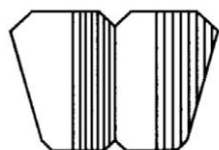


THEMATIC RESEARCH II
Annual Report on Research Activities
Abstracts in English



2024

Kyoto Prefectural Rakuhoku High School

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Advantages and Disadvantages of Hydrophilicity Using Soap Film

Keiko Saito, Futaba Takai, Kako Matsura

Abstract

The goal of this project was to determine the degree of hydrophilicity. The causes of soap bubbles breaking are “evaporation of soap bubble solution” and “degree of hydrophilicity”. In the experiment to examine the amount of evaporation, if there is not much difference in the amount of evaporation in each chemical, the cause of soap bubbles breaking can be narrowed down to “greater or lesser hydrophilicity,” so Experiment 1 is to be conducted. Prepare pure water, pure water and detergent, plus ethanol, methanol, ethylene glycol, and glycerin, respectively. Transfer each to a beaker and let stand for 1 hour to measure evaporation. Next, transfer all but pure water to a Petri dish. Dip a ring made of plastic cups into each solution in the Petri dish to form a membrane. Measure the retention time of the membrane five times in each solution and take the average. The difference in evaporation was within two decimal places. Therefore, it is believed that there is no significant difference in the amount of evaporation regardless of which chemical is used. The retention times of the membranes were longest for methanol, ethanol, ethylene glycol, and glycerin, in that order. Since membrane retention time corresponds to valence, it is believed that membrane retention time increases in proportion to the number of OH (hydrophilic) groups per mole. If the retention time of the membrane is considered to correspond to the degree of hydrophilicity, then the degree of hydrophilicity is considered to be proportional to the number of OHs.

Keywords: *hydrophilicity, hydrophilic ions, evaporation, membrane*

Let's Make Bread that Stretches Well!!

Yuto Ueda, Shunsuke Mizuno, Ato Shiozaki, Koutaro Watatani

Abstract

The purpose of this study was to change the proportion of two proteins in gluten and check the difference in characteristics of texture. Gluten is composed of glutenin, which is likely to return to the original form, and gliadin, which has the ability to extend. To begin, we extracted solid gluten from a mixture of water and flour, then dried this and made powder. Secondly, we made a liquid which dissolves gliadin but excludes glutenin: it is an ethanol solution which is 50% of the density and citric acid which is 2% of the mass. Thirdly, we dissolved gluten and extracted solid glutenin as deposition. Finally, we extracted glutenin by salting. A solid protein that seems to be glutenin shows high elasticity and a protein dissolved in ethanol that seems to be gliadin shows high extensibility were obtained. The data demonstrates that gliadin has high extensibility, but we couldn't confirm whether the extract was glutenin or not because of lack of experimentation.

Keywords: *culinary science, bread, glutenin, gliadin, gluten, elasticity*

Premium Ice Cream

~Producing Plant-based Ice Cream~

Chisa Takahashi, Mako Nishide, Hinako Tabata, Mao Fuchida

Abstract

Recently, because of rising health consciousness and the burden on the environment, plant-based foods are attracting attention. Our purpose is to create a plant-based ice cream that is cost-effective, health-conscious, and edible for vegans and allergy sufferers. To achieve this goal, we experimented with some recipes which have different ingredient combinations and evaluated the solubility, firmness, and taste of the ice cream. We expect ice cream whose ingredients are more viscous will be harder to dissolve and the melting point of the ice cream will get higher, and the ice cream will become harder to dissolve by adding agar. The development of plant-based products is bringing various advantages: consideration of hematein, to measure hardness, meltability (and daintiness) by changing the combination of the ice cream's ingredient. We made six types of ice cream and measured its viscosity, hardness and melting time. We found that ice cream with maple sugar had higher viscosity in experiment 1. In experiment 2 we compared normal ice cream and ice creams made with agar, and found that our hypothesis was wrong, as the melting point and dissolvability of ice cream became higher and harder by adding agar. In experiment 3 we found ice cream made with rice milk and oat milk were softest due to higher sugar contents. Finally, we found ice cream made from rice to be the most flavorful.

Keywords: *plant-based, ice cream, culinary science*

Water Resistance ~Reducing Water Absorption of Paper Made from Carrot~

Rio Daikoku, Mayuko Yamamuro, Kurumi Kato

Abstract

Carrots film contains no additives and is harmless to the body. It is also thought to be easily decomposed, because it is made of only carrots and water, and when buried in soil, it loses more mass than paper. But the carrot film does not have water repellency, and when it gets wet, it loses its shape. So, we thought that if we could make it water-repellent, we could create a carrot film that is friendly to both the environment and people and can be used even when wet with water. A mixture of squeezed carrots and water at a mass ratio of 1:1 is squeezed through a cloth, and the juice is called “carrot juice”, while the residue on the cloth is called “juiced carrot fibers”. In experiment1, we compared carrot paper 1, carrot paper 2 and normal paper to see whether carrot paper decomposed easier than normal paper. They were buried in the soil for 40 days, then they are removed from the soil, and weighed. We calculated what percentage of their mass was lost. In Experiment2, we tried acetalization. Acetalization is a way of making formaldehyde react with hydroxyl groups to reduce them. First, we add water into carrot paper and mix it. Second, we filter it under suction and make it dry by leaving it at room temperature. Third, we add boiled water, 6mol/L hydrochloride acid, and formaldehyde, and kept it 90°C with hot water. We think the reason is the fact that carrot paper couldn't be completely dissolved in water and the difference of the structure of vinyl acetate and cellulose. The carrot film is more easily decomposed than wrapping paper. So carrot film is an eco-friendly product.

Keywords: *carrot paper, water repellent, acetalization*

Flame Reaction Wavelength Investigation

Ryotaro Nagayama, Atuki Sou, Masahiro Higasira, Riku Fujimoto

Abstract

Flame color reactions occur when group 1 and group 2 metal ions are exposed to flame, exciting electrons to higher energy states. As the electrons return to their ground states, they emit energy in the form of light, which can be analyzed to identify specific wavelengths and intensities. This study aimed to detect and record stable spectral data from flame reactions using strontium (Sr) and cesium (Cs) nitrates, individually and in combination, dissolved in methanol. Wavelength data was measured by igniting the solutions and observing the emitted light. The results demonstrated that Sr predominantly emits light in the visible spectrum, with high intensity around 680 nanometers, corresponding to red light. In contrast, Cs emits light with lower energy, predominantly in the infrared region, making visible light emission challenging to detect. When Sr and Cs were combined, the mixture displayed a significant proportion of infrared wavelengths. These findings suggest that Cs has a smaller energy gap for electron transitions. Additional experiments with other metal salts could further elucidate the relationship between energy input and emission spectra.

Keywords: *energy states, wavelengths, electron transitions, spectra*

Let's Freeze and Preserve Emulsion Fuel!

Yuki Ogata, Shion Nishimura, Fai Fu

Abstract

The purpose of this project was to find the best way to preserve emulsion fuels by freezing it. We made emulsion fuels by stirring kerosene, surfactants, and water for 5 minutes. The rate and amount of kerosene and water was the same. We changed the preservation method and type of water and amount of surfactant. We made 6 types of emulsion fuels in our experiment. In 2nd, 4th, and 5th types, we preserve them by leaving them in room temperature, and in the other, 1st, 3rd, and 6th types, by freezing them in a deep freezer. Each type of preservation method has two types of water to use for water, and 2 different amounts of surfactant. 1st, 2nd, 3rd, and 4th types use pure water, and the other 5th and 6th types use saline water, 1st and 2nd types contain 4ml of surfactant, and the 3rd, 4th, 5th, and 6th types contain 8ml of surfactant. Before preservation, we observed the rate of emulsified parts. Then we left them in each preservation method for 1 week, thawing the frozen ones, and observed the rate of each type of emulsified parts again. When we use pure water, the ones left in room temperature preserved the emulsified rate the most. But when we use saline water instead of pure water, after preserving in room temperature, the liquids were completely separated. Also, if we use saline water to bring the freezing points of kerosene and water closer, the emulsified parts were preserved the most. Even though we change the amount of surfactant, the preservation rate of emulsified parts didn't differ. This data demonstrates that the separation of emulsified parts may be caused by the difference of freezing points and the salting out of emulsions. We may preserve emulsion fuels when we use a non-electrolyte solution instead of pure water.

Keywords: *emulsion fuel, emulsion preservation, emulsion freezing*

Domestic Wastewater Clarification

Method

～Be Environmentally Friendly By Using Hot Pad～

Sumire Aoyama, Maya Fujikawa, Nanako Fushiki

Abstract

Many used hot pads will not be reused as a different material but disposed as garbage. So, the purpose of our research is to purify domestic wastewater using activated charcoal, which is a component of hot pads. In place of water, we used water used for washing rice and ran that into a filtering device with activated charcoal. Taking numerical values by taking them into their respective pack tests. Pack tests are tests which observe the value of some sample material or compound which is contained in the water which we are trying to observe. The numerical value of phosphate and oil of plants and animals dropped. But that of chemical oxygen demand (COD) is almost immeasurable. COD demonstrates the demand of oxygen from things like unwanted proteins. The reason the value of simplified water inspection products decreased is because it absorbed organic and phosphoric acid via the activated carbon. However, COD was affected by negative chlorine ions. So, it was difficult to measure the numerical value of COD. So, our hypothesis was proven wrong, while we measured a decrease in the value of filtered phosphate and oil of plants and animals, but the value of COD couldn't be measured.

Keywords: *hot pad, charcoal, domestic water, water clarification*

Barnum Effect in Personality Tests

Are You Being Deceived By Personality Tests?

Riko Tomita, Miyu Nakai

Abstract

Nowadays, personality tests are widely used as a useful tool for self-understanding and improving interpersonal relationships. There is room for discussion as to how reliable their results are. We are experimenting to see whether the Barnum effect will happen based on blood type diagnosis, under what conditions the effect is likely to happen, and whether the people who are vulnerable to the effect are likely to believe in paranormal phenomenon. The Barnum effect is defined as the tendency to accept information such as character assessments as true, even when the information is so vague as to be worthless. It is said that people tend to protect their self-evaluations by preferentially taking in positive information about themselves. We think that people who are more prone to the Barnum effect are more likely to believe in the paranormal. In common with both, they tend to judge ambiguous information based on intuition and feelings and find meaning in unrelated events. We focused on the Barnum Effect as a factor that increases the reliability of diagnoses and are examining whether the Barnum Effect occurs in blood type diagnosis by means of a questionnaire administered to junior and senior high school students at our school. We are also trying to clarify what kind of personality, behavioral, and psychological characteristics people who are susceptible to Barnum effect have, and in what kind of texts the Barnum effect is likely to occur. We are also investigating whether there is a correlation between susceptibility to the Barnum effect and belief in paranormal phenomena.

Keywords: *personality, Barnum effect, blood type diagnosis, paranormal phenomena*

Deodorizer Made of Coffee Grounds

Ayaka Sano, Rurika Kadono, Ruri Okabe, Haruna Otani

Abstract

The purpose of this project was to determine a way we can maximize the effect of coffee grounds absorbing ammonia and make a deodorizers from coffee grounds. In order to investigate the deodorizing effect of coffee grounds, we used ammonia dripped on a filter paper as the object to deodorize, put the filter paper and coffee grounds in a sealed container, waited 3 minutes, and then checked the ammonia concentration with a gas detector. First, we looked at the change in deodorizing effect that occurs when water is added to coffee grounds. At that time, we gradually increased the amount of water and conducted a control experiment under each condition, deodorizing with water alone and deodorizing with the same amount of water and coffee grounds. Second, we experimented with different ways of processing coffee grounds. We tested three methods of processing coffee grounds: heating them, cooling them, and crushing them. Experiments were performed three times under each condition.

Comparing the results obtained in the above two experiments with the results obtained when deodorizing coffee grounds without any treatment, coffee grounds which had added water, were roasted, chilled, and ground absorbed more ammonia than those that were not processed. The data shows that we can multiply the amount of ammonia absorption by roasting, chilling, and grinding. We think it is because by doing those processes, there is some change in the structure of coffee grounds.

Keywords: *coffee grounds, ammonia, deodorizers, upcycling*

Let's Go Home! ~ Survey on People Unable to Return Home ~

Aoi Kojima, Kurumi Nagashima

Abstract

When an earthquake occurs, people whose homes are too far away to return home and who need to walk long distances are at risk. The purpose of this project was to survey what actions most people take after an earthquake at school, and to use the results to make a map to let them know how to walk home safely. First, we surveyed one hundred sixty Rakuoh high school students. The survey asks for information necessary to make a map, such as where Rakuoh students live, how they come to school, knowledge of hazard maps and their accessibility, temporary shelters and homecoming support stations, whether they know which road they would take to get home if an earthquake were to occur at their school, and whether there are any parts of the existing map that are difficult to understand. Then, based on the results, we made a map. The map consists of walking routes, places for temporary shelters, wide-area evacuation sites, homecoming support stations, and places where bridges and cliffs may be impassable due to earthquakes. We have not yet been able to survey the students, and the results are not yet available. As soon as the results of the survey are available, an updated map will be made.

Keywords: *earthquakes, disaster prevention, maps, surveys*

The Most Efficient Stamp Frame

Mitsuki Tabuchi, Ringo Yoshino, Mirac Fujii

Abstract

When we receive home deliveries, we are often asked to use a personal stamp to confirm the delivery. Frames that we must put a stamp on are sometimes round and sometimes are square. We considered the frames which are the easiest to sign with a stamp. We hypothesized that a stamp is most easily pressed when the shape of the stamp and the frame are similar. We define a successful stamp as being correctly placed when it fits completely within its frame. When the stamp moves within the frame without going out of the frame, we call the area which is surrounded by the tracks of the point the movable area. To start, we decided on the shape of the frame, then searched for the shape of a stamp that can move within large “movable areas” in the frame without crossing boundaries. After testing the hypothesis, we found that the hypothesis was proven for triangles, but not for other shapes, but no counter examples were found. In the future, we will test the hypothesis that the closer the similarity is, the easier it is for the stamp to fit the frame.

Keywords: *stamps, frames, similarities, shapes, hanko*

Planaria Numbers ~Square Numbers Separated into Square Numbers ~

Kazuki Ito, Fu Kuno, Nozomi Toba

Abstract

The purpose of this study was to research the properties of planaria numbers," named after the regenerative properties of planarian worms. These are numbers with specific properties, such as 49, 169, and 1681, which are square numbers that can be separated into other square numbers. Through our research, we discovered several key patterns, notably that many planaria numbers follow the rule " $c=(a\pm 1)(b\pm 1)\pm 1$ ". Additionally, we identified an infinite sequence of regular planaria numbers following the pattern " $c=ab+b-a$ ". In our investigation, we proved the existence of an infinite sequence of regular planaria numbers in any number system with an even base. Furthermore, in systems where at least one planaria number exists, we demonstrated that there are infinitely many odd numbers. Among our discoveries was one particularly interesting finding: a cubic planaria number that can be separated into three cubic numbers. Looking ahead, our research has several important directions to pursue. We aim to prove that in the decimal system, there are no other planaria numbers following the rule " $c=ab+b-a$ " besides the discovered infinite sequence. We also seek to understand the mathematical significance of this rule and investigate the possibility of other characteristic patterns. This research opens new avenues for exploring number properties and patterns in different number systems, contributing to our understanding of mathematical relationships.

Keywords: *mathematics, integers, Pythagorean numbers*

Save the Near Threatened *Ricciocarpos natans*! ~Establishing a Cultivation Method ~

Shigeru Takamatsu, Yoshito Yamashita, Riku Morimoto

Abstract

This study focuses on **Ricciocarpos natans**, a near-threatened species found in rice paddies, irrigation ponds, and fallow fields. Their floating leaves have a sponge-like structure, which lacks a cuticular layer, making it vulnerable to sterilizing agents. The species' population is declining due to habitat changes, emphasizing the need for conservation and stable pure culture methods. We aimed to achieve this using an easily prepared Hyponex medium. Initially, we conducted sterilization experiments. Using hypochlorous acid (1-2%) and kitchen bleach with varying concentrations (0.01%-2%), we sterilized **R. natans** and observed their conditions after placing them on moistened cotton under controlled temperature and humidity. Higher concentrations (1-2%) caused complete decolorization and death, while lower concentrations (e.g., 0.1%-0.2%) resulted in partial damage but were insufficient to prevent mold growth. Mold primarily grew on the plants, indicating it originated internally rather than externally. Challenges included strain atrophy during open culture and decolorization after sterilization, leading to significant delays. To address these issues, we adjusted open culture conditions and attempted to terrestrialize the plants. As of October 11th, some plants successfully adapted to terrestrial growth, although the amount was limited. Further efforts involve monitoring pure culture attempts, conducting callus formation experiments using terrestrialized plants, and considering spore-based culture methods if necessary. This research aims to establish a stable culture method and contribute to the conservation of **R. natans**.

Keywords: *Ricciocarpas natans*, aquatic plants, endangered species

Can Pill Bugs Become "Beer Lovers"?

~ Comparative Experiment of Smells that Attract Pill Bugs ~

Kazuki Kono, Shu Otsuka, Hinako Sunaga, Shizuka Hasegawa

Abstract

It is said that pill bugs are attracted to beer, despite that there are no studies which indicate that it is true. The purpose of this project was to determine whether pill bugs are attracted to smells of beer and what substances attract them. So, we grew pill bugs and exposed them to small amounts of beer and water. As beers contain a lot of alcohol, we guess that they are attracted by the smell of alcohol. We decompressed a bottle of beer (Kirin) and reduced the bubbles. Then, we distilled it and made a liquor. We call it "1" and the remained liquid after distilling "2". We took 40ml of 1, 2, and 40ml as well as water and put them into petri dishes. These petri dishes were set in the place where Pill bugs live for 24 hours. We conducted this experience twice. The Petri dish of "2" attracted the most Pill bugs. According to these results, our hypothesis is incorrect. Our results showed that Pill bugs are not attracted to the smell of alcohol, but by the other smells of beer.

Keywords: *entomology, pill bugs, beer, alcohol*

Effects of Growth Inhibitors on E.coli

Saki Fukunaga, Yuna Ito

Abstract

Previous studies have shown that bacteria such as E. coli produces growth inhibitors as they grow. Our objective is to determine if there is a relationship between the size of the colony and the effect of the inhibitor. We used an autoclave with 25g of LB broth and 15g of powdered agar in pure water and transferred the mixture to the petri dish. We then used a water bath to stir E.Coli stock solution and diluted it using a spreading stick to spread it on an LB agar medium and put it in a 38°C incubator for 24 hours. Afterwards, we took out the medium from the petri dish and added the LB broth and autoclave and put them in a 38°C incubator for 24 hours. Our observation was that the size of the colony was smaller than that of the medium not containing inhibitors. This shows that auto-developmental inhibitors slow down the growth rate of E. coli. It has also been found that it also has an inhibitory effect on other bacteria.

Keywords: *e. coli, inhibitor, colony, sucrose, LB*

The Power of Euglena ~Optimum Culture Conditions for Euglena~

Rumi Ueno, Miwa Yamamoto, Haruto Sakurai, Ao Wakayama

Abstract

E. gracilis are tiny organisms that are rich in nutrients. They are sometimes used to supplement nutrition. They are also being researched for use as an environmentally friendly fuel. The purpose of our research is to find the conditions under which Euglena can be best cultured and to contribute to environmental issues. We first looked for the right nutrient concentration in the culture medium. We tested different concentrations of a plant fertilizer called Hyponex to see if the green beetles were alive and how much they increased. We first looked for the right nutrient concentration in the culture medium. We tested different concentrations of a plant fertilizer called Hyponex to see if the Euglena were alive and how much they increased. While in experiment 1 we observed moving euglena in the culture solution we couldn't observe algae precipitate in the culture solution of euglena 7% and 5%. In experiment 2 we couldn't observe moving euglena but cyanobacteria from flasks and the pH was 8 when we confirmed it in October. Due to the extreme heat this Summer (where many days in a row exceeded 30 degrees Celcius) and, the concentration of Hyponex not being appropriate and the pH level being too high (where in other studies, it was found that the optimal pH levels were between 3.5 and 5.5, where ours was 8) we were unable to maintain the population of euglena after cultivation. These factors also contributed to the growth of other organisms, which were harmful to euglena maintenance and sustainability.

Keywords: *euglena gracilis*, *Hyponex*, *culture*

Battling Earthquakes with Solid Ground

Chizuru Masui, Ai Morimoto, Asuka Kawaguchi, Kosuke Kurokawa

Abstract

In Japan, earthquakes frequently occur. Big buildings often collapse due to earthquakes, so we decided to research ground that is resistant to earthquakes. We assume that models would collapse on soft ground including water. The purpose of this project was to find earthquake resistant ground. We made a model of a building and a device that causes vibration and prepared sand and gravel as ground. We put them into the earthquake simulation device and put the model on it. We put a smartphone on the model and started the app named Phyphox. We operated the device and measured the acceleration by the app. However, there was no significant difference in acceleration between sand and gravel in this experiment. Z-direction-acceleration was larger than acceleration in the other directions. We think that this is because we didn't fix the pillars of the model to the bottom of the box. Also, we should have measured change of position instead of acceleration.

Keywords: *earthquakes, stable ground, acceleration, model experiments*

Open Levee ~Changing the Benefits of Flood Control~

Koki Isono, Syunta Kinoshita, Sakaki Ishida, Hayato Uchino

Abstract

The purpose of this experiment was to find the appropriate angle that has the greatest flood control effect. Nowadays, making levees concentrated on reducing disasters is encouraged and open levees are one of those methods. It plays two roles, where one is drainage and the other is to quickly return the floodwater to prevent the spread of damage. We focused on studying the latter role. Our experiment made a model of open levees and rivers out of styrene foam and used this model to see how flood situations change with each angle of the wall. We hypothesize a benefit of flood control, which is how quickly it takes for the water accumulated in the flood control pool to come out, becomes greater by increasing the wall angle. From our experiment, we found that the time was shorter from decreasing the angle proving our hypothesis wrong.

Keywords: *open levee, flood control effect, disaster prevention*

Cleverly Foresee Frisbee's Trajectory

~You Can Master the Frisbee!!~

Shunsuke Fujisawa, Yuta Yamada, Ryo Moriyama

Abstract

Our research was aimed at calculating the trajectory of a Frisbee. Without taking air resistance into account, the maximum projection angle for flying distance is 45 degrees. However, we confirmed through calculations and experiments how complex conditions such as air resistance and the Frisbee shape affect the projection angle. Our hypothesis is that an angle smaller than 45 degrees is the optimum ejection angle, since the longer dwell time causes more aerodynamic drag. The trajectory of the Frisbee was calculated under the conditions of aerodynamic drag and lift, and the correctness of the equation was verified using an automatic ejection device. For the trajectory calculation, the working force was analyzed, the equation of motion was formulated based on it, and the equation of trajectory was calculated by integrating it. The projectile device was made to fly in the tangential direction of the tire by turning the tire with a screwdriver and using friction with the Frisbee. As for the injection experiment, a control experiment was conducted in a windless gymnasium, with other conditions exactly the same. Currently the projection equipment was inadequate and could not project at different angles. Therefore, we need to improve this. To this end we plan to recreate the curve of the projectile and adjust the position of the tires. For the trajectory calculations, we found that we needed to learn more about fluid dynamics to obtain realistic Frisbee trajectories, taking into account more complex conditions. For those numbers that did not seem feasible to calculate in practice, we decided to represent the trajectory by substituting actual measurements.

Keywords: *frisbees, lift force, trajectory, integral equations*

Why Electricity Is Generated in the Absence of Sound? ~Success in Sound Power Generation~

Tomoharu Tsujino, Mio Urata, Yukito Ueda, Kanae Yamamoto

Abstract

The piezoelectric element that generates voltage when pressure is applied may improve the Earth's environment, if we create a useful way to generate electricity by using the noise around us. When measuring voltage in frequencies, we found that the voltage measured in situations without sound from a speaker was higher than the voltage measured in situations where sound is played from a speaker. Therefore, we wanted to research the cause and make use of it. The purpose of this project was to discover efficient methods for energy generation using sound. White noise was used to record waves with an oscilloscope, and Fourier transform was used to study the maximum response of recorded waves to frequency sounds. The results of this experiment showed the piezoelectric element that we used reacts to frequency of about 20000Hz the most, and there are no sounds that generate a bigger voltage than when there is white noise. Moreover, the reaction to frequency of about 20000Hz is similar to between no sounds and white noise.

Keywords: *piezoelectric element, frequency, 20,000Hz*

Let's Stop Sound Leakage

Teppei Takizawa, Masahiro Furukawa, Satoshi Okimoto, Shion Kitagawa

Abstract

These days, noise problems occur in a variety of places. In order to prevent them, you should interrupt the sound leaking from the room. Related to this, the purpose of our study is to research the effect of sound insulation materials if they are layered. In this study, we struck them inside of the box which we regard as a room. Our hypothesis is that the more insulation we stick, the less sounds leak, and low-frequency sounds can be blocked by stacking the number of sheets. We experimented by changing the sound from 500Hz to 5000Hz and the process was repeated from 0 to 5 sheets of them. Then, we made graphs. Our experiments show sound leakage becomes smaller and smaller from 0 to 3 sheets of materials, while the data of 4 sheets shows a lower amount of sound leakage than that of 5 sheets. Also, they suggest that in 2500Hz, they cannot prevent sound leakage in all processes. The reason why the graph shows the most sound absorption when 4 sheets of sound insulation material were used is because the sound insulation material was applied roughly when it was attached, so we think that the change in sound reflection became more complicated. The sound leakage at 2500Hz was related to the natural frequency of the wooden box. However, the noise tended to decrease from the first to the fourth sheet.

Keywords: *acoustics, sound proofing, urethane, noise*

Relationship Between Wing Shape and Power of Lift

Kei Ushiro, Yukou Mochioka, Shota Furukawa, Mizuki Kawabata

Abstract

A study was conducted to investigate the relationship between wing parameters and lift force using NACA 4-digit airfoil profiles. The research utilized Fusion360 for 3D modeling and FlowSquare+ for fluid dynamics simulation. The NACA profile parameters examined were:

- Maximum thickness ratio (t): 10, 15, 20
- Maximum camber position (p): 2, 4, 6
- Maximum camber ratio (m): 2, 4, 6

The key findings revealed that increasing the thickness ratio (t) led to a monotonic increase in lift force. However, variations in the maximum camber (m) and its position (p) showed no significant impact on lift generation. The study confirmed that lift force increased with angle of attack across all parameter combinations. The lift force equation $L = \rho V \Gamma$ suggests that thickness (t) influences the circulation (Γ) around the wing, as it does not affect fluid density (ρ) or velocity (V). We hypothesized there exists a maximum thickness value beyond which lift force would decrease due to flow separation. However, the study was limited in its ability to draw detailed conclusions about the effects of camber parameters (p and m) due to insufficient data points.

Keywords: *lift force, wing parameter, simulate soft, angle*