after 10 min.
- Dissolve the detergent enzyme in water.
- Place 100 μl of *Koji* or detergent enzyme on the jelly.



(pic 1: Additives on board L: *Koji* R: detergent enzyme)

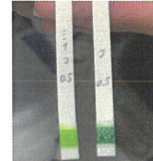
Result:



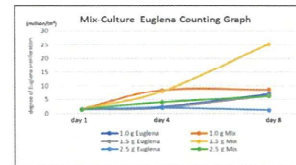
(pic 2: State of removing additives L: *Koji* R: detergent enzyme)

It was confirmed that both additives dissolved the jelly and caused dents. In addition, comparing *Koji* and the detergent enzyme, the degree of dissolution by *Koji* is lower than that of the detergent enzyme. We concluded that there is little influence on Euglena.

Result:



(pic 5 comparing glucose L: mix R: only *Koji*)



(pic 6 Euglena counting graph)

From pic 5, it was confirmed that *Koji* degraded starch into glucose, and that the amount of glucose in the mix medium was lower than that in the only *Koji* medium.

From pic 6, the degree of proliferation of mix medium is higher than that of the only Euglena medium in each amount of rice. In addition, it was confirmed that 1.5 g rice medium is the highest degree of proliferation.

Conclusion

We clarified that a mix-culture of Euglena and *Koji* is possible. It is impossible for Euglena to ingest starch, but it becomes possible for Euglena to take energy with *Koji* ability, just as yeast uses glucose to perform alcoholic fermentation with *Koji*.

References

- Hall, R.P. 「The Biology of Euglena」 Science (1969)
- Kitaoka, S. 「Euglena physiology and biochemistry」 (1989) Gakkai Shuppan Center

Appreciation

Thanks to Ms. Nakazawa, Osaka Prefecture University, and Mr. Nakaya, Osaka Kyoiku University, for giving us Euglena strains for research and a great deal of advice.



How mucin effects the swell of dough

Grade II Mizuki Uyama Grade I Misato Inoue Miyabi Miho

Abstract:

The goal of this research is to make well-swelled dough by adding ingredients containing mucin, and ingredients which are familiar to our daily lives will be focused on. This research also will reveal, which material helps dough become puffy the most. Also, how viscosity effects the swell of dough was clarified.

Objectives:

- To make sure which material helps dough become puffy the most by adding ingredients containing mucin.
- To clarify how viscosity effects the swell of dough.

Conclusion:

Mucin of natto makes well-swelled dough.

What is mucin?:

Stickiness of okra, natto and, Chinese yam.

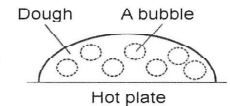


Principle and Hypothesis:

Bubbles confined into a dough expands and the dough swells by heating. Bubbles become hard to crack and the dough swells well by adding ingredients with mucin.

[Hypothesis 1] Strength of bubbles in a dough increases and the dough swells by adding ingredients containing mucin better than that added nothing.

[Hypothesis 2] The higher the viscosity is, the higher the strength of bubbles in a dough is. So the dough swells well.



Research:

Experiment 1

① Extract mucin.(From okra, natto, and Chinese yam.)

- ※Extraction method of mucin.
- 1. Mix ingredients of mucin and water by hand until the ingredients lose their stickiness.
- 2. Filter extraction in 1 by using a sieve.
- 3. Suction and filter extraction in 2.

② Mix 15g of extraction in ① and 15g of flour, and make a dough.

③ Bake the dough made in ②.

- ※How to bake dough
- 1. Pour 10ml of the dough into a 50ml beaker.
- 2. Put the beaker on the hot plate which is warmed up at 160°C and leave the beaker on it for 5 minutes.



④ Measure increment of thickness of the dough.

Experiment 2

- ① Measure viscosity of mucin extracted in the experiment 1 by using a viscometer.
- ② Compare the results.

How to use viscometer

1. Pour extraction in ① in the experiment 1 by using the pipette.
2. Suck up extraction in 1 until this line.
3. Measure the time from extraction in 2 falls until this line.
4. The longer time extraction in 1 falls, the higher viscosity is.



Result:

Experiment 1

① Okra

Times(times) / Thickness(cm)	Okra+Flour	Water+Flour
1	+0.4	+0.4
2	+0.7	+0.2
3	+0.7	+0.4
4	+1.2	+1.1
5	+0.4	+0.2
6	+0.8	+0.5
Average	+0.33	+0.30



② Natto

Times(times) / Thickness(cm)	Natto+Flour	Water+Flour
1	+0.4	+0.2
2	+0.2	+0.1
3	+0.8	+0.1
4	+1.1	+0.2
5	+0.5	+0.2
6	+0.4	+0.5
7	+1.1	+0.4
8	+0.5	+0.1
9	+0.6	+0.1
10	+0.5	+0.2
11	+0.3	+0.7
12	+0.5	+0.4
Average	+0.68	+0.27



③ Chinese yam

Times(times) / Thickness(cm)	Chinese yam+Flour	Water+Flour
1	+0.5	±0
2	+0.2	±0
3	+0.3	±0
4	+0.5	±0
5	+0.4	±0
6	+0.2	+0.2
7	+0.3	±0
8	+0.1	±0
Average	+0.31	+0.03



Experiment 2

Times(times) / Viscosity(minute / times)	Okra	Natto	Chinese yam
1	00:19:55	Unmeasurable(00:30:00 over)	00:20:25
2	00:28:00	Unmeasurable(00:30:00 over)	00:04:08
Average	00:23:58	Unmeasurable(00:30:00 over)	00:12:17

Consideration:

- A dough mixed with mucin extraction and flour swells better.
- Mucin makes dough well-swelled in the order of natto, okra, and Chinese yam.
- Regarding the height of viscosity, natto comes first, then okra and Chinese yam.
- ➔ The higher viscosity is, the higher strength of bubbles in dough is, and the dough swells well.

Future work:

- To measure viscosity of Chinese yam before its mucin extract is separated.

Acknowledgement:

Thank you very much for Ms. Tamura, Mr. Minami, Mr. Miyake and others teachers who are engaged in this study.

Reference:

- http://www.aichi-inst.jp/shokuhin/other/up_docs/news1412-2.pdf
- <http://www.holonicssystem.com/nutrition/layout/201810.html>
- <http://www.ekouhou.net/ムネの食料水溶液の製造方法/disp-A-2008-54654.html>
- Morinaga pancake mix recipe



Elucidation of the principle of Cola milk

Tennoji High School Attached to Osaka Kyoiku University II · HARUKA YAMAKI I · AIRI SHIJO MOEKA YOSHIDA

○ Introduction

When milk is put into cola, there is a phenomenon that the cola becomes transparent and precipitates. We were interested in this phenomenon and decided to investigate its principle. The hypothesis is that acids such as carbonic acid and phosphoric acid contained in cola may denature and precipitate casein protein contained in milk.

○ Experiment 1 (adding milk to carbonic acid and phosphoric acid)

□ Carbonic acid

Add 1 ml of milk to 50 ml of commercial carbonic acid in a beaker (boiling carbonated water is also available as a control experiment).

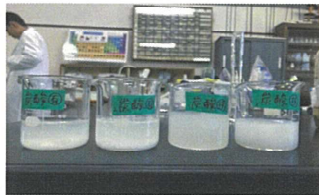
□ Phosphoric acid

Add milk to 50 ml of phosphoric acid with different concentrations.

○ Result 1

□ Carbonic acid

As shown in the figure on the right, precipitation was clearly different between boiling and non-boiling.



□ Phosphoric acid

As the molarity increased, precipitation appeared to increase. However, contrary to expectations, precipitation occurred at 0.03 mol / L at pH 3.63, and precipitation at higher molar concentrations failed.

○ Experiment 2 (adding milk to hydrochloric acid)

When Experiment 1 was announced in an interim presentation, I received advice from a university professor: "Because the first digestion of milk is gastric juice (hydrochloric acid), why not use hydrochloric acid as a standard?"

Add 1 ml of milk to 50 ml of different concentrations of hydrochloric acid.

○ Result 2

The results are as follows.

concentration	pH before addition	pH after addition	status
0.01mol/L	2.8	3.0	not formed.
0.02mol/L	2.6	3.9	formed.
0.05mol/L	2.2	2.3	formed.(most)
0.1mol/L	2.2	2.0	formed.

○ Experiment 3 (adding milk to other carbonated drinks)

I was wondering what kind of results would be obtained with other carbonated drinks, not just cola, so I decided to investigate. 1 ml of milk was added to 50 ml of each beverage in a beaker. In addition to cola, the drinks used were Mitsuya Cider, Fanta Orange, Calpis Soda and THE TANSAN. ① Remove carbonic acid and cool ② Remove carbonic acid and cool at room temperature ③ Cool with carbonic acid ④ Cool with carbonic acid at room temperature (cooling: 9.2 ° C, normal temperature: 17.6 ° C)

□ Mitsuya Cider

In all of ① to ④, precipitation occurred, and no significant change in pH was observed.

□ Fanta Orange

In all of ① to ④, precipitation occurred, and no significant change in pH was observed. Initially it was a white precipitate, but precipitate turned orange and the liquid became clear.



↑ Fanta Orange ①

□ Calpis soda

In all of ① to ④, precipitation occurred, and no significant change in pH was observed. It remained cloudy white and did not become transparent.

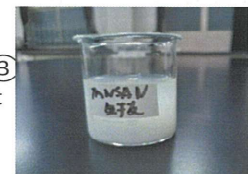


↑ Calpis soda ①

□ THE TANSAN

Precipitation occurred in ①, but no precipitation occurred in ② ③ to ④, and there was a significant change in pH in ② and ④.

* I will explain in detail verbally.



↑ THE TANSAN ①

○ Discussion ▪ Outlook

Experiments 1 and 2 are not shown here, but showed that the pH increased most around 2.2 compared to the experiment where dairy was added to the cola. When researched, the isoelectric point of a protein called casein in milk is pH 4.6, which is most likely to aggregate at that point. This can cause precipitation around pH 4.0. I would like to investigate the reason for precipitation around pH 2.2.

Experiment 3 shows that precipitation with other carbonated water is possible. However, I don't know if it is happening on the same principle as cola. There is no significant change in the amount of precipitation that can be observed visually even if the presence or absence of carbonic acid or temperature changes, and the presence or temperature of carbonation or temperature is thought to have little relation to the cause of precipitation. In the future, other components of carbonated water will be investigated to find similarities with cola. I don't know why THE TANSAN alone gives different results, so I would like to investigate that too.

○ References

Coca cola HP <https://www.cocacola.jp/>
(2019.12.13)

武村政春『たんぱく質入門—どう作られ、どうはたらくのか』ブルーバックス 2011



Making UV Resin that Does Not Deteriorate

grade 2 *Hinako Kihara* grade 1 *Saho Ikeda Chihiro Omori*

Abstract

UV resin degrades by heat. When the UV resin is oxidized by heat, that is degrading. A preceding study showed that investigated. This research followed the preceding study. We added an antioxidant to the UV resin and heated it by an oven. We checked the degree of the degradation by color change.

purpose

When time has passed, a UV resin degrades and turns yellow. The cause of this will be investigated by this research. And the UV resin which does not degrade can be made.

Research method

- ① An antioxidant was mixed with a UV resin.
- ② ① was hardened for 10 minutes under the ultraviolet rays.
- ③ The color of the UV resin is gauged with a machine.
- ④ ② was heated for 15 minutes at 200 °C in an oven.
- ⑤ The color of the UV resin at ④ was measured.

The Antioxidants used in this study

Lemon juice
→ **Vitamin C**

Rosemary oil
→ **Phenolic system antioxidant**

Results: Detailed data are shown in the right table.

Lemon juice

- Sugar was included in this burned.
→ Therefore a change with the color was not understood.
- Lemon juice did not mix with a UV resin.

Rosemary oil

- UV resin did not turn yellow.
→ That did not degrade.

Discussions

- It is difficult to mix with a resin and lemon juice because of the different density.
- Rosemary oil was easy to mix because the density was almost the same as a UV resin.
-
- The UV resin is easy to separate from vitamin C of lemon juice.
- **Rosemary oil functioned as an antioxidant.**



Reference

"Deterioration by heat analysis of polystyrene in FT-IR" Japanese reliability assessment organization

"Production of methane and ethylene from plastic in the environment"
Sarah-Jeanne Royer, Sara Ferro´n, Samuel T. Wilson, David M. Karl

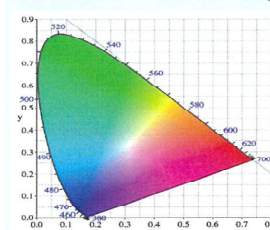
The difference between the normality and the lemon juice (n=7)

	Normal	Lemon juice	the difference
ΔRs	-20.63	-18.93	-1.7
ΔGs	14.9	3.36	11.54
ΔBs	-31.49	-4.57	-26.92

The difference between the normality and the rosemary oil (n=7)

	Normal	Rosemary oil	the difference
ΔRs	-20.63	-89.66	69.03
ΔGs	14.9	19.66	-4.76
ΔBs	-31.49	-3.01	-28.48

※ The standard RGB color difference (sRGB), and color difference indication in "135 A of TES, differential colorimeter" were used.



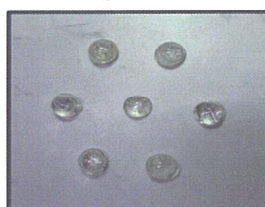
Color difference
→ Distance between colors in a color space composed of RGB combinations

Large color difference → **easy** to distinguish
Small color difference → **hard** to distinguish

The color specification system in the left figure : CIE (Commission Internationale de l'Eclairage)

Actual pictures

Rosemary oil



Lemon juice



← Normal

← Rosemary oil

Future problem

- More experiments should be required because the number of data is small.
- When heating the UV resin which was mixed with rosemary oil, some air bubbles were made. The way to reduce these should be considered.
- The way to use an antioxidant besides the liquid should be considered.

The condition that a crystal of the pyramid-shaped salt precipitates

Osaka Kyoiku University Attached to Tennoji High School Hirokazu SUNAIKE

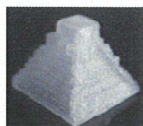
ABSTRACT *Ptolemy salt* is a crystal of a pyramid-shaped salt. It emerges when you add other materials to a salt solution. We did research into the relationship between *Ptolemy salt* and liquidity. It was revealed that the liquid characteristics had to be less than a constant pH, and then surface tension will work at the surface for generation of the *Ptolemy salt*.

PURPOSE OF RESEARCH

Examine the relationship between the materials to add and precipitation of *Ptolemy salt* and clarify the appearance conditions of *Ptolemy salt*.

IS WHAT PTOLEMY SALT?

Kind of salt
About 5mm
Pyramidal shape Inside is hollow



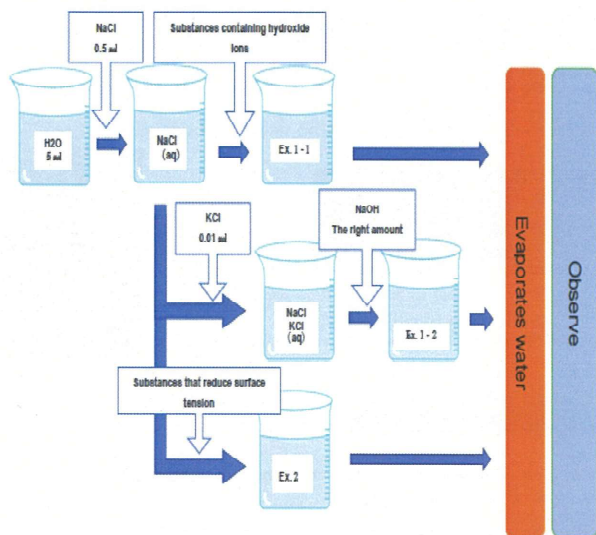
Find in Uyuni salt lakes
Additives affect formation



Hypothesis

You Can't make it when you add Hydroxide ion or reduce the surface tension.

Examine



Result[2]

Substance	Content	<i>Ptolemy salt</i>	
Oleic acid etc.	Oil	×	
Benzalkonium chloride	Surfactant	×	
Ethanol	Alcohol	○	

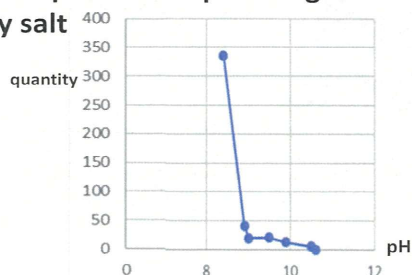
Ptolemy salt does not appear when surface tension reducing substances are added.

Emergence of *Ptolemy salt* requires a certain surface tension.

Results[1]

Substance	liquid	<i>Ptolemy salt</i>	
HCl, CuSO ₄ , KCl etc.	Acidic Neutral	○	
NaOH, KOH, Ca[OH] ₂	Strong base	×	
NH ₃ , Al[OH] ₃ etc.	Weak base	○	

Relationship between pH and generation of *Ptolemy salt*



Consideration



Future development

Finding an environment where *Ptolemy salt* tends to precipitate.

Examine the relationship between pH and the growth direction of salt crystals.

Investigate how *Ptolemy salt* is formed in nature, such as Uyuni salt lake.

References

<https://msp.c.yimg.jp>
Conditions for *Ptolemy Salt* Formation
Researcher Maho Minakami Tomoka Miyata Risa Wakizaki
About the crystal form of saltThe mechanism of the formation of mysterious salt crystals that has been pursued since middle school
Approaching [Chemistry] Saitama Prefectural Omiya High School Faculty of Natural Science



Synthesis of Biodegradable Plastic Made from Starch

Airi Nojiri, Ryo Murakami, Rina Kusaba

Abstract

Recently, bad influence on nature due to a large amount of trash which is thrown away by people is regarded as a serious problem. When they are buried under ground, conventional plastics keep its shape forever, but biodegradable plastics are decomposed by microbes. We did the research of making biodegradable plastics by using starch. The purpose of this study is to clarify the condition that they made and to make the practical plastic made from starch.

Purpose

Last year, we succeeded in synthesizing plastics from three types of starch including dogtooth violet starch, corn starch, and kudzu flour. We conducted experiments for the following purposes.

1. To examine whether we can synthesize the plastics under various conditions
2. To examine whether we can use the plastics in terms of thermoplasticity and swelling

Conclusion

- Any kind of starch did solidify not with acetic but acetic anhydride
- Esterified at heating to 80°C
- Some kinds of starch did or did not solidify
- These plastics were thermoplastic and did not swell so much

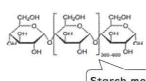
To make the practical plastics using starch, kudzu starch or sweet potato starch with acetic anhydride is appropriate at heating to 80°C for 5 min. These products may be practical plastics.

Experiment 1

Synthesis Under Various Conditions

(Purpose)

To examine whether we can synthesize the plastics using four types of starch including dogtooth violet starch, corn starch, kudzu flour, and sweet potato starch under various conditions



(Methods)

Preparation of starch acetic esterification

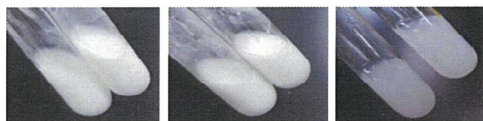


(Experimental procedure)

1. Prepare 2g of starch, 2ml of distilled water, and 2ml of acetic acid x4 (A)
Prepare 2g of starch, 1ml of distilled water, and 2ml of acetic acid x2 (B)
2. Add a few drops of concentrated sulfuric acid, and bath at suitable temperature for 5 min (Ax2 and Bx2)
Add a few drops of concentrated sulfuric acid, and bath at 80°C for 5 min (Ax2)
3. Neutralize with sodium hydrogen carbonate and wash with distilled water a little after cooling to the appropriate temperature

(Results)

Any kind of starch did not solidify under any conditions.



Experiment 2

Measurement of Absorbance

(Purpose)

To examine whether the starch is esterified and clarify the reason why the water bathed at 80°C became transparent

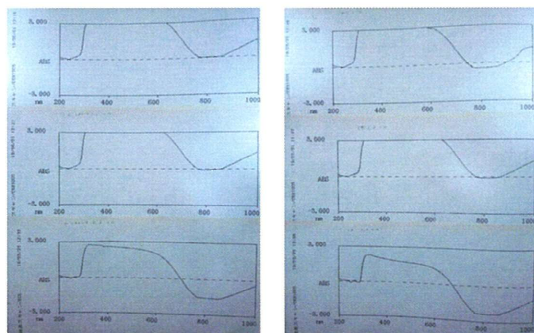
(Methods)

Make the graph of absorbance using a spectrophotometer

(Experimental procedure)

1. Prepare 2g of starch, 2ml of distilled water, and 2ml of acetic acid (A) and bath at suitable temperature for 5 min
Prepare 2g of starch, 2ml of distilled water, and 2ml of acetic acid (A) and bath at 80°C for 5 min
2. Prepare an aqueous starch solution as a control group
3. Measurement the absorbance of each group

(Results and Discussion)



Since all graphs are similar in shape, the substances are scientifically considered to be the same. The substance may have changed under 80°C.

Experiment 3

Experiments with Acetic Anhydride

(Purpose)

To examine whether we can synthesize the plastics using acetic anhydride for the same experiments

(Methods)

Preparation of starch esterification with acetic anhydride using four types of starch including dogtooth violet starch, corn starch, kudzu flour, and sweet potato starch

(Experimental procedure)

1. Prepare 2g of starch, 2ml of distilled water, and 2ml of acetic acid (A)
2. Bath at 80°C for 5 min
3. Perform the same experiment using acetic anhydride

(Results)



Experiment 4

Thermoplastic/Swelling Test

(Purpose)

To examine whether we can use the plastics in terms of thermoplasticity, and swelling

(Methods)

Put on a hot plate and examine the thermoplasticity
Put in water and see the mass change
Using only two kinds of starch: kudzu flour and sweet potato starch

(Experimental procedure)

1. Put on a hot plate and heated at 160°C for 5 min or 10 min
2. Put the plastic in a beaker for 5 min and check the change in mass

(Results)

	thermoplasticity	swelling
kudzu starch		Pre 1.167g → Post 1.233g
sweet potato		Pre 1.348g → Post 1.453g

increased a little
↓ but
Considering the weight of the water droplet, it does not seem swelling



Gradually softer and easier to deform
↓
These plastics may have the thermoplastic

References

- Kenichi Kudo (1962) *Making plastic from starch*
<https://doi.org/10.1271/kagakutoseibutsu1962.33.159>
- Chemistry Keirinkan
- National Institute for Environmental Studies
<http://tenbou.nies.go.jp/science/description>



Change Polluted Water to Clean Water by Using γ -PGA(The Material of Japanese Food)

Tennoji High School Attached to Osaka Kyoiku University
Kotaro Kanazawa Yuki Inoue Yuki Ito

Abstract

Elucidate the system of clean the polluted water by using γ -PGA which is the material of extracted from Natto(Japanese food).We consider the way of changing the sewage water to drinking water by using something around our life.

Purpose

- Making the clean water by using something around us
- Invent the machine that we can carry

Main Research

- What material do it case purification of water quality?



According to previous research of us , using $\text{Ca}(\text{OH})_2$ as neutralizer can occur purification of water quality.

Patern1

- When Cation decide Ca^{2+}

Patern2

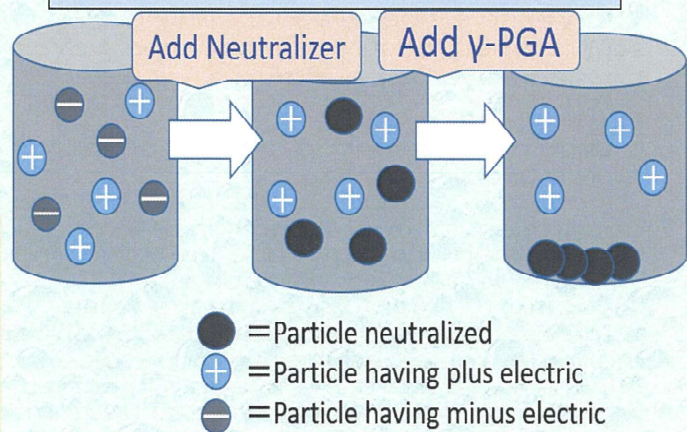
- When Anion decide OH^-

Cation= Ca^{2+}	Result
$\text{Ca}(\text{OH})_2$	◎
$\text{Ca}(\text{NO}_3)_2$	○
CaO	◎
CaCl_2	○
Anion= OH^-	Result
$\text{Ca}(\text{OH})_2$	◎
$\text{Na}(\text{OH})_2$	△
$\text{Al}(\text{OH})_3$	×
$\text{Zn}(\text{OH})_2$	×

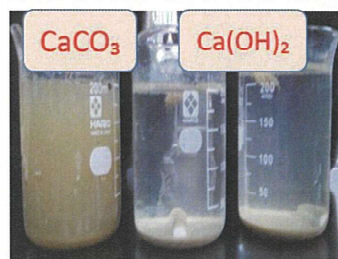
Consideration

- When cation is Ca^{2+} ,the water-purification occur in polluted water.
- It is proven that Ca^{2+} has the effect to help working of γ -PGA, but we think OH^- is not involved with water purification.

Hypothesis-mechanism of purifying dirty water



When Neutralizer is CaCO_3 and $\text{Ca}(\text{OH})_2$



Why we want to use CaCO_3 ?

It's because CaCO_3 is neutral material ,s o we can drink water after purified by our mechanism
Besides there are CaCO_3 many exist in the nature , such as shell.

Assignment and Project

- From now, we are going to develop and invent the simple machine that clean the polluted water to clean water which use in poor countries.

【References(URL)】

Japan Poly-gulu(poly-glu.com)
Japan Water Guide (ngojuwg.org)
Ajinomoto company(ajinomoto.com)



My IG ID
pkotaro0516



Changes in the Sound Transmitted Through the Thread Phone

Tennoji High School Attached to Osaka Kyoiku University

2nd grade Aki Yamamoto

1st grade Takatoshi Hashimoto Tomoki Nagaosa

Purpose of Research

The purpose of this study was to investigate changes in the magnitude of the sound transmitted by a thread phone when changing the state of the thread, such as bending the thread.

Principles and Hypotheses

A yarn phone is a toy that connects the bottom of two paper cups with a single thread and allows you to talk between two points. The principle is also to transfer sound to the vibration of the thread, and to convert it to a voice again. Assuming that the sound transmitted through the thread phone is transmitted as a longitudinal wave, as long as external factors do not exist, the frequency of the wave does not change, so it is believed that only the volume changes among the three elements of sound. When the thread is bent, the wave path does not change in volume and it is considered to be constant.

Experimental Method

(1) Using a mobile phone application, play the sound source of 67dB, 1013Hz.

(2) Measure the volume of the receiving side in the application, for each condition of thread.

(3) When measuring, average the values that come out.

(Value per second → 5 seconds)

(4) Repeat 10 times to average the value.

※ The average value is calculated by omitting the maximum value and the minimum value.

※ In the experiment, the thread is intended to refer to a wire of iron relatively easy to fix, at 0.04mm.

<Preliminary Experiment>

Check environmental sound and examine the value of the error.

① Don't play the sound source used in the experiment.

② Play the sound source used in the experiment.

③ Play the sound source through a thread phone.

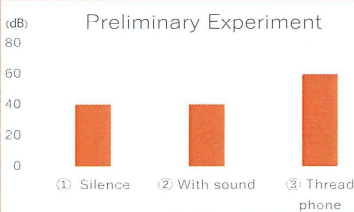
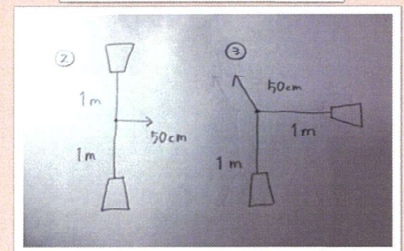
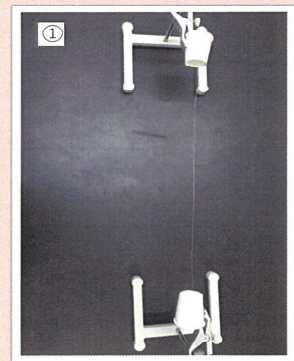
Measure the volume at 2 m under the above three conditions.

Conditions of thread

① 2 m straight line

② Tie 50 cm thread to the midpoint of 2 m thread

③ 2 m straight line tied up 50 cm thread at the midpoint as a fixed end, bent



← From "silence" and "with sound", it was found that about 1 to 2 dB could be regarded as an error.
← From "silence", the environmental sound at the experiment site was about 40 dB, and it was found that it was necessary to consider this when conducting the experiment.
← From "with sound" and "thread phone", it was found that the volume is higher when through the thread phone.



← When "tied up", the value was larger than when not using a thread phone, but smaller than "bent".
← Although the value was slightly larger "bent" than when not using thread phone, the change in volume could not be heard by ear.

Consideration

It is believed that the sound volume changes due to external factors such as fixed ends that affect the volume of the sound transmitted through the thread. Also, we believe the reason the value of "bent" was smaller than that of "tied up" is that the fixed end was pulled too much when bending the thread, so there was difference in the tension of the thread. However, we think the reason why there is an area that cannot be explained only by these reasons is that the hypothesis by which this was first established, the longitudinal wave, is wrong.

Task

It is necessary to investigate whether the waves transmitted through the thread are longitudinal waves or different waves. We should continue our research based on this.

References

「糸電話を伝える音の変化について」
鍛冶山凌、山口憲 2016/11/14
「糸電話を伝える音の研究」
第12回 山崎賞



Glass Temperature and Changes in Contact Angles

~By Half Angle Method~

Tennoji High School Attached to Osaka Kyoiku University
Grade II Ryusuke AMAOKA Grade I Takuto HORI Yuki YAMADA

Abstract

Our hypothesis was that when a solid is warmed, the intermolecular force weakens and the interfacial tension decreases. We focus on the contact angle, which is one of the phenomena caused by the interfacial tension. We tested the hypothesis by applying heat to the glass and measuring changes in the contact angle with water using the half angle method.

Purpose

When it rains, water droplets remain on the windshield. We want to prevent water droplets from decreasing visibility by remaining on glass.

Hypothesis

When heat is applied to glass, the intermolecular force becomes weak and interfacial tension becomes small. Therefore, it is hypothesized that the contact angle increases.

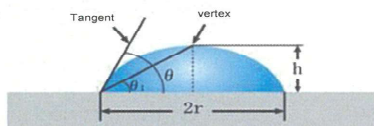
Principle

• Interfacial tension

A molecule is more energetically stable when surrounded by other molecules. As the surface molecules are only partially surrounded by other molecules, they are energetically unstable. Work, therefore, is required to bring molecules to the surface. The energy required for this is called surface energy, which is interfacial tension. Because solids cannot move, solids bring molecules from nearby to stabilize the surface.

• Half angle method

The half angle method is a method for obtaining the contact angle using the fact that θ_1 in the figure below is $1/2$ of θ when the outline of the droplet is a part of a circle.



Experiment method

The glass is warmed, drops of water are taken and the contact angle is measured from the video. This is one cycle.

1. Turn on the power and raise the glass temperature while looking at the thermometer.
 2. Measure $10\mu\text{l}$ of water with a micropipette and drop it onto the glass slide.
 3. Record video with the camera and measure the contact angle using the Half angle method.
- *The video was recorded 10 seconds after dropping the water.
*Result of the temperature is the average of the start and end of shooting.

References

What is surface / interfacial tension? | Sanyo Trading Co., Ltd. Science Instruments Business Unit
<https://www.sanyo-si.com/learn/report/02/> (Interfacial tension diagram)

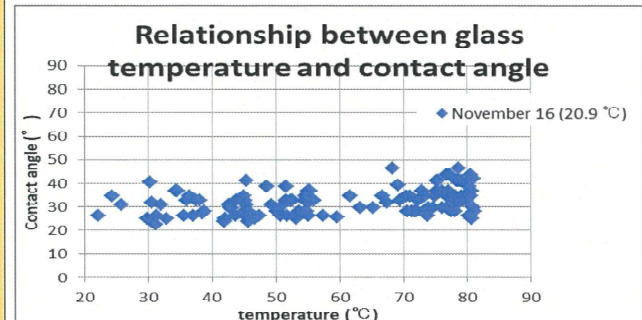
What is contact angle (wetting)? | Kyowa Interface Science
https://www.face-kyowa.co.jp/science/theory/what_contact_angle.html (Diagram of $\theta / 2$ method)

PHYSICS AND CHEMISTRY OF INTERFACES Hans-Jurgen Butt, Karlheinz Graf, Michael Kappl, Syozi SUZUKI, kozi HUKAO

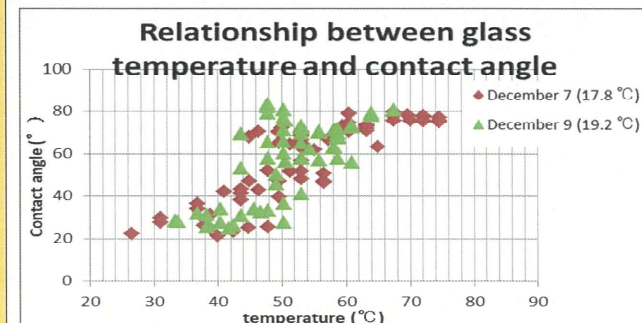
Experimental device



Results



From the graph above, there are many cases where the contact angle increases as the glass temperature increases. The reason there was no difference in the results on November 16 is that the interval between experiments was short and the temperature of the glass remained low. Therefore, in the experiment in December, the number of repetitions was reduced and the interval was lengthened.



Conclusion

Because the contact angle often increased as the glass temperature increased, it is believed that interfacial tension decreases as the glass temperature increases.



Reasons a Drop of Water is Layered

Tennoji High School Attached to Osaka Kyoiku University Grade 2 Yuto FUJIMORI
Grade 1 Ayu OTSUKA Yuka KATAYAMA

Research Reason and Purpose

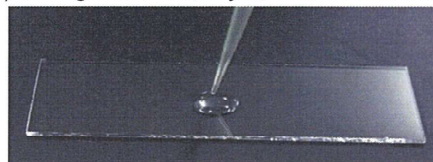
One day, I saw circular white marks on a beaker. When water droplets were dropped on the glass slide and dried on trial, white traces were left in layers.



We started this study **to find out why a drop of water is layered**. We changed the conditions in various ways and hypothesized reasons based on similarities and differences.

Design of Study

I drop a certain amount of an aqueous solution (including tap water) on a glass slide, dry it, and observe it.



Experiment ① "Are layers really formed?"

○ Place many drops of **tap water** on a glass slide and dry **to make many samples**.

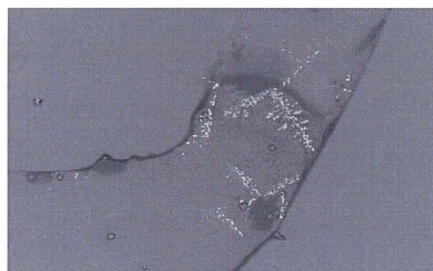
○ Use **an electron microscope** to check the layers.

Result ①

○ The layers were confirmed by sight in about 61 out of 70 samples.

○ It was confirmed that the particles were arranged in layers with the electron microscope.

➔ **The traces of tap water drops are layered.**



← Photo taken with electron microscope.

Miniscope 2019/07/13 NL D3.9 x100 1mm

Experiment ② "Are the white marks formed by impurities?"

○ Drop **distilled water** on a glass slide.

Result ②

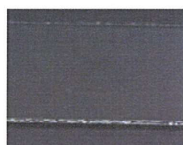
○ There was no trace left.

➔ **It is thought that the white traces made when observing tap water are made by impurities contained in tap water.**

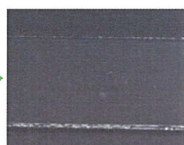
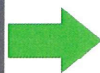
Experiment ③ "How does marks evaporate?"

○ Observe **the evaporation of tap water**.

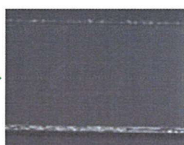
Result ③



↑ Just before the water drops move. Water droplets are spreading thinly.



↑ The water droplets have finished moving. Water droplets approach one side and are thicker than immediately before the water droplets move.



↑ Water drops that have been moved and dried. At this time, the second layer is about the same size at the same position as the traces of the moved water droplets.



Zoom in ...



○ Water drops move toward the inclined side and form layers on the inclined side.
○ If there is dust (the core for making trace) in the liquid, impurities will be gathered dust and a layer will not be formed.

➔ **The position / size of the moved water droplets may be the position / size of the second layer mark.**

Experiment ④ "Can we change the evaporation speed?"

○ The evaporating **speed was changed** by putting the glass slide with tap water in a box and **wrapping** it (with plastic wrap).

Result ④

○ The inside of the second layer becomes whiter when wrapped.

➔ **Evaporation speed is related to how the layers are formed.**

Experiment ⑤ "How about mineral water?"

○ Six kinds of **mineral water** with various hardnesses were tested.

→ Contrex. Very high hardness.



← Dr. Silica Water. A lot of silica is in this water.

Result ⑤

○ Depending on the type of mineral water, the traces of water vary.

Conclusion

Traces of water droplets are formed by the impurities contained in the water droplets, and the evaporation speed and the amount and type of impurities contained in the water droplets affect the way the marks are made. In addition, when the traces are layered, the second layer has the same position and size as the water droplets that moved while drying. We also found water drops form layers on the inclined side and dust in the liquid prevents the formation of layers.

Acknowledgments

I would like to express my gratitude to Mr. NUKANO.



Study of the Relationship between Sequences and Limits of Adjacent Binomial Ratio of the Sequences by Visualizing Sequences

Tennoji High School Attached to Osaka Kyoiku University

Ryoga Kochi (Soph.) Ryota Kuzumoto Yosuke Shima (Freshman)

Introduction

The limit of adjacent binomial ratio of Fibonacci's sequence is the golden number, and that of Pell's sequence is the silver number. These numbers are metallic numbers, which are visually beautiful. The aim of this study is to find a visually understandable relationship between the sequences and metallic numbers.

Methods

The method of this study is to draw 3D graphs of sequences the limits of when the adjacent binomial ratio is a metallic number and compare elements which can be read from the graph.
<Software> grapes 3D

Results

The length of the spiral ($x=0$ to $x=-2$) is expressed in the following formula: (μ is a metallic number)

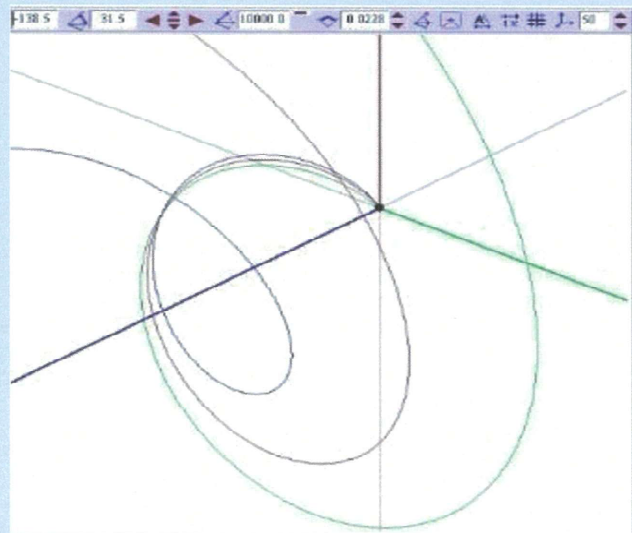
$$\sqrt{1 + \left(\frac{1}{5}(4(\log \mu)^2 + \pi^2)\right)} - \sqrt{1 + \left(\frac{1}{5}\mu^4 \left(\frac{(\mu^4 + 1)(\log \mu)^2}{\mu^8} + \pi^2\right)\right)}$$

Data

$$\text{3D Graph } \begin{cases} x = t \\ y = \frac{1}{\sqrt{n^2+4}}(\mu^t - \mu^{-t} \cos \pi t) \\ z = -\frac{1}{\sqrt{n^2+4}}\mu^{-t} \sin \pi t \end{cases} \quad (\mu \text{ is a metallic number})$$

Blue : golden / Red : silver / Green : Bronze

Graph



Observation

According to the results, when drawing 3D graphs of the sequence whose recurrence relation is $a_k = na_{k-1} + a_{k-2}$ ($k \geq 2, a_0 = 0, a_1 = 1, n = 1, 2, 3, \dots$), it is confirmed that metallic numbers are related to the length of one round of a spiral drawn in the case of $x < 0$; however, further consideration will be needed to yield any findings as to how it actually affects the graph. Moreover, it is concluded that μ must be a metallic number in the sense that it corresponds to a sequence. From examining the findings, a close study of relationship between the graph and logarithmic spiral is necessary for our aim.

Appendices

• metallic number $\frac{n + \sqrt{n^2 + 4}}{2}$ ($n \in \mathbb{N}$)

• arc length formula (3D arc length) $\int_a^b \sqrt{\left(\frac{dx}{dt}\right)^2 + \left(\frac{dy}{dt}\right)^2 + \left(\frac{dz}{dt}\right)^2} dt$

References

- Mochizuki, R. & Yamamoto, N. Shizuoka Municipal Senior High School. (2018). Relationship between Fibonacci's sequence and Pell sequence.
- Hiroshi, Y. (2007). *Suugaku Girl* [Mathematical Girls]. Tokyo: SB Creative.
- Fibonacci's Sequence Expansion -From "discrete" to "continuous"-. (July 1, 2010). <https://mino-mathematics.blog.ss-blog.jp/2010-07-01>



Improving Harmony by Changing Musical Temperament

Tennoji High School Attached to Osaka Kyoiku University

Masazumi Sasaki Haruki Takemura Okui Ryunosuke

1. Introduction

• Abstract

→ There are two major musical temperaments; one is just intonation and the other is equal temperament. When we play the piano, we can modulate by equal temperament, but it occurs beats, whereas just intonation doesn't do it, but we can't modulate. Therefore, **our research is making new temperament which has slower beats and we can modulate by.**



• Why do we research this

→ It is difficult to judge improving harmony because we have preference of music, Therefore **we define it is improving harmony to become slower beats**

• Why does beats occur?

→ When you play more than two tones, the tone's overtone does not match each other because the two overtones are very close frequency. Therefore, beats occur.

2. Main subjects

• 2-1 Defining about temperament

① **New temperament has 12 tones and we can modulate by it.**

② Distance is 1 octave between base frequency and twice frequency

• 2-2 Assuming

③ New temperament scale is major diatomic scale.

• Why do we have to assume major diatomic scale?

→ Scale's Interval change by major and minor.

④ **Beats became tones when that isn't separated more than 20Hz.**

→ this fact is general, but audible range is difference according to each person.

• 2-3 How to value

1st Checking is beats according to ④

2nd, Giving beats which is occurred by lower overtone but valuation by ⑤

3rd, If we can't value perfectly by 1st and 2nd, we value by ⑥

4th, **we check scale's fluctuation by listening.**

• 2-4 Our hypothesis

Changing equal temperament's ratios in interval to easier ratios is improved harmony because of becoming slower beats and rational number.

• 2-5 Proving value's formula

⑤ **Beats which is occurred by lower overtone is bigger than by higher overtone.**

→ when $n \neq 0$, k is frequency, $f(x)$ which is original wave shape can be separated.

$$f(x) = \sum_{n=-\infty}^{\infty} C_n e^{ik_n x}$$

Also, n defined integer, assuming trigonometric function and period T substitute this function.

$$f(t) = \sum_{n=-\infty}^{\infty} C_n e^{\frac{2\pi n i t}{T}}$$

Then, C_n show ⑤ because this equation has natural logarithm.

$$C_n = \frac{1}{T} \int_{-\frac{T}{2}}^{\frac{T}{2}} f(t) e^{-\frac{2\pi n i t}{T}} dx$$

5. Bibliography

- Kaitei buturi* [Revision Physics] (Tokyo syoseki)
 Susumu Sakurai, Sakaguchi Hiroki, *Ongaku to sugaku no kousa*
 [About relation music and mathematics (Otuki syoten)]
Uchu ni haitta kamakiri [Mantis in the space] (<https://takun-physics.net/?cat=18>)

⑥ **Slower beats have longer period, therefore we can calculate it by frequency.**

→ When there are two frequency f_1 and f_2 on the unit circumference, defining A as amplitude and t as time.

$$x_1 = A \sin(2\pi f_1 t) \quad x_2 = A \sin(2\pi f_2 t)$$

Also, new function F which f_1 and f_2 is synthesized can be shown by addition theorem.

$$A \sin(F) = A \sin(2\pi f_1 t) + A \sin(2\pi f_2 t)$$

Then the equation is deformed.

$$= 2A \sin\left(2\pi \frac{f_1 + f_2}{2} t\right) \cos\left(2\pi \frac{f_1 - f_2}{2} t\right)$$

Therefore, new period is $\frac{2}{|f_1 - f_2|}$ because \cos indicate the horizontal axis.

3. Results

We made 3 new temperament to reconcile just intonation and equal temperament by Changing scale's ratio.

• C major key

A ratio of 1-3-5 interval is 20:25:29

B ratio of 1-4-6 interval is 20:25:33

C ratio of 1-3-6 interval is 80:108:135

① Cm beats(overtone)

Base	A-type temperament	B-type temperament	C-type temperament	Equal temperament
C-G				0.89(3-2)
C-E				10.38(5-4)
C-G				1.77(6-4)
E-G			18.59(6-5)	17.79(6-5)
E-G	12.76(7-6)			

② Fm7 on C

	A-type temperament	B-type temperament	C-type temperament	Equal temperament
C-F		13.04(4-3)		1.18(4-3)
C-A		16.3(5-3)		11.87(5-3)
F-A				13.86(5-4)
C-F				2.36(8-6)

③ Gm7

	A-type temperament	B-type temperament	C-type temperament	Equal temperament
B ₁ -G				15.56(8-5)

→ **A, B and C temperament have fewer beats than equal temperament.**

→ A temperament is better according 2-3.

4. Conclusion

→ 2-4 Our hypothesis is correct.

• Why do beats fewer occurs?

→ Definition ④ doesn't have effect by frequency and this is absolute value. Therefore, when **some overtone multiply higher tone, then ④ loss affected, thus higher overtone zone become fewer beats.**



Creating a Distorted Picture by a Computer

-Elucidate Painting Methods with Mathematics-

Tennoji High School Attached to Osaka Kyoiku University
Moeka Wada Ayana Hata Natsumi Harada

Abstract

The goal is to create our an original Distorted picture using mathematics and computer, through elucidation of the painting methods for distorted picture from ancient times with math and computer. First, we select the mage, and then distort it using BASIC, one of the programing languages, including the conversion formula that we think.

Introduction

First of all, I will use mathematics and computer to elucidate the painting method of "Distorted picture" from ancient times. The purpose of this study is to create an original picture by using the analysis results.

Hypothesis

"Distorted picture" can be expressed by mathematics and computer.

Methods

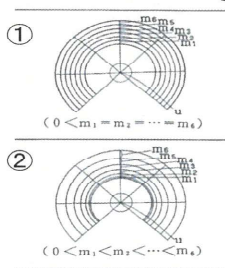
1. Find out and decide how to draw a trick art.
2. Output original image on BASIC.
3. Make a sentence of distorting original image.
4. Assign the sentence, and run.
5. Search whether the output image is correct.

Materials

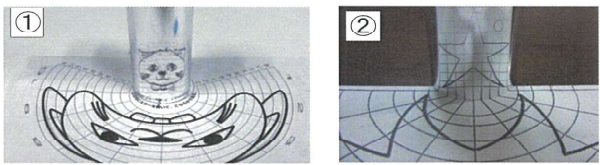
1. Column mirror
2. Computer
3. Printer

Process

1. ② is the most clear image that reflected in the Column mirror.



Why this method is good?
We draw each methods, and measure

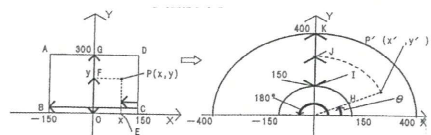


2. We use 4 types of Trump. (Heart, Spade, Clover, and Diamond)

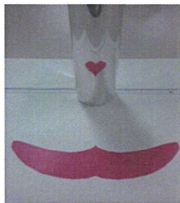
3. Make these sentences by right coordinate.

$$X = (150 + 250/300y) \cos(\{180(150-x)/300\}^\circ)$$

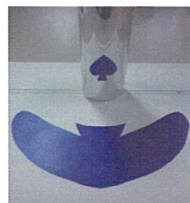
$$Y = (150 + 250/300y) \sin(\{180(150-x)/300\}^\circ)$$



4. Assign the above sentences into BASIC.
5. Put the image in front of the Column mirror.



Heart



Spade



Clover



Diamond

Future perspective

- . Now, we search accuracy by eye measurement, so we have to find how to measure accuracy accurately.
- . Make our original Distorted picture.

T

JSIF





Gas and Power Outage Alarm System



Ayana Hata ,Moeka Wada ,Napat Sirijaitam And Panchita Meksakulwong

Osaka Kyoiku University Attached High School and Princess Chulabhorn's Science High School Pathumthani

Abstract

The objective is to detect LPG gas, Natural Gas and alert. We found the program can detect when there is Gas leak or Voltage dropped and notify. That is useful when there are not any people or have only child and elderly person at home.

Introduction

There is nobody or only child or elderly person at home when accident occurs. That is very dangerous. Therefore, we make a system that let users know there is Gas Leak or Power Outage, and find a way to prevent fire and others.

Materials and tools

1. Computer
2. MQ5 Gas Sensor
3. Single Phase Voltage Sensor Module AC 220V
4. Adapter 12V 1AM.
5. ESP8266 D1 / R1
6. Dupont line male to male jumper
7. Dupont line male to female jumper
8. Micro USB

Methods

1. Think of the project topic and learn about problem
2. Learn how to write arduino board, program language
3. Write Flowchart which shows method of this system
4. Test and adjust

Results

Operation of Gas and Power Outage Alarm System

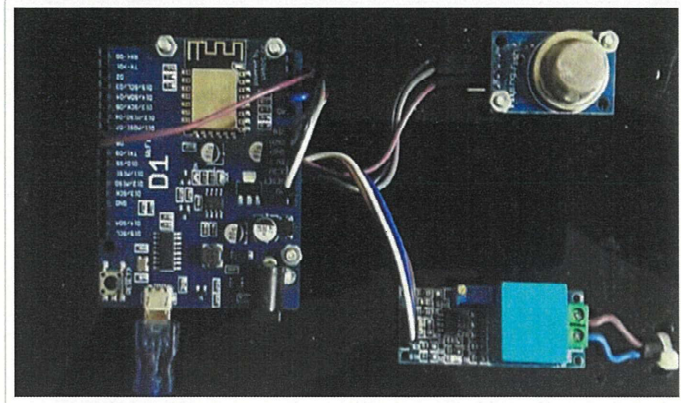
This system has two functions. First, it detects LPG city gas, Methane, Butane and Propane by MQ5 Gas Sensor. It can check values Digital 0 and 1. When the system detect gas, the value is 0, and when it doesn't detect gas, the value is 1. Second, it detects Power Outage by Single Phase Voltage Sensor Module AC 220V. The sensor gives analog values. When the system detects them, it can notify to phone.

Conclusion

The system can tell the users via their phone when it detect gas by MQ5 Gas Sensor or power outage by Single Phase Voltage Sensor Module AC 220V. This project is to make Gas and Power Outage Alarm System, that has been done successfully.

Reference

- [1] ESP8266 Arduino Core Documentation Release 2.4.0 , <https://atpece.files.wordpress.com>
- [2] Singlephase voltage sensor <https://www.thaieasyelec.com>
- [3] Interfacing MQ5 LPG Sensor to Arduino, <http://www.circuitstoday.com>



Write Flowchart

Sensor mq5→1 "There isn't Gas Leak."
0 "There is Gas Leak."
Sensor Value→analog value

Initial setting

1. Set up that we use Sensor mq5 (That can find Gas.), and Sensor Value (That can search Voltage.)

2. Connect the computer and the system substrate.

Use Gas Sensor

1. If there isn't Gas Leak, mq5 gives signal '1'.

2. Inform user's phone of "Have no Gas Leak".

Use Voltage Sensor

1. If Voltage is over 190, there isn't Power Outage.

2. Inform user's phone of "Voltage Normal".

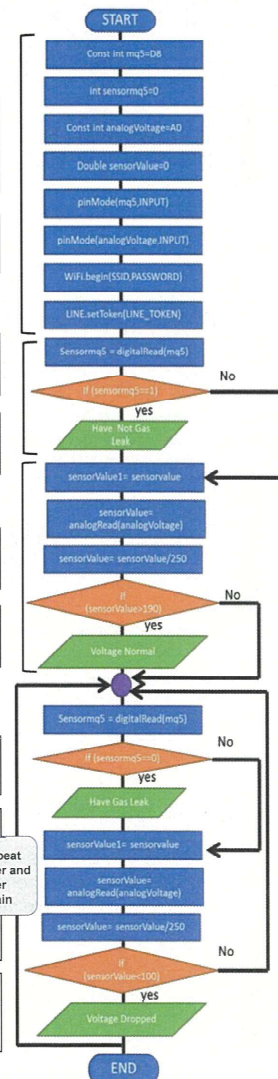
Repeat part

1. If there is Gas Leak, mq5 gives Signal '0'.

2. Inform user's phone of "Have Gas Leak" until Gas Leak is stopped.

1. If Voltage is under 190, there is Power Outage.

2. Inform user's phone of "Voltage Dropped" until Power Outage is stopped.



Gas Leak and Power Outage Alarm System

 <p>Gas Leak and Power Outage Alarm System</p> <p>Osaka Kyoiku University Attached Tennoji High School Ayana Hata, Moeka Wada Princess Chulabhorn's Science High School Pathumthani Napat Sirijattam, Anchita Meksakulwong</p>	<p>Hello! We are Japanese students of Osaka Kyoiku University attached High School. We studied our research with Thailand students. We will talk about our research. Our research is to make up a Gas leak and Power Outage Alarm System.</p>
 <p>Introduction</p> <p>Gas Leak Power Outage</p> <p>If we didn't know accident is happened.</p> <p>If we know accident is happened.</p> <p>We can prevent it!</p>	<p>First, I talk about introduction of our research. When there are no one or only children and elderly person at home. It will be extremely dangerous if there is an unexpected accident, regardless of whether the gas leak causes a fire. So, we want to make a system that informs to us when there are gas leak and power outage to prevent a fire, and if we know accident is happened, we can prevent secondary damage.</p>
 <p>Materials 1</p> <p>Computers</p> <p>Adapter 12V 1Amp</p> <p>Micro USB</p>	<p>And, I tell about the system function. The system informs user's phone of "The accident is happened", if there is Gas leak or Power outage at home, until they are stopped. This is imaginary picture.</p>
 <p>Function</p> <p>If there is Gas Leak or Power Outage at home, the system inform user's phone of "The accident is happened" until they are stopped.</p> <p>Image picture</p>	<p>Second, I explain the materials and methods. Materials and tools that we used are computers, Adapter 12V 1Amp, USB,</p>

<p>Materials 2</p> <p>The sensor That can measure Voltage</p> <p>Single Phase Voltage Sensor Module AC 220V</p> <p>MQ5 Gas Sensor</p> <p>The sensor that can detect Gas leak.</p>	<p>Single Phase voltage sensor module that can measure Voltage, MQ5 gas sensor that can detect Gas leak,</p>
<p>Materials 3</p> <p>ESP8266 D1/R1</p> <p>Dupont line male to male jumper</p> <p>Dupont line male to female jumper</p> <p>Female</p> <p>Male</p>	<p>ESP8266 D1/R1, Dupont line male to male jumper , and Dupont line male to female jumper.</p>
<p>How to use sensors</p> <p>This is a circuit.</p> <p>ESP8266 D1/R1</p> <p>MQ5</p> <p>Sensor Value</p>	<p>We used these materials to this circuit. MQ5 connects with ESP8266, and this too do with Sensor Value.</p>
<p>Methods</p> <ol style="list-style-type: none"> 1. Think of the project topic and learn about problem 2. Learn about how to write arduino board 3. Write Flowchart 4. Test and adjust 	<p>Also, methods are thinking of the project topic and learning about problem, learning about how to arduino board, program words, writing Flowchart that shows methods of system, and testing and adjusting.</p>

System's Mechanism

We use sensor mq5(That can find Gas), and sensor Value(That can search Voltage).

If there is Gas Leak or Power Outage, LINE Notify inform us.

0 or 1

Infinite number

Next, I tell about system's Mechanism. We use sensor MQ5 that can check values Digital 0 or 1, and sensor Value that can has value Analog, infinite number. Then, if there is Gas leak or Power Outage, LINE Notify inform us.

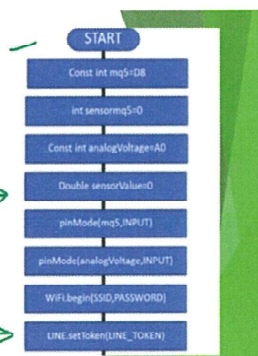
Result 1

> Write Flowchart

1st part Initial setting

We set up 'We use WiFi, Sensor mq5, and Sensor Value.'

LINE Notify inform users .



Next, I explain the result of our research. We succeed writing Flowchart.

1st part means initial setting. This zone means that we set up "We use WiFi, Sensor MQ5, and Sensor Value". Also, this sentence means that we are informed by LINE Notify.

Result 2

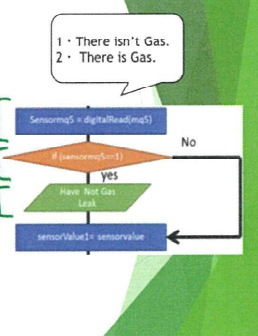
> Write Flowchart

2nd part Use Gas Sensor

MQ5 searches whether there is Gas or not.

If there isn't Gas Leak, MQ5 gives Signal "1".

Inform user's phone of "Have Not Gas Leak".



And, 2nd part means using Gas Sensor. This sentence means MQ5 Searches whether there is Gas or not. When MQ5 is 1, there is not Gas. When MQ5 is 0, there is Gas.

Next sentence means that if there is not Gas Leak, MQ5 gives signal "1". Then, inform user's phone of "Have not gas leak".

Result 3

> Write Flowchart

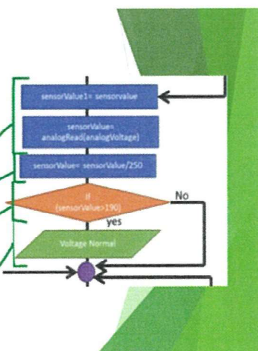
3rd part Use Voltage Sensor

Sensor Value searches Voltage.

Sensor Value searches under 250

If Voltage is over 190,

Inform user's phone of "Voltage Normal".



3rd part means using voltage sensor. These three sentences mean that sensor value searches voltage, and under 250V. Next sentence means that if voltage is over 190V, inform user's phone of "voltage normal".

Result 4

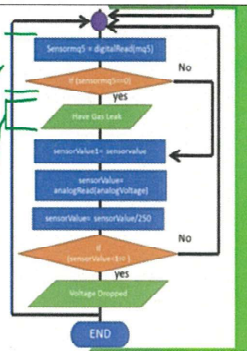
> Write Flowchart

4th part Repeat Part 1

If there is Gas Leak, MQ5 gives Signal "0".

Inform user's phone of "Have Gas Leak".

Until Gas Leak is stopped.



4th part means repeat part 1. These two sentences mean that if there is gas leak, MQ5 gives signal "0", and Next sentence means to inform user's phone of "have gas leak" until Gas leak is stopped.

Result 5

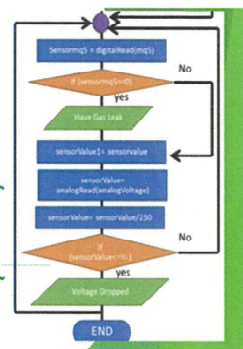
> Write flowchart

5th part Repeat Part 2

If Voltage is under 190,

Inform user's phone of "Power Off".

Until Power Outage is stopped.



Lastly 5th part means repeat part 2. This zone means that if voltage is under 190V, then in next sentence inform user's phone of "power off" until power outage is stopped.

These flowchart is program of the system made by us.

Inspection Result 1

We simulate our system.

• Gas Leak

• Power Outage



Robbing alcohol

Unplug the Outlet



I explain the inspection result.

We simulate our system. 1st, gas leak. We made a situation of gas leak by rubbing alcohol . 2nd, power outage. We made a situation of power outage by unplugging the outlet.

Inspection Result 2

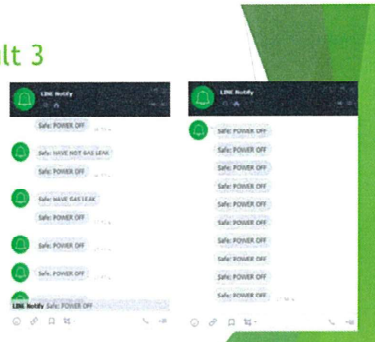
When gas doesn't leak, computer shows "1".



Then, when gas doesn't leak, computer was able to show "1". Likewise when gas leak, computer was able to show "0". About power did too.

Inspection Result 3

We can receive notification when there is accident or not.



We was able to receive notification when there is accident or not.

Conclusion

The system can inform user's phone

●Gas Leak

When it detected LPG city gas by MQ5 Gas Sensor.

●Power Outage

When it detected Power Outage by Single Phase Voltage Sensor Module AC 220V.

In conclusion, We made the system can notice the users to their phone. It can detect LPG City gas by MQ5 gas sensor and power outage by single phase voltage sensor module AC 220V.

Reference

[1] ESP8266 Arduino Core Documentation Release2.4.0 ,<https://atpece.files.wordpress.com>

[2] Singlephase voltage sensor, <https://www.thaieasyelec.com>

[3] Interfacing MQ5 LPG Sensor to Arduino, <http://www.circuitstoday.com>

These are references.

Thank you for listening.



↑ The condition of our research



↑ The place where we gave a presentation



Scanner Application with Object Detection for Japanese and Thai foods



(TH) Chayangoorn Sonsena
(JP) Kotaro Kanazawa (JP) Yuma Bono

Abstract

The objective is to develop applications to measure calories of Thai food and Japanese food from pictures and evaluate the accuracy of the model. This application can tell the calories of food from pictures. Either from taking one or several foods at a time, and notifying when the calories in that day exceed the TDEE (Total Daily Energy Expenditure).

Keywords: Deep Learning, Application, Object Detection, TDEE

Introduction

Most people can't control the calories of the food. Therefore, the author then introduced Google's artificial intelligence system to help detect food types and the number of food types eaten in one meal within one image.

Materials and tools



Ionic Framework



Azure custom vision



Computer for development



Image Datasets



Android Smart Phone

Method

1. Study about Azure Custom Vision more.
2. Find data sets from other and train to model (food label and image)
3. Make a draft of the project to draft. Plan for working, and design prototype workflows.
4. Developed an application and train model to completed
5. Test application's function with model
6. Evaluation from Azure Custom Vision evaluate mode

Result



Precision 82%



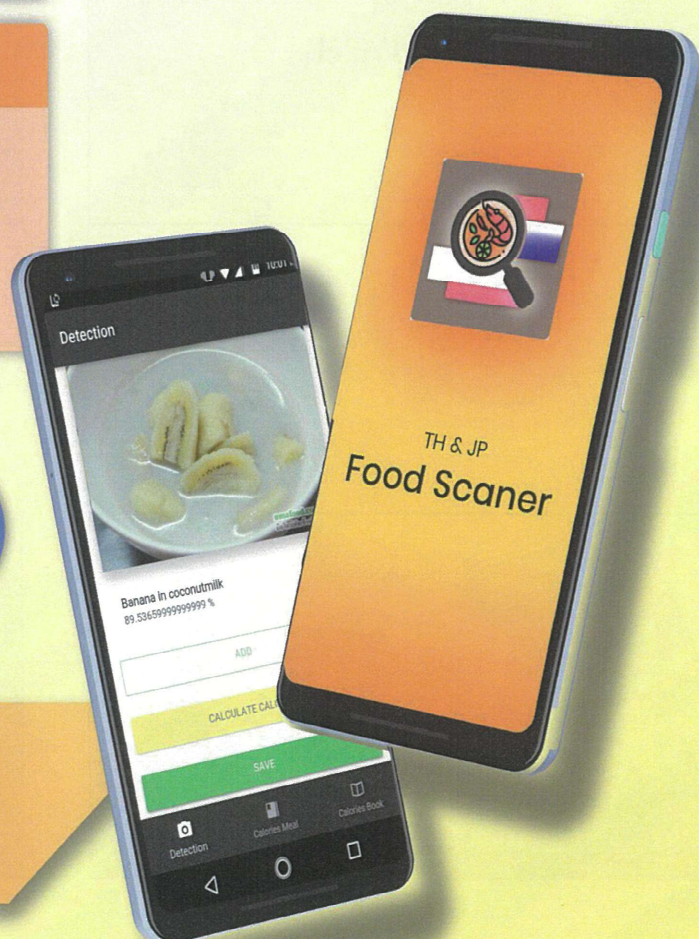
Recall 85%



mAP 80%

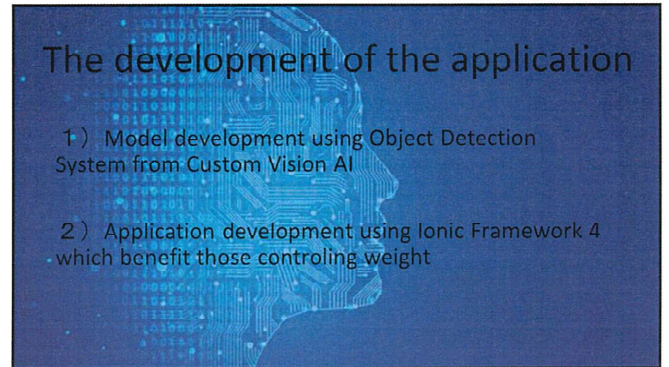
Conclusion

1. The performance of the application is good.
2. The assessment of the accuracy of the model is at a good level because the data set is used in sufficient quantities and have more resolution to bring to train and test the model.





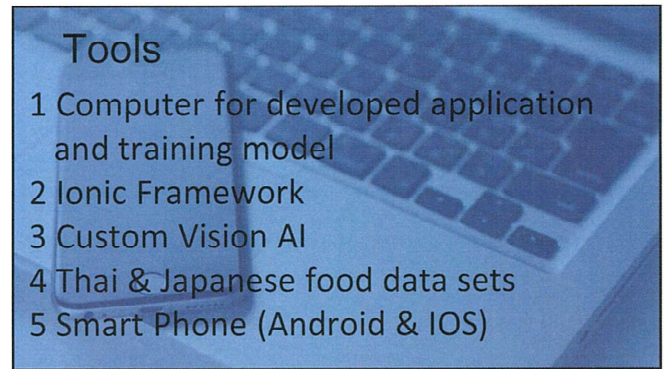
1



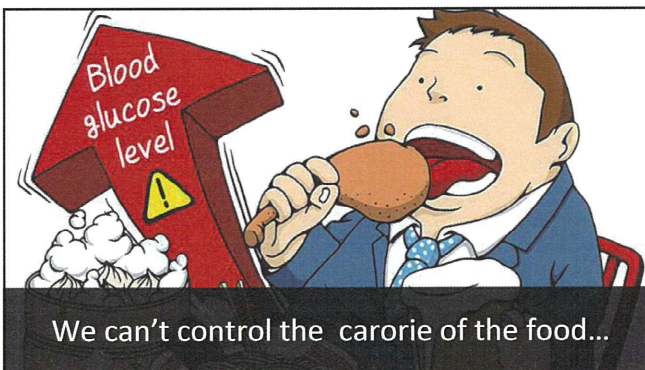
4



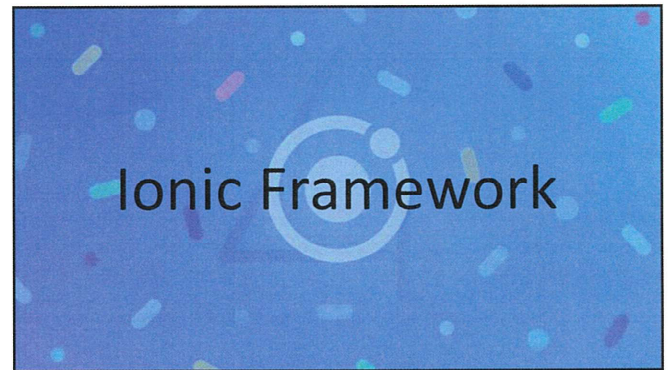
2



5



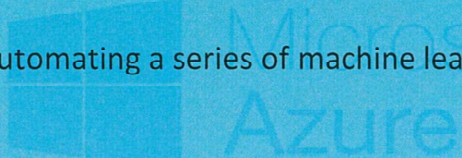
3



6

What is Microsoft Azure?

Automating a series of machine learning tasks



Microsoft's AI

7



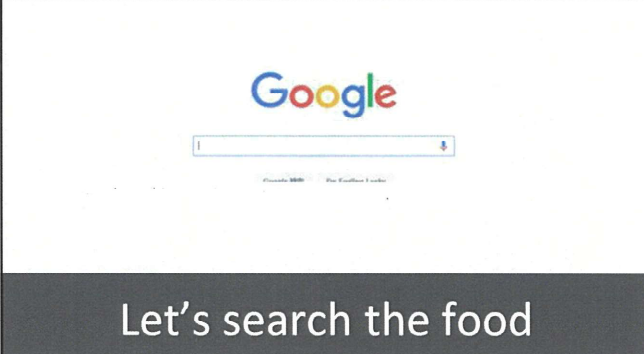
180.6 kcal

10

Method

1. Study about Microsoft Azure more.
2. Find data sets from other and train to model (food label and image)
3. Make a draft of the project to draft. Plan for working, and design prototype workflows.
4. Developed an application and train model to completed
5. Test application's function with model
6. Evaluation from Custom Vision AI evaluate mode


8



Let's search the food

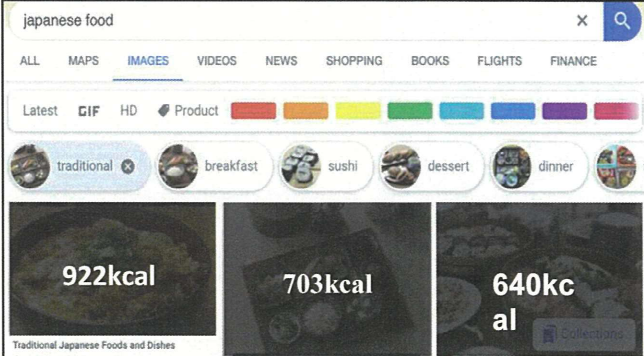
11

example



180.6 kcal

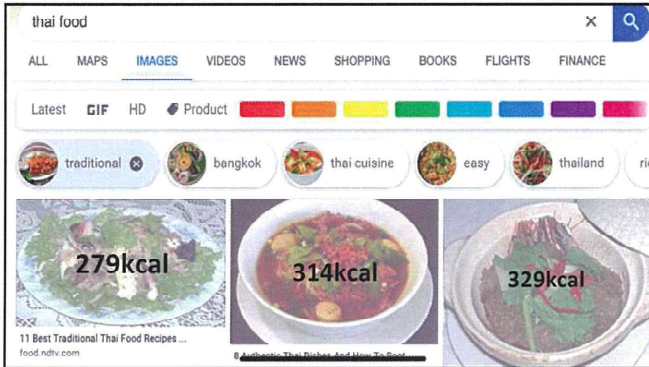
9



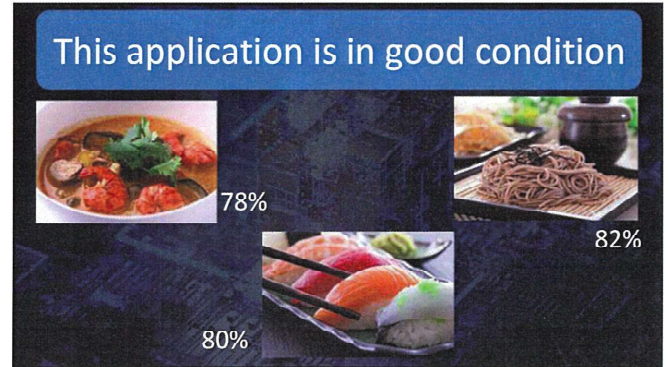
japanese food

922kcal 703kcal 640kcal

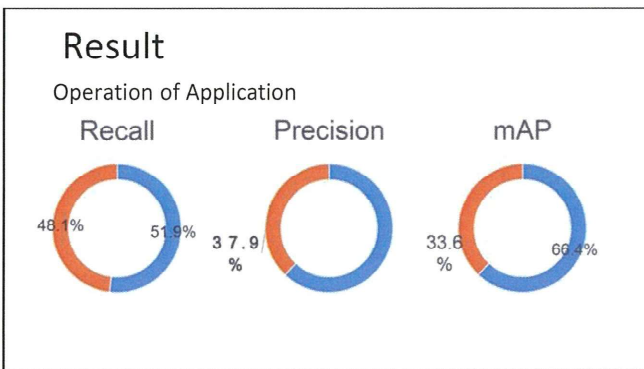
12



13



16



14



17

A slide titled "Conclusion" with a magnifying glass icon over a plate of food. The text reads: "1. The performance of the application is good. 2. The assessment of the accuracy of the model is at a good level." Below the text, it says "We still have room for improvement".

15



**Peace
Project**

Peace Project

10/23/2019

Arkansas School for Mathematics, Sciences and the Arts
&
Tennoji High School Attached to Osaka Kyoiku University

This project is an activity that gives students the opportunity to think about peace between the U.S. and Japanese students. This year was the first Peace Project. We discussed with our sister school, The Arkansas School for Mathematics, Sciences and the Arts (ASMSA). In October every year, about ten ASMSA students visit our school, and they experience Japanese culture through home stay or visiting famous places like Kyoto. Before ASMSA students came to our school in Osaka, they visited Hiroshima Peace Memorial Park. As most people know, an atomic bomb was dropped on Hiroshima on August 15th, 1945. How do we hand down information and convey the feeling of people at the time for the next generation? We shared opinions with each other and thought more deeply about peace.

Purposes of the Peace Project

- Learn about the past with Hiroshima as a base, think deeply what we can do for peace in the future.
- Perform an exchange through discussion.

To complete these purposes, we should respect each other's goal because there are differences of opinion or amounts of knowledge, and we expect this will make discussion more diverse.

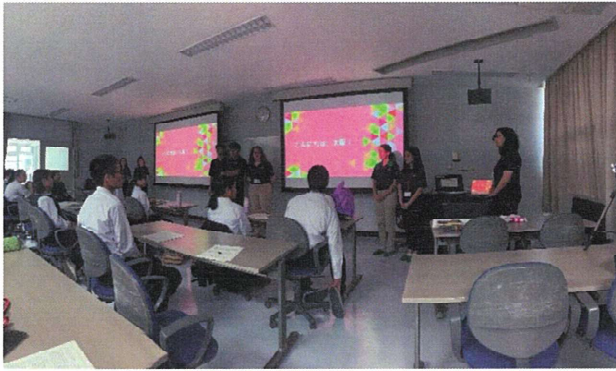
Discussion Theme

How do we pass down Hiroshima?
~Comparing history textbooks between
the U.S. and Japan~

Textbooks are written objectively to tell down next generations, but there are small differences depending on each country to protect themselves. Comparing these differences and sharing opinions, we aim to think deeply how to tell talk about Hiroshima and the atomic bomb specifically to children in the future.

Timetable

- Term 0: Greeting, introduce ourselves
- Term 1: Presentation
- Term 2: Group discussion
- Term 3: Sharing, conclusion



Introduce ASMSA school life



Presentation by ASMSA

She told her impression of visit Hiroshima.

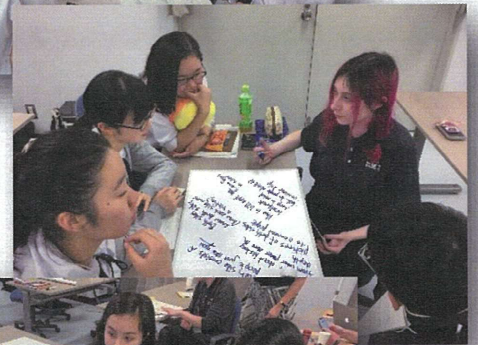


ASMSA teacher lecture

He showed a history textbook and talked about values in the U.S. There were many pictures that we had never seen.

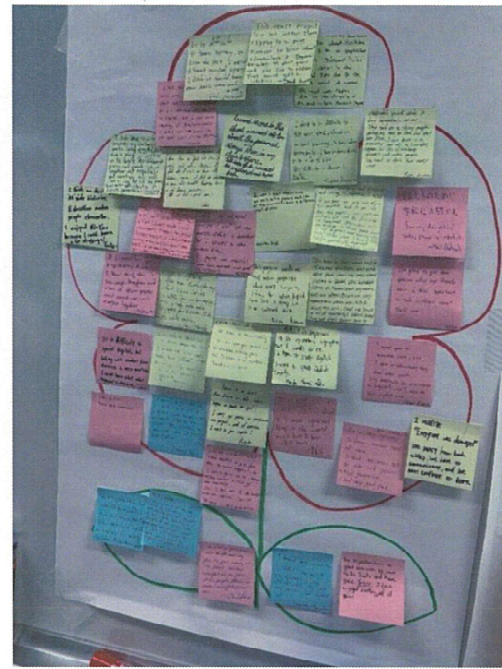
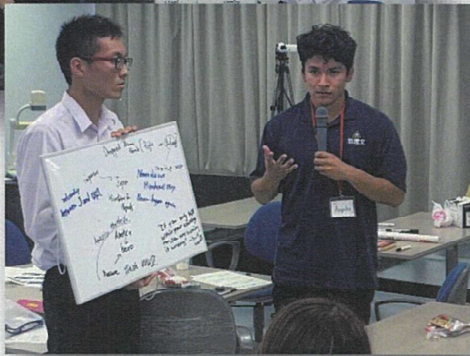


Group discussion



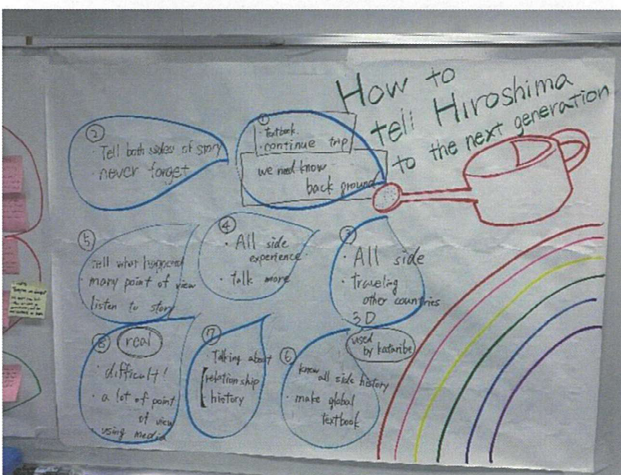


Sharing



We wrote our impressions of this peace project discussion, and finally the activity was done.

It was so interesting for us to think about peace deeply with our ASMSA friends. We were worried about talking in English, but we were able to share our opinion and feel firmly. We hope this project continues for a long time.



Conclusion sheet

We summarized each group opinion by brainstorming, as in the photo above. There are many concrete and unique opinions.

Peace Project

Special Lecture (Neil Oatsvall, Ph.D.)

ASMSA-Tennoji Peace Project
ASMSA-附属天王寺高校
ピース・プロジェクト

Neil Oatsvall, Ph.D.
23 October 2019

Where does the story start?

- What Americans think
 - Pearl Harbor
 - Hiroshima
 - End of War in Tokyo Bay

Where does the story start?

- What Americans think
 - Pearl Harbor
 - Hiroshima bombing
 - End of War in Tokyo Bay
- What actually happened
 - Admiral Perry
 - Chinese Exclusion Act
 - WWI and Japan part of League of Nations
 - US cuts off Japanese oil
 - Pearl Harbor
 - Japanese-American Internment
 - Firebombing in Tokyo and elsewhere
 - Hiroshima bombing
 - End of War in Tokyo Bay

The Problem ・ 問題

We all think
we were the
only victims
in World War
II.

自分たちだけ
が第二次世界
大戦の時
被害者だと
思っている。

The Truth ・ 真実

Everyone
was a victim
in World
War II.

第二次世界
大戦で全世
界の人々が
被害者になり
ました。

Commodore Perry and Japan (1853)



American Gold Rush

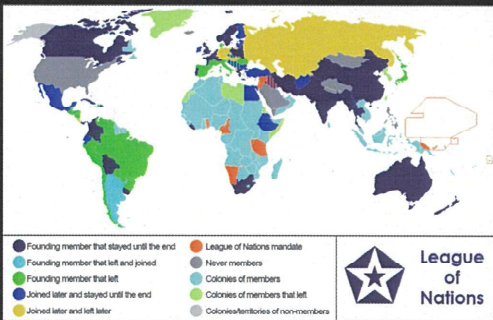


Chinese Exclusion Act of 1882



- Prohibited Chinese workers who had previously been important, especially to building the railroad
- After, more Japanese came to USA

Japan helps Allies during WWI



Conflict between U.S. and Japan



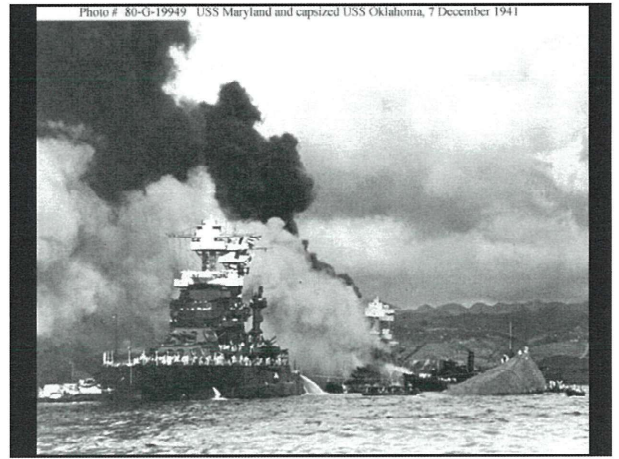
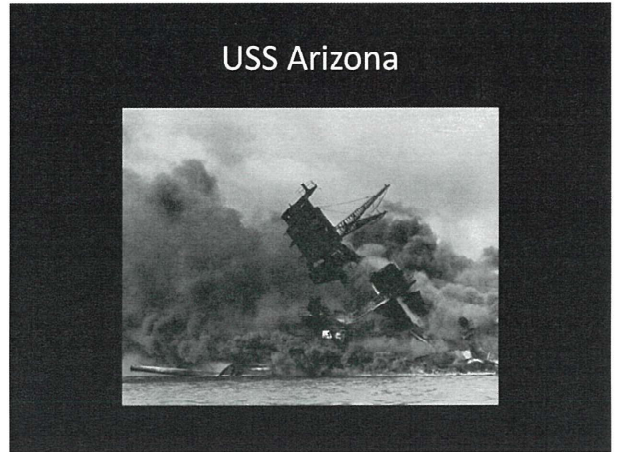
- Japan expands in Pacific
- After Japan invades French Indochina (Vietnam) in 1940, U.S. embargoes oil exports to Japan

Japanese Empire



Pearl Harbor

- 7 December 1941
- U.S. President Franklin Roosevelt says it is "a day that will live in infamy"
- 2,400 U.S. citizens killed
- Many ships and planes destroyed



Racism against Japanese

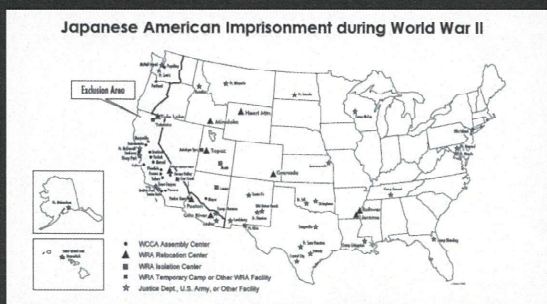
Racism = 人種差別



Japanese Internment Camps

- Executive Order 9066 on 19 February 1942
- About 120,000 Japanese Americans interned across the nation (mostly the Pacific Coast)
 - Over 3/5th of these people were US citizens
- Not as many on Hawaii were interned (only 1% of the 150,000 people there)

Japanese Internment Camps, cont.



Japanese Internment Camps, cont.



Ansel Adams, Manzanar photos



Manzanar from guard tower, facing Sierra Nevadas



Richard Kobayashi, with cabbages

Japanese Internment Camps, cont.

- Around 2/3 of all mainland persons of Japanese descent were U.S. citizens
- Nonetheless, moved into these “relocation centers”
- About \$400 million in lost property/businesses
- 1944 Supreme Court *Korematsu* decision upheld the blatant constitutional violation because it was a “military necessity”



Iwo Jima



US prosecution of war

- Firebombing
- Bombing runs from November 1944 till 15 August 1945
- 100,000 people killed in one night
- Rivers boiled
- Tokyo made of wood



Tokyo Firebombing

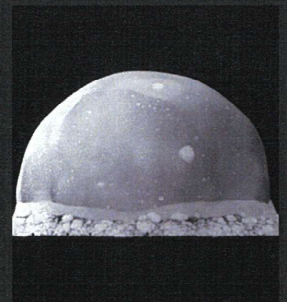


Atomic Bomb

- Had been developed since 1942 in the Manhattan Project
- More than 100,000 people worked on the project in some form or another
- U.S. only had enough fissionable material for 3 bombs

Atomic Bomb, cont.

- One test in the New Mexico desert (Trinity) proved that it worked
- U.S. required that Japan surrender unconditionally, but Japan did not plan to do so



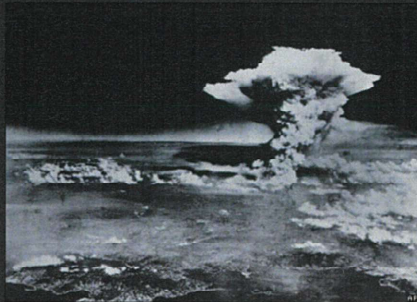
Atomic Bomb, cont.

- 6 August, 1945 the *Enola Gay* dropped the first bomb over Hiroshima
 - Killed 78,000 people, mostly civilians, leveled the city
- 9 August dropped the second bomb on Nagasaki, killed more than 100,000
- 14 August Japan surrendered unconditionally

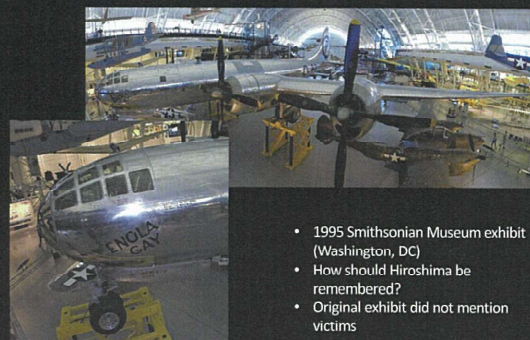
Enola Gay



Mushroom Cloud Over Hiroshima

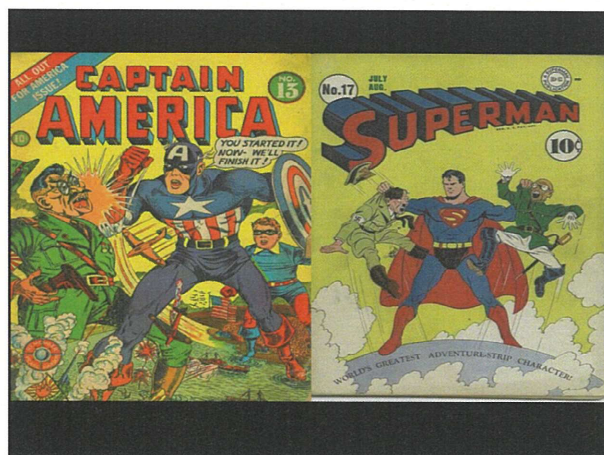
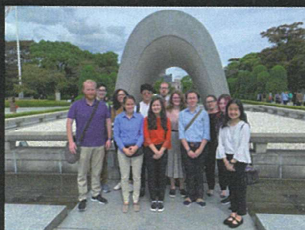


Enola Gay Controversy



- 1995 Smithsonian Museum exhibit (Washington, DC)
- How should Hiroshima be remembered?
- Original exhibit did not mention victims

Americans don't learn atomic bomb victims' stories

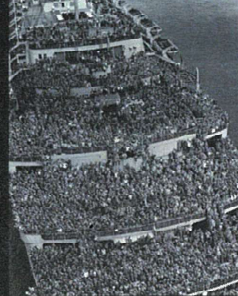


Japanese Surrender



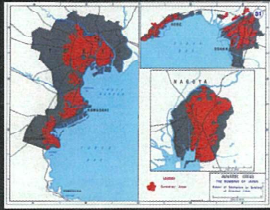
- USS Razorback was in Tokyo Bay at time of Japanese surrender
- Currently in Little Rock, Arkansas

U.S. after the war



The Liner, Queen Elizabeth, bringing American troops into the New York Harbor, at the end of WWII.

Japan after the war



Map of showing parts of cities destroyed by firebombing

World War II Deaths = ~70,000,000
第二次世界大戦の死者 = ~70,000,000

Peace

平和

ASMSA-Tennoji Peace Project
ASMSA-附属天王寺高校
ピース・プロジェクト

Neil Oatsvall, Ph.D.
23 October 2019

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63rd Year SSH Students

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Postscript

English for Science. It is the name of the class we took this year and the name of this book. We made this book with our own power as the crystallization of our leaning, as literally a crystal of one year of our scientific research using English: our effort, knowledge, and experience.

“Basic English for Science” was created for this book. It is composed of 11 titles. We divided the titles between us, researched each theme, and put it together. There was no set rule to make “Basic English for Science”, so we made it from scratch. Each page has a characteristic of students in charge. I am sure “Basic English for Science” and the experience of making it will help us in the future.

I am grateful to the teachers for giving us this opportunity, and glad I was able to make this book together with all of the 63rd year SSH students.

Ryoga Kochi (The Chief Editor)

We are

Burly **C**apable **R**esourceful

Permanent **T**imeless **P**ersonnel!



English for Science

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