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（学校用）

様式 A-1

(FY2023)

年　　月　　日

サイエンス・ダイアログ　実施報告書

1. 学校名・実施責任者氏名: 学校法人池田学園　池田高等学校　小田　紘史

2. 講師氏名: Dr. Jakia Sultana JOTHI (Ms.)

3. 講義補助者氏名: 中田 秀元

4. 実施日時: 令和5年 10月 19日 （木） 10:40 ～ 12:25

5. 参加生徒: 高校2年生 24人、 高校1年生 3人、 中学3年生 2人 （合計 29人）
   備考: (例:理数科の生徒)
   ※今回、オンラインによる聴講生はなし

6. 講義題目: 環境負荷低減型殺菌法の開発: CFD 解析による柑橘類の非薬剤・非加熱処理の最適化

7. 講義概要:出身国の紹介、自身の研究内容に関する講義等

8. 講義形式:
   ☒対面 ・ □オンライン （どちらか選択ください。）
   1) 講義時間 80 分　　質疑応答時間 20 分

   2) 講義方法 （例:プロジェクター使用による講義、実験・実習の有無など）
   プロジェクター使用による講義

   3) 事前学習
   (有)・ 無 （どちらかに〇をしてください。）
   使用教材 講師が事前に作成したアブストラクト

9. その他特筆すべき事項:

10.

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Form B-2
(FY2023)
Must be typed

Date（日付）24/10/2023
（Date/Month/Year：日/月/年）

Activity Report -Science Dialogue Program-
（サイエンス・ダイアログ事業　実施報告書）

- Fellow's name（講師氏名）: Jothi Jakia Sultana.　（ID No. P22082）

- Name and title of the accompanying person（講義補助者の職・氏名）
Mr. Nakada Hidemoto

- Participating school（学校名）: Ikeda Junior & Senior High SchooL,　Kagoshima

- Date （実施日時）: 19/10/2023　（Date/Month/Year:日/月/年）

- Lecture title（講義題目）:
Unlocking the potential of UV-C: A high-tech computational solution to extend fruit freshness and Eight food waste for a sustainable future

- Lecture format（講義形式）:
◆☒Onsite ・ □Online (Please choose one.)（対面 ・ オンライン）（（どちらか選択ください。））
◆Lecture time（講義時間） 60 min（分）, Q&A time（質疑応答時間） 60 min（分）
◆Lecture style（ex.: used projector, conducted experiments）
（講義方法（例：プロジェクター使用による講義、実験・実習の有無など））
PowerPoint and poster

- Lecture summary（講義概要）: Please summarize your lecture within 200-500 words.

Abstract

Hello, everyone! I'm thrilled to talk to you about something that affects all of us, no matter where we come from: that is **"food"**. I'm from Bangladesh, a country in South Asia, where I grew up seeing the immense potential of our land to produce delicious fruits and vegetables due to our tropical and subtropical climate.

But there was a problem. A significant amount of these fruits and vegetables never reached our tables due to spoilage of fruits after harvest, it's called "postharvest losses". In Bangladesh, it meant that we were losing 20-40% of the food we worked so hard to grow. This waste wasn't just a problem in my country; it's a global issue too.

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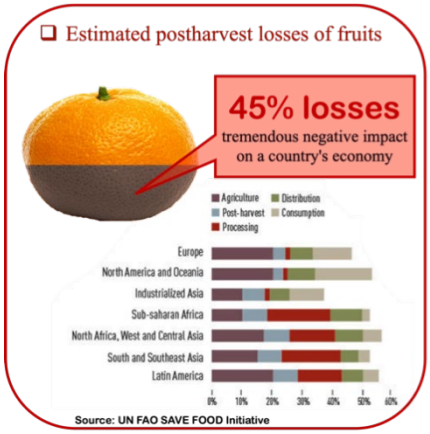
So, I decided to become a scientist to help address this issue. My journey began with a simple desire: I wanted to do something about this problem. I wanted to find ways to reduce food waste and make sure that the food we grow reaches as many people as possible, safely and with high quality. That's why I decided to study Food engineering in Bangladesh. I've been driven by the desire to learn more about Food engineering. So, I came to Japan, where I completed my Ph.D. from Hiroshima University with the support of MEXT scholarship. Now I am doing postdoc in Kyushu University.



Now, you might be wondering, what's so exciting about my current research? Well, I'm currently researching how to use a special type of light called UV-C to make oranges last longer. Oranges are not only delicious but also packed with vitamins and minerals like vitamin C. However, after they are harvested, they start to spoil, and we lose a lot of them. Traditionally, chemicals were used to keep them fresh, but that can leave harmful residues on the fruit. That's where my research comes in. I use something called UV-C treatment, a safe and non-chemical method, to keep oranges fresh for longer. UV-C light has the power to kill harmful microorganisms that cause spoilage, but if we use too much of it, it can harm the oranges. So, I'm working on creating computer models that help us find the perfect balance – the right amount of UV-C light to keep the oranges fresh without damaging them. This is where science, technology, and creativity come together to solve a real-world problem.

So, what's exciting about this for you? Well, imagine if we could use this technology to not only save delicious oranges but also other fruits and vegetables. That means less wasted food, healthier eating for everyone, and a cleaner environment. Plus, it's a great example of how science can solve real-world problems and make the world a better place.

In summary, I became a scientist because I wanted to make a difference in my country and in the world. My research aims to reduce food waste, make food safer to eat, and help ensure that everyone can enjoy fresh, healthy fruits. So, let's all work together to fight food waste and make our planet a better place to live. Thank you!

Here are some keywords and key phrases from the lecture: UV-C (紫外線)

Fruit freshness (果物の鮮度)

Food waste (食品廃棄物)

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Sustainable future (持続可能な未来)

Postharvest losses (収穫後の損失)

Bangladesh (バングラデシュ)

Tropical and subtropical climate (熱帯および亜熱帯気候)

Food engineering (食品工学)

MEXT scholarship (文部科学省奨学金)

Kyushu University (九州大学)

JSPS (日本学術振興会)

Harmful microorganisms (有害微生物)

Science, technology, and creativity (科学、技術、創造力) Wasted food (無駄にされた食品)

Healthier eating (より健康的な食事)

Real-world problems (現実の問題)

Making a difference (違いを作る)

Reduce food waste (食品廃棄物を減らす)

Fresh, healthy fruits (新鮮で健康的な果物)

◆Other noteworthy information（その他特筆すべき事項）:

- Impressions and comments from the accompanying person（講義補助者の方から、本事業に対する

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意見・感想等がありましたら、お願いいたします。）:

Students asked some questions in Japanese, Mr. Nakada answer that. He also helped to translate some portion of my lecture if needed.

Computational Fluid Dynamics-Based Simulation of UV-C dose Distribution and Inactivation of Mold Spore on Oranges

○ Jakia Soltana Jothi[1, 2], Hidemoto Nakada[3], Fumina Tanaka[1] and Fumihiko Tanaka[1]

([1] Faculty of Agriculture, Kyushu University, [2] Faculty of Food Science and Technology, Chattogram Veterinary and Animal Sciences University, [3] Graduate School of Bioresource and Bioenvironmental Sciences, Kyushu University)

❑ BACKGROUND

❑ Estimated postharvest losses of fruits

45% losses

❑ Postharvest losses of oranges: Challenges and Solution

Fungi mice, including green rot (Penicillium digitatum) during storage is a common issue

Conventional Approach: Surface decontamination with chemicals (leading to potential toxic residues)

Emerging Alternative: UV-C irradiation (200–280 nm), a promising non-chemical technology for safe, affordable, and eco-friendly fruit preservation

Challenges

Over dose degrade the quality of the fruits

Insufficient dose concerns about antimicrobial safety

Optimization required for fruit quality and microbial safety

❑ Overcoming UV-C Challenges with CFD Modeling

Computational fluid dynamics (CFD), a numerical method and algorithm, analyzes problems involving non-uniformity of irradiation.

❑ METHODOLOGY

CFD simulation geometry, mesh, initial, boundary conditions, and post-calculation

Geometry

Meshing

Fig 2. Mesh Generation for 3D Model

Microbial inactivation model

Penicillium digitatum

$$\log_{10}\frac{N}{N_0} = -\frac{Kt}{2.303}$$

Table 1. The physical surfaces and domain walls parameters

Name	Type	Internal emissivity	Radiation	Diffuse fraction	Temp
Opening wall	Pressure-outlet	-	-	-	-
Cover	Wall	0.35	-	-	-
Lamp	Wall	0.89	Opaque	0.5	10K
Housing	Wall	0.95	Semi-transparent	1	-
Fluid	-	-	Opaque	0.5	10K

❑ RESULTS

Fig 5. UV-C intensity of all models at 6 s treatment time

Table 2. % inactivation of Penicillium digitatum of all models at 6 s treatment time

Model	% Inactivation		
	Maximum	Minimum	Mean
A	78.35	77.46	77.90
B	84.51	83.66	84.08
C	84.44	76.05	80.95
D	59.08	34.81	63.97
E	67.56	40.87	72.56
F	87.02	87.02	68.67