RGC Ref. No.:
UGC/IDS(R)25/20
(please insert ref. above)

RESEARCH GRANTS COUNCIL
COMPETITIVE RESEARCH FUNDING SCHEMES FOR THE LOCAL SELF-FINANCING DEGREE SECTOR

INSTITUTIONAL DEVELOPMENT SCHEME (IDS)
RESEARCH INFRASTRUCTURE GRANT

Completion Report

(for completed projects only)

Submission Deadlines:
1. *Auditor's report with unspent balance, if any: within **six** months of the approved project completion date.*
2. *Completion report: within **12** months of the approved project completion date.*

Important Note:
In completing the report, please use the following format:

Page limit:	Items 1 to 5 and Summary of Completion Report: no page limit Items 6 to 9: maximum **20 A4 pages** (excluding any appendices and attachments)
Font:	Times New Roman
Font Size:	**Not smaller** than Point 12
Margin:	Two centimeters margin all around
Spacing:	Single-line spacing

1. Project Title

Establishment of the Centre for Interdisciplinary Research on Food By-products Utilization (CIFU)

2. Investigator(s) and Academic Department(s) / Unit(s) Involved#

Project Team	Name / Post	Department / Unit	Average Number of Hours Per Week Spent on this Project
Project holder* (i.e. Head of Institution)	Prof Alan LAU / President	THEi	3
Team leader	Prof Paul TSANG / Vice President (Academic)	VP(A) Office / THEi	10
Team member(s)	Dr TSANG Chi Wing / Assistant Professor	Department of Construction, Environment and Engineering / THEi	5
	Mr CHOY Yip Hong / Assistant Professor	Department of Design and Architecture / THEi	5

	Dr LAW Ho Yin Angus / Assistant Professor	School of General Education and Languages / THEi	5
	Dr LEUNG Tsui Yan / Assistant Professor	Department of Hospitality and Business Management / THEi	5
	Dr FONG Lai Ying / Associate Professor	Department of Food and Health Sciences / THEi	5
Others	N/A	N/A	N/A

[#] *Please state the **key** staff and department/unit involved in the project. Please add row(s) as necessary. Please also highlight the approved changes in project team composition and quote the date of the RGC approval for such changes.*

[*] *Refer to "Applicant" for 2015/16 exercise and "Project holder" for 2017/18 exercise onwards.*

3. Project Duration

	Original	**Revised**	**Date of RGC / Institution Approval** *(must be quoted)*
Project Start Date	01/01/2021	N/A	N/A
Project Completion Date	31/12/2023	N/A	N/A
Duration *(in month)*	36	N/A	N/A
Deadline for Submission of Completion Report	31/12/2024	N/A	N/A

4. Project Objectives

Summary of objectives addressed / achieved:

Objectives[*]	**Percentage Achieved**	**Remarks**[**]
1. To establish a Centre for Interdisciplinary Research on Food By-products Utilization (CIFU) for research and development programs and activities in the area of food by-products utilization.	100%	The Centre for Interdisciplinary Research on Food By-products Utilization (CIFU) had been established. An opening ceremony was held on 1 March 2022. A logo design competition was held at THEi. A winning logo had been selected.
2. To enhance the research capacity and expertise of staff members at THEi	100%	The objectives of the CIFU had been well disseminated to THEi's staff members. The acquisition of the new equipment had greatly enhanced the research capacity and strengths of THEi. Training sessions for the new equipment were

Objectives*	**Percentage Achieved**	**Remarks****
		organized for THEi's staff members and students. Team member TSANG Chi Wing served as mentor and supervised junior staff members (research assistants and technicians) and students to foster new skills in interdisciplinary research methodologies related to food by-products utilization such as lignin extraction. Team member CHOY Yip Hong supervised his final year students and technicians of Product Design program for research studies on eggshell-derived PLA bio-polymer. Team member LEUNG Tsui Yan supervised her final year students of Culinary Arts and Management program to revitalize food by-products (soy okara and meat straps) to value-added products.
3. To strengthen research synergy among staff members and talented researchers at THEi	100%	Several training sessions on new equipment were organised for THEi's staff members, including technical staff members, and students. Several new research collaborative projects among THEi's staff members were initiated and the research proposals were submitted to external funding bodies for consideration. Team leader TSANG Wai Kei and team member TSANG Chi Wing facilitated collaborative projects among staff members in other departments and programs of THEi to strengthen research synergy. They co-authored a journal publication in sustainable textile materials and processing techniques. They also engaged in joint research studies on thermogravimetric analysis and catalytic processing of

Objectives*	**Percentage Achieved**	**Remarks****
		food by-products. Team leader TSANG Wai Kei and team member LEUNG Tsui Yan initiated two new interdisciplinary projects among staff members in other departments and programs of THEi to work with an industry partner on sustainable dining. This new collaboration laid a solid foundation for the establishment of a new research centre at THEi.
4. To encourage THEi's students engage in interdisciplinary research	100%	Team member Mr CHOY Yip Hong commenced collaborative research projects between technical staff members and final year students of Product Design program to create and develop different supporting equipment and tools for bio-polymer creation and development. Three final year students of Product Design program were supervised by team member CHOY Yip Hong. The research findings were disseminated in local conferences to the public and relevant industry stakeholders. Team member LEUNG Tsui Yan commenced collaborative research projects between final year students of Culinary Arts and Management program to use soy okara and spent grains to produce edible utensils; and use meat straps to product pet snacks. The research findings were disseminated in local and international conferences to the public and relevant industry stakeholders. Team member TSANG Chi Wing supervised two final year students of Environmental Engineering and Management program for studies on bio-based filter materials and valorization of lignocellulosic biomass. Student Applied Research

Objectives*	**Percentage Achieved**	**Remarks****
		Presentations (SARP) were organized annually in 2022, 2023, and 2024 to showcase the research outputs of students' final year projects. Some of them were interdisciplinary research studies.
5. To upgrade the research facilities for THEi's staff members and students	100%	All items under "Facilities and Equipment" have been installed and set up for THEi's staff members and students.
6. To promote the concepts of "Sustainable Living" to the general public and industrial stakeholders to relieve the cost of managing food by-products	100%	Team leader TSANG Wai Kei approached a local social enterprise CookEasy under Tung Wah Group of Hospitals and had a meeting with their staff to promote the key concepts of "Sustainable Living". He also arranged the CIFU team members and senior management of THEi to visit the production kitchen. Team members CHOY Yip Hong and FONG Lai Ying approached with social enterprise iBakery under Tung Wah Group of Hospitals to foster research collaboration. iBakery regularly provided eggshells for development of new combinations of bio-polymer. Team member LEUNG Tsui Yan connected with Drinks330 and The New Life Psychiatric Rehabilitation Association to foster research collaboration on revitalization of food by-products (e.g. soy okara). The new findings were disseminated in local conferences and workshops to the general public and industrial stakeholders. The CIFU team had connected with the following organizations to promote the concepts of "Sustainable Living" and food by-products utilization to relieve the cost of management: Hong Kong Institute of Environmentalists, Cordis Hotel Hong Kong, Industrial Designers Society of Hong Kong, and Environmental Association.

Objectives*	**Percentage Achieved**	**Remarks****
		Team member FONG Lai Ying liaised with several bakeries and breweries for mass collection of food by-products, such as bread crust and unsold white toast from MacField and A-1 bakery; spent grains from local SME breweries. All these edible food by-products were vacuum-packed and hygienically delivered to the CIFU for further processing with revitalization and conversion to value-added ingredients for making plant-based meat, sausage, crispy chips, and taco pastry. Team member CHOY Yip Hong disseminated his research deliverables in Education and Career Expo 2023 and InnoCarnival 2023 to promote the concepts of "Sustainable Living" and the importance of sustainability and innovation. Team member TSANG Chi Wing disseminated his research findings in public forums and seminars to highlight the importance of sustainable practices in food by-products utilization. Team leader TSANG Wai Kei and team members LEUNG Tsui Yan and LAW Ho Yin Angus served as Education Advisors to promote the concepts of "Sustainable Living" and disseminate the research deliverables of the CIFU to the general public, secondary school students, and industrial stakeholders in different occasions.
7. To foster collaboration among academics and external stakeholders relevant to sustainability and innovation	100%	Team member LEUNG Tsui Yan commenced a research collaboration with a number of industrial partners (including Drinks330 and The New Life Psychiatric Rehabilitation Association) to revitalize soy okara (a food by-product) to edible

Objectives*	Percentage Achieved	Remarks**
		utensils and to replace flour for making sponge cakes. Sponge cake scraps from local bakery factories were collected for making edible spoons. The research findings were disseminated in local and international conferences to the general public and relevant industrial stakeholders. Team member LEUNG Tsui Yan collaborated with The Meat Lab to revitalize meat straps to pet snacks. This new idea led to a proposal for a start-up competition in 2023. The idea was also disseminated in another local start-up food waste disposal competition in the same year and was awarded a 2nd runner-up prize and HK$100,000 financial support. The same innovative idea was awarded HK$100,000 from the HKSTP Ideation Award and another HK$100,000 from the 2nd THEi – Lions Clubs Enterprise Start-Up Competition. Team members CHOY Yip Hong and FONG Lai Ying commenced a research study with iBakery to employ eggshells for production of new form of bio-polymer, and the left-over white toast or bread as for other applications after freeze-dried to replace flour. The research findings were disseminated in local and international conferences to the public and relevant industry stakeholders. Workshops were arranged to promote these new and innovative ideas to secondary school students via taster programs. Team leader TSANG Wai Kei and member TSANG Chi Wing prepared a new research proposal for lignin revitalization and submitted to UGC for consideration for funding in the 2022-2023 exercise.

Objectives*	**Percentage Achieved**	**Remarks****
		Team member TSANG Chi Wing submitted two new research proposals (one to UGC and one to ITF) for consideration for funding and another new research proposal to UGC by his fellow academic staff member of the Department of Construction, Environment and Engineering in the 2022-2023 exercise. Team member TSANG Chi Wing engaged in inter-institutional collaborations that resulted in journal publications related to sustainability and innovation. Team leader TSANG Wai Kei and team member LEUNG Tsui Yan initiated two new interdisciplinary projects among staff members in other departments and programs to work with an industry partner on sustainable dining.
8. To establish a platform for showcasing of research deliverables with potential applications in different disciplines	100%	The 1st Staff Research Symposium was held on 29 March 2022 to showcase the latest research findings from the CIFU. The research deliverables of the CIFU were showcased in InnoCarnival 2022 and InnoCarnival 2023, Future Skills Community Events 2022, and taster programs for the general public and secondary school students. Student research symposiums, The Student Applied Research Presentations (SARP), was held in 2022, 2023, and 2024 to showcase the deliverables of students' applied research with interdisciplinary elements. Team leader TSANG Wai Kei and team member LEUNG Tsui Yan participated in VTC Skills Fiesta in 2023. They organized Halloween

Objectives*	**Percentage Achieved**	**Remarks****
		icing cookie workshop using cookies made of soybean residue (a food by-product from bakery industry). A workshop on eggshell-derived PLA 3D printing was organized to THEi's students for delivery of hands-on experience in running 3D printers and making filaments. The 2nd Staff Research Symposium was held in December 2023. The topic of the symposium was "Circular use of resources: from research to industry". Two keynote speakers were invited and several key persons from the industry were present to share their ideas and thoughts on "Sustainable Living". Team member CHOY Yip Hong presented his research findings (Title: Revolutionizing Manufacturing: Embracing Additive Manufacturing with Eggshell Polylactide (PLA) Polymer) at ICCPS 2023 International Conference on Chemistry and Polymer Science. Team member CHOY Yip Hong compiled the research deliverables of the eggshell PLA project to participate in the Hong Kong Green Innovation Awards 2023. Team member CHOY Yip Hong submitted a manuscript for consideration of publication (Title: Helping reduce food by-product waste and disposable plastic: 3D printed eggshell-PLA material") to Discover Sustainability in 2024.
9. To prepare, develop, and disseminate teaching and learning materials for students and the general public to propagate the ideas and importance of sustainability and innovation	100%	Several training sessions on new equipment were organised for THEi's students. A CPD webinar was organized on 26 March 2022 on sustainable

Objectives*	Percentage Achieved	Remarks**
		energy in collaboration with Hong Kong Institute of Environmentalists. Team member LEUNG Tsui Yan and her final year student of Culinary Arts and Management Shahid Maahin UBEAD delivered an oral presentation (Title: Should we embrace upcycled food products") in THEi's research webinar, organized by THEi Research Office, on 25 October 2022 to promote upcycled food products. Team leader TSANG Wai Kei delivered a speech (Title: New dining experience: spoon feeding with your flavor) in the Theme Day Talk of Education and Careers Expo 2023 on 2 February 2023. In addition, research deliverables generated from the CIFU were showcased at the VTC's booth. Team member LAW Ho Yin Angus served as guide for tours and the VTC's booth to promote the concepts of "Sustainable Living" to the general public. Team member TSANG Chi Wing developed education resources contributing to curriculum enhancements in environmental engineering and sustainability, e.g. research deliverables of an ECF projects have been incorporated into a laboratory module (SGE5321 Green Engineering Laboratory). Team member CHOY Yip Hong engaged in a workshop to students who studied a general education module (GEE5109 Design for Fun) for dissemination of the concepts of eggshell-PLA polymer and the applications and usage of related machines (3D printers and computer controlled electronic universal testing equipment).

Objectives*	Percentage Achieved	Remarks**
		Team member CHOY Yip Hong displayed the eggshell-derived PLA bio-polymer on the "VTC Mobile Vehicle" commencing from December 2023. The "VTC Mobile Vehicle" was rolled out as a School Outreach Program that visited many secondary schools in Hong Kong. Team leader TSANG Wai Kei and team members LEUNG Tsui Yan and LAW Ho Yin Angus served as Education Advisors to promote the concepts of "Sustainable Living" and disseminate the research deliverables of the CIFU to the general public, secondary school students, and industrial stakeholders in different occasions.

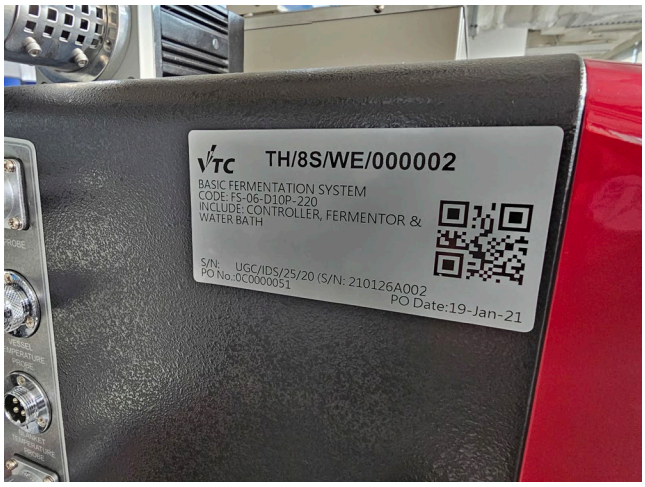
* *Please refer to the originally approved objectives. If there are changes in objectives, please highlight the changes and quote the date of RGC approval for such changes.*

** *Please provide reasons for significant slower rate of progress when compared with the approved implementation timetable.*

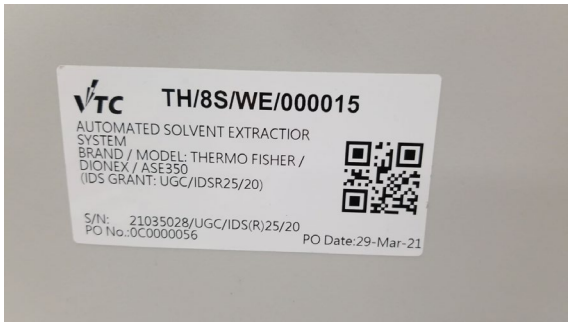
5.4 Please attach photo(s) of acknowledgement of RGC-funded activities / facilities / equipment.

The following new equipment were purchased and installed at the CIFU:

- Fermentor and control modules

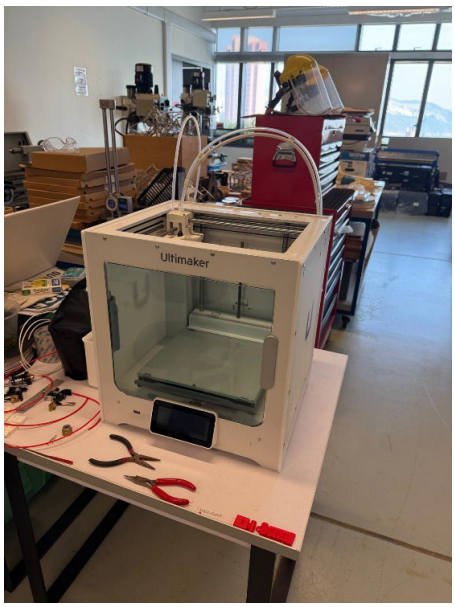


- Automated solvent extractor and accessories



- Computer controlled electronic universal testing machine and accessories

- 3D printing machine



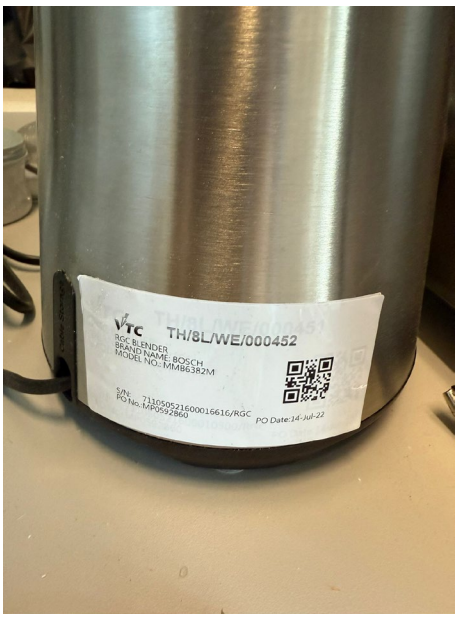
- 3D printing filament making machine and accessories

- Shredding machine

- Polymer compounding machine

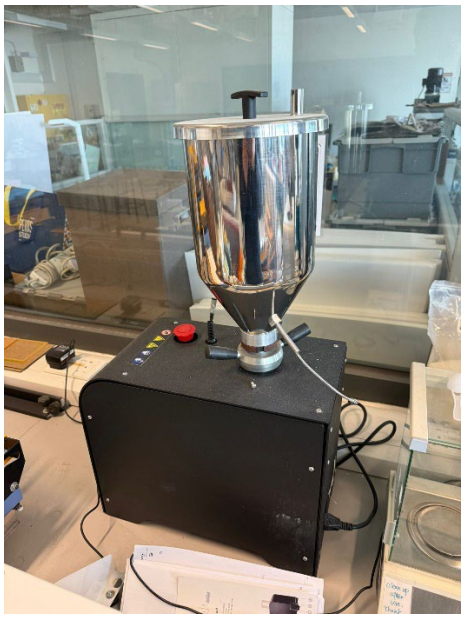
- Gel permeation chromatography system

- Stainless steel blender / liquidizer

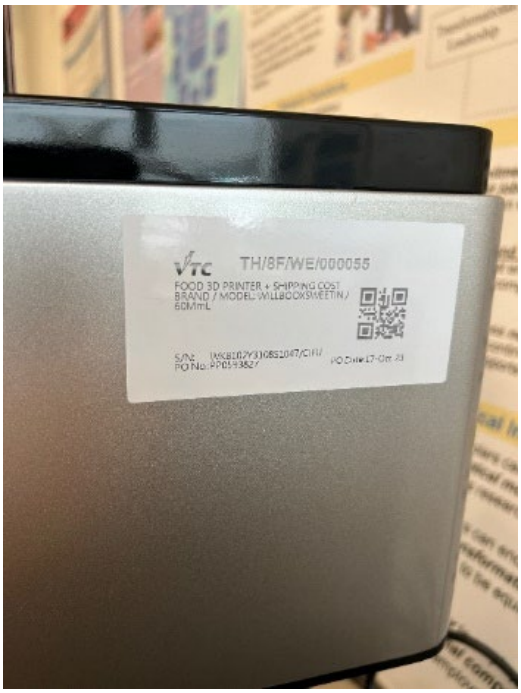


- High speed homogenizer

- Granulate dryer



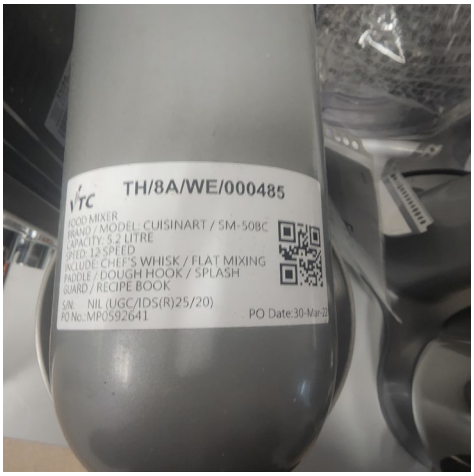
- Food 3D printer

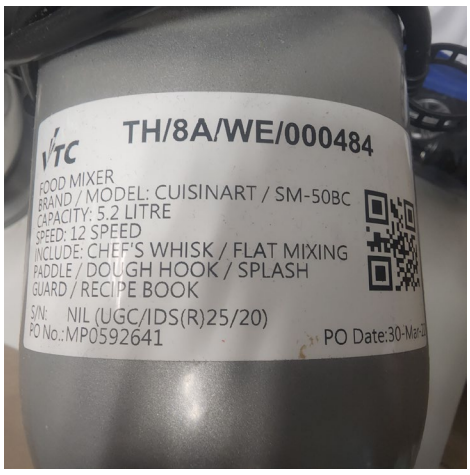


- Food mixer

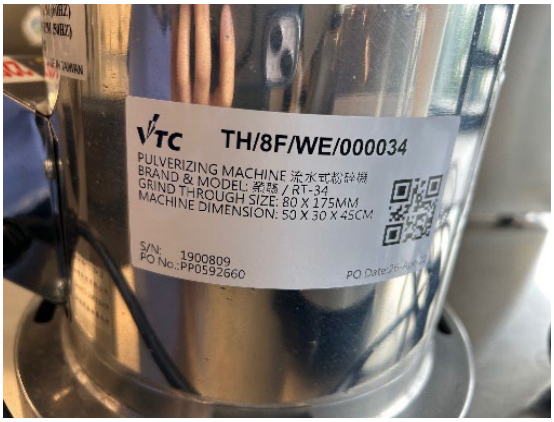

KitchenAid

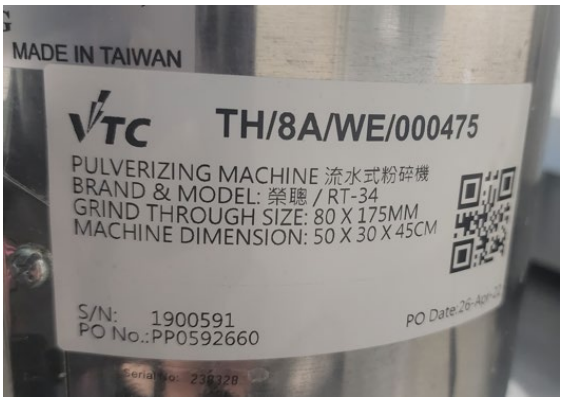

VTC
TH/8F/WE/000042


VTC
TH/8A/WE/000485
FOOD MIXER
BRAND / MODEL: CUISINART / SM-50BC
CAPACITY: 5.2 LITRE
SPEED: 12 SPEED
INCLUDE: CHEF'S WHISK / FLAT MIXING
PADDLE / DOUGH HOOK / SPLASH
GUARD / RECIPE BOOK
S/N: NIL (UGC/IDS(R)25/20)
PO No.:MP0592641

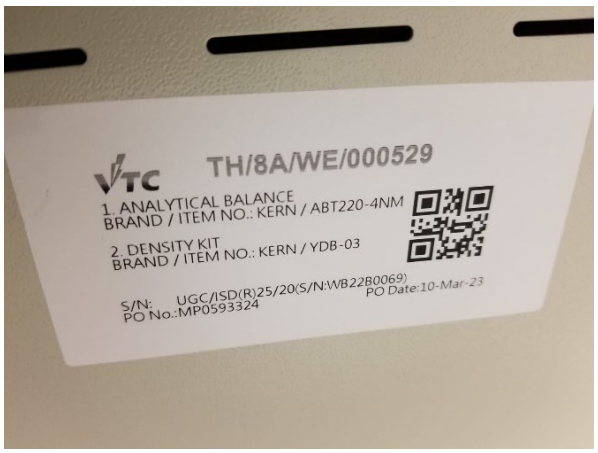

VTC
TH/8A/WE/000484
FOOD MIXER
BRAND / MODEL: CUISINART / SM-50BC
CAPACITY: 5.2 LITRE
SPEED: 12 SPEED
INCLUDE: CHEF'S WHISK / FLAT MIXING
PADDLE / DOUGH HOOK / SPLASH
GUARD / RECIPE BOOK
S/N: NIL (UGC/IDS(R)25/20)
PO No.:MP0592641
PO Date:30-Mar-

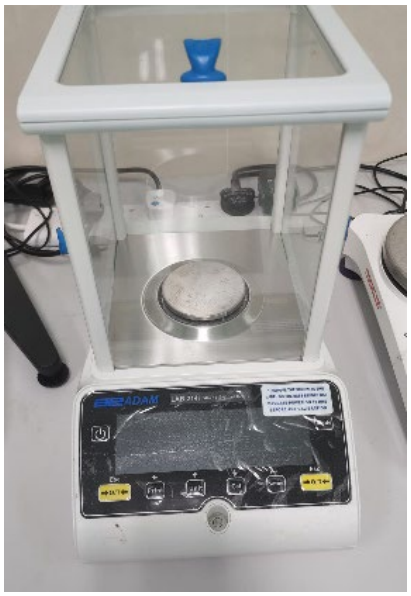
- Pulverizing machine

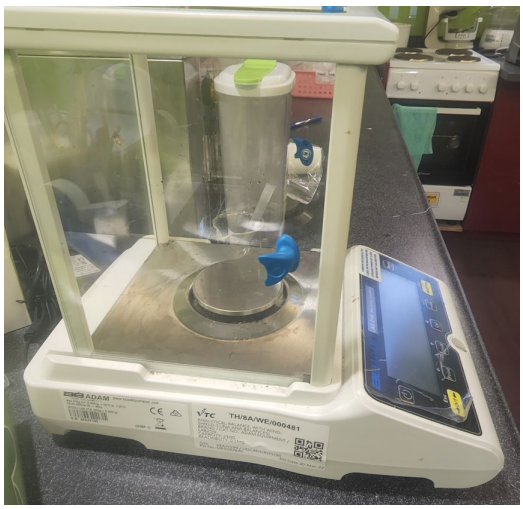


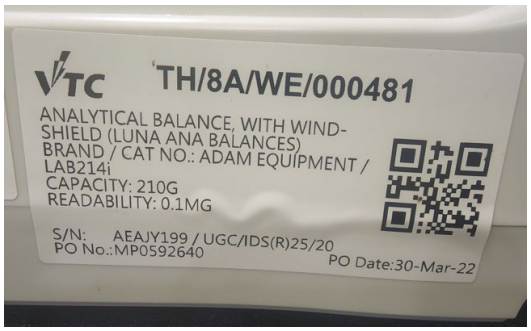


- Electronic balance









6. Research Outputs

6.1 What are the accomplishments of the project?

(i) Please provide reports on conference, seminar, workshop, exchange programmes or other activities held (if applicable).
(Please provide details of the activities organized, including the theme / objectives of the activities, targeted participants, attendance, analysis of participants, e.g. country of origin, research background, etc., evaluation forms of the activities and a summary of the participants' evaluation. Photos of the activities are preferred.)

- A logo design competition for the CIFU was organized in 2021 and the winning log is shown in Appendix 1.
- An opening ceremony for the CIFU was organized on 1 March 2022. The Secretary for the Environment, Mr WONG Kam Sing, was the guest of honor. More than 60 participants from academics, industry, and other relevant sectors attended the event. The video of the opening ceremony is available for viewing from: https://www.youtube.com/watch?v=M8SBWgn8eF4. (Appendix 2)
- Both the Food By-products Revitalization Lab (FBRL) and Food By-products Conversion Lab (FBCL) had been set up, they are located at the Tsing Yi (Room 801 & Room 1001) and Chai Wan (N1035, N919) campuses. (Appendix 3)
- The 1st staff research symposium was organized on 29 March 2022. The objectives were to promote the research initiatives of CIFU; to share research findings; and to establish networks with potential research collaborators in Hong Kong and mainland (e.g. Shenzhen Polytechnic). A total of 295 persons registered and close to 230 attended, including participants from THEi, VTC, other local higher education institutes, Shenzhen Polytechnic, and local industry attended the symposium via online mode. (Appendix 4)
- Training sessions on the newly acquire equipment were organized and offered to THEi's staff members and students. (Appendix 5)
- Team member TSANG Chi Wing organized a CPD webinar (Title: Meeting the hydrogen economy era: development of hydrogen production method from hydrogen storage materials) in collaboration with Hong Kong Institute of Environmentalists on 26 March 2022. (Appendix 6)
- Team member CHOY Yip Hong organized a workshop on eggshell-derived PLA biopolymer, filament production, and applications to THEi's students on 28 April 2022. (Appendix 7)
- Team member FONG Lai Ying delivered a demonstration of making plant-based meat and sausages to VTC's senior management and leading experts from industry on 16 May 2022. (Appendix 8)
- Team leader TSANG Wai Kei, team member LEUNG Tsui Yan, and Marcus HO (final year student of Culinary Arts and Management program) exhibited edible spoons with lemon and cocoa flavors made from bean dregs at the VTC 40th Anniversary Ceremony cum Outstanding Alumni Award Presentation on 13 June 2022. (Appendix 9)
- A THEi Student Applied Research Presentations (SARP) 2022 was held from 1-10 August 2022. A total of 74 abstracts, 62 posters, and 24 video presentations were submitted by THEi students and exhibited online, and the Best Poster Awards and Best Video Presentation Awards were given to the most outstanding work. The online event attracted over 1,700 visits from local and overseas institutes. (Appendix 10)
- Team member CHOY Yip Hong participated in InnoCarnival 2022 at Science Park

(22-30 October 2022) to showcase samples of eggshell-derived biopolymers. Visitors could examine the samples with different percentages of eggshell-derived materials. The biopolymers were presented in design concepts to promote a positive environmental impact on society and stimulate visitors' curiosity and discussion on sustainable lifestyle. Final year students of Product Design program were engaged in this activity to promote the concepts of "Sustainable Living" to all visitors. (Appendix 11a)

- Team member LEUNG Tsui Yan delivered a live online workshop (Title: Food by-products usage: making edible spoon by using okara and sponge cake crust) in InnoCarnival 2022 on 24 October 2022. (Appendix 11b)
- Team member TSANG Chi Wing delivered a pre-recorded webinar (Title: Novel materials for green hydrogen production, energy conversion, and fuel cell applications) in InnoCarnival 2022.
- Team member LEUNG Tsui Yan and Shahid Maahin UBEAD (final year student of Culinary Arts and Management program) delivered an oral presentation (Title: Should we embrace upcycled food products?) in THEi's research webinar on 25 October 2022. (Appendix 12)
- The CIFU team organized a 2-day taster program (lecture, guided tour, and workshop) on 12 November 2022 for secondary school students and their families at the FBCL. Basic principles and potential applications for eggshell-derived PLA biopolymers were introduced to the participants. (Appendix 13)
- Team members LEUNG Tsui Yan, FONG Lai Ying, Helen LEE (research assistant), and Marcus HO (final year student of Culinary Arts and Management program) were invited to participated in FoodSmart Conference and Expo for the Food and Beverage Trade 2022 to showcase edible spoons made from okara on 14 November 2022 (Appendix 14). Team leader TSANG Wai Kei and team member LAW Ho Yin Angus participated in the event.
- Team member FONG Lai Ying organized a training workshop for students from VTC's Shine Skills Centre on 29 November 2022. The students learnt the freeze-drying processing methods and procedures to make kale cookies for Christmas packs without using artificial colorant. (Appendix 15)
- Team leader TSANG Wai Kei, team members LEUNG Tsui Yan, FONG Lai Ying, CHOY Yip Hong, Helen LEE (research assistant), and Marcus HO (final year student of Culinary Arts and Management program) participated in VTC's Future Skills Community Event 2022 (9-11 December 2022) within the THEi thematic booth at the Hong Kong Convention and Exhibition Centre to showcase the research deliverables generated from the CIFU. (Appendix 16)
- Team member FONG Lai Ying organized a series of taster programs and workshops (Themes: "No Food Waste – fully utilize the food sources" and "Revitalization of Food By-products") for local secondary school students. Nearly 400 students from 15 secondary schools participated in the taster programs and workshops held in FBRL at Tsing Yi Campus since 2022. (Appendix 17)
- Team leader TSANG Wai Kei delivered a talk (Title: New dining experience: spoon feeding with your favour) at the Education & Careers Expo organized by HKTDC on 2 Feb 2023. (Appendix 18)
- A THEi Student Applied Research Presentations (SARP) 2023 was held from 20 November to 1 December 2023. A total of 85 abstracts, 55 posters, and 8 video presentations were submitted by THEi students and exhibited in a hybrid mode. The Best Poster Awards and Best Video Presentation Awards were given to the most outstanding work. Overall, the event attracted over 1,020 visitors from local and overseas institutes. (Appendix 19)
- Team leader TSANG Wai Kei and team member LEUNG Tsui Yan participated in

the VTC Skills Fiesta, held in West Kowloon Cultural District on 22 October 2023. They organized Halloween icing cookie workshop using cookies made of soybean residue (a food by-product from bakery industry). The whole day event attracted more than 500 visitors. (Appendix 20)

- The 2nd staff research symposium was organized on 1 December 2023. The topic of the symposium was "Circular use of resources: from research to industry". Two keynote speakers were invited: Ms Sonia LUI (Deputy Head, FoodTech Research and Management, HKPC) (Title: Introduction on advanced FoodTech development in Hong Kong) and Prof Paola PITTIA (Delegate of the Rector for International Affairs, University of Teramo) (Title: Advanced food processing technologies for sustainable future foods). Other guest speakers included team members CHOY Yip Hong and Tsang Chi Wing. Industry guest speakers included Mr Steve YEUNG (Cofounder of Innosphere) and Ir Kelvin TANG (Managing Director, Luen Fat Air Condition (Holding) Trading & Engineering Co., Ltd.). Team member LEUNG Tsui Yan convened an industry panel discussion (Title: Food innovation to sustain the environment from industry perspective) with guest speakers Mr Calvin CHOI (Executive Sous Chef, Regent Hong Kong (Western Cuisine), Mr Romeo ALFONSO (General Manager, The Meat Lab Hong Kong) and Mr Will CHAN (Executive Chef, Greater China Club Chinese Cuisine). (Appendix 21)
- Team member TSANG Chi Wing delivered a talk (Title: The integration of solid-state hydrogen storage materials into town planning for a sustainable urban future) at the HKIE Environmental Forum on 18 April 2024. The topic of hydrogen had gained significant attention as a potential alternative energy source, offering immense promise to reduce carbon emissions and promote environmental sustainability. More than 300 participants attended the Forum. (Appendix 22)
- Team member TSANG Chi Wing disseminated his research findings and the concepts of "Sustainable Living" at an event (Integrating Energy Storage Material for a Sustainable Future of Clothing Industry) organized by Hong Kong Elective on 17 May 2024. He showcased to the participants the innovative fabrics embedded with high-performance energy storage components, ranging from flexible solar cells to piezoelectric materials that convert kinetic energy into electricity. More than 300 participants attended the event. (Appendix 23)
- A THEi Student Applied Research Presentations (SARP) 2024 was held from 31 October to 29 November 2024. A total of 63 abstracts, 42 posters, and 6 video presentations were submitted by THEi students and exhibited in a hybrid mode. The Best Department Poster Awards, Most Popular Poster Awards, and Most Popular Video Awards were given to the most outstanding work. Overall, the event attracted over 1,372 visitors. (Appendix 24)
- Team leader TSANG Wai Kei and team member LEUNG Tsui Yan arranged a site visit at the Integral Institute at Guilin, Guangxi to conduct pilot studies on sustainable dining from 17-19 December 2024. A total of 12 staff members and students joined the site visit. (Appendix 25)

(ii) Please provide reports on asset purchase such as acquisition of research facilities, communal equipment, software licence, dataset and / or status of infrastructure / physical research structure building such as research centre, research supporting unit (if applicable).
(Please provide supporting documents and / or photos, and provide the utilization rate.)

- The CIFU had been established at THEi campuses: both the FBRL and FBCL had been set up at Tsing Yi (Room 801 & Room 1001) and Chai Wan (N1035 & N919).

(Appendix 3)

- All new equipment for the FBRL and FBCL had been purchased and installed. They had been tested and in use. Utilization rates of the equipment are recorded. (Appendix 26)
- A homepage (in both English and Chinese) for the CIFU had been established. (Appendix 27)
- The 1st and 2nd CIFU Newsletter were published. (Appendix 28)

(iii) Please provide reports on research activities carried out (if applicable).

With the establishment of the CIFU and the installation of all new equipment, the research capacity of THEi had been strengthened. Various interdisciplinary research activities had been carried out by THEi staff members, researchers, and students on the theme of "Sustainable Living", focusing on food by-products utilization.

- The CIFU members commenced new research idea on revitalization of eggshell (a food by-product from bakery industry) to produce value-added products, with cooperation and collaboration with industry partners and THEi's students.

  Research and development for creating bio-polymer for non-edible applications was undertaken at the FBCL. Initial experimentation and testing were conducted in conjunction with final year students and technical staff of the Product Design program. Organic materials including eggshell, coffee bean husk, prawn shell, fish scales, fish bones, and shrimp shell were evaluated to synthesize bio-polymers with a range of physical properties. With the collaborative effort and the use of the new equipment obtained from the CIFU, these experimental materials were examined and eggshell was selected for further improvements in material stability.

  The second stage of the research focused on high temperature treatment and combining with polylactide (PLA), biodegradable substance, to produce eggshell-derive PLA bio-polymer. The research work involved shredding or grinding of eggshell to a powder state and combined it with PLA at high temperature (at melting point of PLA) within custom created metal molds. Once poured into the mold, the bio-polymer was allowed to cure and harden. Results showed promise as the bio-polymer exhibited better physical properties than the air dried and naturally cured versions. Various proportions of eggshell with PLA were created for next stage testing of physical properties. A number of bio-polymer application ideas were generated by the students and technical staff, e.g. whether the bio-polymer can be used as material for 3D printing.

  In the next stage, 3%, 9%, 11%, and 13% of eggshell-derived PLA bio-polymer were evaluated to be used as 3D-printable filaments, which were examined to produced designed cutlery and specimens for testing. The computer controlled electronic universal testing machine was used to examine the properties of the bio-polymers of the following parameters: tensile strength, elongation to break, Young's modulus, elongation to yield, and load of each material.

  Team member CHOY Yip Hong supervised final year students of the Product Design program on research studies using the eggshell-derived PLA bio-polymer on the following themes:

  - Sustainable food container set – the product was made from the bio-polymer, and it was found to be stable, hard, smooth, and water

resistant.
- A tea table with sustainable material – part of the table was made by the eggshell-derived PLA bio-polymer.
- Environmentally friendly stationary set – pen was made by eggshell-derived PLA bio-polymer which is biodegradable.

This new research idea was submitted to Hong Kong Green Innovation Awards 2023 (Title: New polymer to reducing carbon footprint: eggshell PLA bio-polymer) and a recognition of participation was received.

- The CIFU members commenced new research ideas on revitalization of food by-products soy okara, sponge cake scraps, and meat straps to value-added to produce value-added products, with cooperation and collaboration with industry partners and THEi's students.

  Team member LEUNG Tsui Yan worked in collaboration with industry partners Drinks330 and The New Life Psychiatric Rehabilitation Association, and final year students of Culinary Arts and Management program to investigate the use of soy okara for the production of edible utensils. Drinks330 donated soy okara and provided expert advice. Under the supervision of team member LEUNG Tsui Yan, her students examined and evaluated the different combinations of soy okara on product durability. The students also tested the effect of adding different flavors to edible teaspoons to create a new dining experience.

  In a second research project, team member LEUNG Tsui Yan revitalized soy okara and used it to replace flour for making sponge cakes.

  In a third research project with an industry partner, team member LEUNG Tsui Yan collaborated with The Meat Lab to revitalize meat straps and transformed them to pet snacks. The experimental procedures included freeze-dried and grinding of the raw materials and addition of flavors to produce pet snacks. The research work involved research assistant and final year student of Culinary Arts and Management program. This innovative idea and the products had been recognized as they had formed a team (U-Treats) and won the 2nd runner-up in a local competition (Food Waste Recycling Promotion Campaign) organized by The Hong Kong Community & Construction Association (HKCCA) in 2023; obtained start-up fund and award (HKSTP Ideation Award; HK$100,000) in Jan 2024 and the 2nd THEi – Lions Clubs Enterprise Start-Up Competition (HK$100,000) in July 2024.

  The U-Treats also disseminated the research deliverables in public setting to promote the concepts of "Sustainable Living" and innovation for food by-products utilization.

- The new equipment obtained for the establishment of the CIFU had laid a strong foundation for new innovative research ideas and initiatives in "Sustainable Living".

  Team member TSANG Chi Wing started a new research project using the gel permeation chromatography system (GPC) to analyze the modular weight (MW) of lignin derived from wood waste. The objective of his new research project, funded by Environment and Conservation Fund (ECF), was to develop nano-fiber materials using electrospinning method. In-depth understanding of the MW of

lignin was crucial for optimizing the electrospinning parameters and ensuring the quality of the resulting nano-fiber.

Samples of lignin were extract from wood waste, purified and dissolved in solvents. The GPC was calibrated and used to determine the MW of the samples. Using suitable column filled with porous beads, this size exclusion method allowed effective separation and precise determination of the MW and polydispersity of the lignin samples, which directly influenced the viscosity of the solutions used for electrospinning. By adjusting the electrospinning parameters, team member TSANG Chi Wing was able to create high quality nano-fiber materials. The GPC analysis not only validated the suitability of lignin for electrospinning, but also maintained the consistency of the quality of lignin, contributing significantly to the overall success of the research project.

Team member TSANG Chi Wing utilized the polymer compounding machine to initiate a new research idea to develop catalysts for efficient production of hydrogen from hydrogen storage materials. The research work was under the Faculty Development Scheme (UGC/FDS25/E08/20 and UGC/FDS25/E04/22). The polymer compounding machine was ideal for achieving a homogenous mixture of catalyst precursors, including metal salts and carbonaceous materials, which were crucial for optimizing catalytic performance. The polymer compounding machine, specifically a twin-screw extruder, created intense mechanical shear and heat to promote thorough dispersion of the catalyst precursors. This step was vital as uneven mixing could lead to inconsistent properties of the catalysts.

The homogenous mixtures were ground into fine powder for pyrolysis, leading to the formation of metal nanoclusters. The products were characterized to evaluate the structural integrity (e.g. SEM, TEM, HAADF-STEM, XANES) and activity of the catalysts. This systematic approach, leveraging the capabilities of the polymer compounding machine and furnace, significantly facilitated the completion of the research objectives on hydrogen production towards more efficient energy storage solutions.
Team member TSANG Chi Wing supervised two final year students of Environmental Engineering and Management program on the following themes:

- Bio-based filter materials and their economic impact – this project investigated the potential use of renewable bio-polymers as electrostatic and antibacterial materials from lignin.
- Analysis of a one-pot process of valorization of lignocellulosic biomass to fine chemicals – this project examined the techno-economic aspects of valorization of lignocellulosic biomass.

- Team member FONG Lai Ying and her colleagues carried out food revitalization experiments on the following food by-products:
  - Bread crust collected from industry partners MacField and A-1 Bakery was pulverized to bread flour to produce a variety of bakery items.
  - Ugly strawberries collected from local fruit wholesale were washed, dehydrated, and freeze-dried as ingredients for making fruit flavored muffins.
  - Soy okara collected from soy processing plants and spent grain collected from local SME breweries and manufacturers were dehydrated to less than 1% moisture content using heat treatment and freeze-dried to achieve the best quality with retention of its best nutritional value and appearance.

They were homogenized and pulverized as main ingredients for making plant-based meat, meat ball, and sausages.

- Sweet corn pomace collected from local corn drinks manufacturers was used to produce high fiber healthy snack for corn roll.
- Green vegetables (excess, left-over, and low-grade stem parts) collected from local vegetable traders were washed, pulverized, and freeze-dried as ingredients for making high fiber and multi-vitamins healthy cookies.
- Low-grade or under-utilized fish (e.g. mullet) provided by local fishery farmers was processed as major ingredients to produce high protein-rich fish noodles and nutritious fish sausages.

- Team leader TSANG Wai Kei used the fermentor system for scale-up experiments to enhance the production of extracellular phytase from *Pichia pastoris*. Different fermentation parameters (e.g. baffle speed, number of baffles, aeration, biomass size, feeding scheme) were evaluated to maximize production of extracellular phytase which could be used to releases tightly bound inorganic phosphate in natural environment.

6.2 Please describe where and how the IDS Research Infrastructure Grant project assisted in building up the research capacity of the institution in its strategic areas (e.g. has the IDS Research Infrastructure Grant project facilitated the academics in formulating their research proposals under the Faculty Development Scheme, etc.).

The IDS Research Infrastructure Grant project provided support to the establishment of the new Centre for Interdisciplinary Research on Food By-products Utilization (CIFU) at THEi for research and development programs and activities in the area of food by-products utilization. The establishment of the CIFU serves as a platform for talented staff members of THEi to engage in interdisciplinary research activities in line with THE's strategic research plan on the theme of "Sustainable Living". The CIFU is positioned to focus on research programs of sustainable innovation of natural resources with the establishment of two new Labs: the Food By-products Revitalization Lab (FBRL) and the Food By-products Conversion Lab (FBCL). These two new Labs are responsible for research projects on sustainable innovation of food by-products in edible and non-edible applications using a wide of approaches.

The research capacity of THEi had been strengthened significantly with the establishment of the CIFU a few years ago. In particular, synergies had been evident among staff members, technicians, and students from different departments and programs in forming new research ideas and initiatives in interdisciplinary research, including but not limited to food by-products utilization and other related areas. Those new research projects also involved collaboration and support from industry partners and relevant stakeholders as they unanimously concurred the objectives and deliverables of the CIFU. Intimate and strong network with the industry is crucial to the success of the CIFU in promoting the concepts of "Sustainable Living" to the general public and our next generations for a better Hong Kong in terms of sustainable future.

The IDS Research Infrastructure Grant project provided support to the CIFU to acquire new equipment which definitely laid an important foundation for new research development in sustainability and innovation. THEi staff members, researchers, technicians, and students are able to develop new research ideas for food by-products utilization and other related aspects with the new equipment. Four research proposals had been formulated with the support of the IDS Research Infrastructure Grant and the establishment of the CIFU under the Faculty Development Scheme (FDS), as shown

below:

Principal Investigator	Title of the Research Proposal	Funding Sources and Reference No.	Total Awarded
TSANG Chi Wing	Development of Intrinsically Safe Rechargeable Nickel-Zinc Batteries with Tunable Hydrogel Electrolyte-integrated Covalent Organic Frameworks	Faculty Development Scheme UGC/FDS25/P01/24	HK$ 1,059,747
CHAN Cho Yin	Development of a novel energy saving-low CO_2 emission wastewater treatment approach by using microalgae-bacteria consortia immobilized with magnetic biochar nanocomposites	Faculty Development Scheme UGC/FDS25/E01/24	HK$ 1,088,369
TSANG Chi Wing	Development of synergistic dual-atom catalysts with high activity and superior durability for catalytic hydrogen release reactions	Faculty Development Scheme UGC/FDS25/E04/22	HK$ 1,199,610
CHAN Cho Yin	Feasibility study on innovative hybrid wastewater treatment design for achieving carbon and energy neutrality by using forward osmosis-anaerobic membrane bioreactor (FO-AnMBR) with microalgae post-treatment	Faculty Development Scheme UGC/FDS25/E05/22	HK$ 1,439,096

Four other new research proposals were financially supported by the HKSAR Government's Research Matching Grant Scheme, details are shown in 7.1.

6.3 If the project has not met its original objectives, why?

N/A

6.4 (a) Please provide details e.g., title, authorship, publication dates, etc. and attach an abstract of each publication reported. Please place asterisks on publications involving inter-institutional collaborations.

Publications (Team members and research staff of the CIFU are bolded)

- **Choy YH**, Luk CM (2024) Helping reduce food by-products waste and disposable plastic: 3D printed eggshell-PLA material. Discover Sustainability (Submitted).
- Chan EMH, Cheung J, Leslie CA, Lau YY, **Suen DWS**, **Tsang CW** (2024) Revolutionizing the textile and clothing industry: pioneering sustainability and resilience in a post-COVID era. Sustainability 16:2474.*
- Zhu C, Xia Y, Long Y, Li L, Xie Y, Deng T, Yang K, **Tsang CW**, Ouyang S (2024) Synergistic effect during co-pyrolysis of tea seed shell and waste printed circuit board: thermogravimetric characteristics and operation parameter optimization. Energy Resources, Part A: Recovery, Utilization, and Environmental Effects 46:15773-15790.*
- Xia Y, Zhu C, Ouyang S, Yang Y, Xie Y, Deng T, Li L, Yang K, Xiao Y, **Tsang CW** (2024) Thermogravimetric characteristics and evaluation of products during pyrolysis of *Camellia oleifera* seed residues. Biomass Conversion and Biorefinery

doi:10.1007/s13399-024-05342-6.*

- Shen W, **Suen DWS**, Sze ETP, Chen X, Liang C, **Tsang CW** (2023) Co-MoC_x supported on N-doped CNTs for efficient hydrogen evolution reaction under alkaline medium conditions. New Journal of Chemistry 47:21024-21032.*
- **Suen DWS**, Chan EMH, Lau YY, Lee RHP, **Tsang WK**, Ouyang S, **Tsang CW** (2023) Sustainable textile raw materials: review on bioprocessing of textile waste via electrospinning. Sustainability 15:11638.*
- **Lee HY**, **Leung TY**, Kwok YW (2023) Synergy of the municipal solid waste (MSW) charging scheme with different strategies for food waste recycling in Hong Kong. E3S Web of Conferences 379.
- Poon PC, Wang Y, Li W, **Suen DWS**, Lam WWY, Yap DZJ, Mehdi BL, Qi J, Lu XY, Wong EYC, Yang C, **Tsang CW** (2022) Synergistic effect of Co catalysts with atomically dispersed CoN_x active sites on ammonia borane hydrolysis for hydrogen generation. Journal of Materials Chemistry A 10:5580-5592.*
- Poon PC, Lee KM, Wang Y, Lam WWY, Leung PS, Lu XY, Li W, Mehdi BL, Lu Y, **Tsang CW**, Wong EYC (2021) Synthesis of metal nanoparticles supported on carbon nanotube with doped Co and N atoms and its catalytic applications in hydrogen production. Journal of Visualized Experiments doi:10.3791/62955.*
- Du B, Chen X, Ling Y, Niu T, Guan W, Meng J, Hu H, **Tsang CW**, Liang C (2022) Hydrogenolysis-isomerization of waste polyolefin plastics to multi-branched liquid alkanes. ChemSusChem doi:10.1002/cssc.202202035.*
- Ouyang S, Zhu C, Xia Y, Yang Y, Zhang C, **Tsang CW**, Xiong D, Li L, Yang K (2022) Synergistic effect of co-pyrolysis of tea seed shells and scrap tyres and product evaluation. Biomass Conversion and Biorefinery doi:10.1007/s13399-022-03617-4.*

Conference (Team members and research staff of the CIFU are bolded)

- **Choy YH**. Revolutionizing manufacturing: embracing additive manufacturing with eggshell polylactide (PLA) polymer. In ICCPS 2023 International Conference on Chemistry and Polymer Science (4-5 December 2023).
- **Lee HY**, **Leung TY**, Kwok YW. Synergy of the municipal solid waste (MSW) charging scheme with different strategies for food waste recycling in Hong Kong. In 13th International Conference on Future Environment and Energy, Sophia University, Tokyo, Japan (13-15 January 2023).
- **Lee HY**. Recipe development on edible spoon by the valorization of okara (soybean residue) and its durability examination. In Food Innovation Asia Conference 2023 – Future Food for Sustainability, Health and Well-being, Bangkok, Thailand (15-17 June 2023).
- Ubead SM, **Leung TY**. Sensory analysis on novel recipe formulation using food by-products. In Food Innovation Asia Conference 2023 – Future Food of Sustainability, Health and Well-being, Bangkok, Thailand (15-17 June 2023).
- **Leung TY**. Addressing environmental awareness on purchase intention on upcycled food products. In International Conference on Food and Nutrition, Las Vegas, USA (24-25 July 2023).
- **Suen DWS**, Wong WK, Leung LY, **Tsang CW**. $CoMn_xN_y$ supported on carbon nanotube with atomically dispersed Co active sites for efficient hydrogen generation from hydrolysis of ammonia borane. In 3rd International Conference on Carbon Chemistry and Materials, United Scientific Group (26-27 Oct 2023).*
- **Tsang CW**, **Suen DWS**, Liang H, Wong WK, Tang SK. Synergist function of nanocluster and single atom catalysts for exceptional performance in hydrogen production form solid hydrogen storage materials. In International Conference on Recent Advances in Chemistry, United Kingdom (8-9 November 2022).*

- **Tsang CW**, **Suen DWS**, Wong WK, Lui KH, Tang SK. Lignin-derived electro-spun fiber for filtration applications. In The 10th International Conference on Sustainable Development 2022, Rome, Italy (7-8 September 2022) (Virtual Conference).*
- Ho MY, **Leung TY**. Recipe development on edible cutlery in using okara (soybean residue) and its decomposition process. In APacCHRIE 2022, Malaysia (23-25 May 2022) (Virtual Conference).
- Lai LY, **Leung TY**. Analyzing customers' purchase intention towards restaurants with corporate social responsibility by augmenting the theory of planned behaviour. In APacCHRIE 2022, Malaysia (23-25 May 2022) (Virtual Conference).
- Shahid MU, **Leung TY**. Upcycled food products: the effects of mental stimulants on consumers' willingness to purchase (WTP). In APacCHRIE 2022, Malaysia (23-25 May 2022) (Virtual Conference).
- Yau SW, **Leung TY**. Lactose-free Canelé Recipe development and the acceptance of lactose-free dessert among HongKongers. In APacCHRIE 2022, Malaysia (23-25 May 2022) (Virtual Conference).
- Mak CP, **Leung TY**. Motivations and challenges in affecting the intention to sue edible cutlery. In APacCHRIE 2022, Malaysia (23-25 May 2022) (Virtual Conference).
- Ho KY, **Leung TY**. Using okara powder as partial flour replacement in sponge cake. In Twelfth International Conference on Food Studies, New York, USA (22-23 October 2022).
- **Choy YH**. Bio-polymer materials for sustainable consumer and medical applications. In XVI International Conference on Green Industries and Sustainability (ICGIS) 2022, Auckland, Australia (1-2 December 2022).
- Poon PC, Lee KM, **Tsang CW**, Leung PSW, Liang H, Lam WWY, Wong EYC, Chan EMH, Ho DCK. Fabrication of carbon-based single-atom catalysts using pyrolytic decomposition of g-C_3N_4 for hydrogen energy production. In The 6th International Conference on New Energy and Future Energy Systems (NEFES 2021) (1-4 November 2021) (Virtual Conference).*

(b) RGC funding should have been acknowledged in all activity(ies) / publication(s) / conference(s) papers listed in (a) above. If no acknowledgement has been made in any of the event / publication / paper, please indicate and provide explanations.

N/A

6.5 Research staff trained

(Please provide names and capacities of research staff trained and elaborate on what training has been provided.)

1. – Worked under the FBCL, trained in making catalytic materials, procurement of equipment and chemical reagents, operation and maintenance of ball milling machine and GPC, and organization of the CIFU's activities.
2. – Worked under the FBCL, trained on construction of yeast strains, data analysis, and operation and management of fermentation system.
3. – Worked under the FBCL, trained on controlling the computer controlled electronic universal testing machine for tensile testing, contributing to training workshops and preparation of creative visuals, and carrying out experiments and drafting manuscripts.
4. – Worked under the FBRL, trained in developing edible food products and performing consumer behavior research.

5. – Worked under the FBRL, trained in developing edible food products. He was Culinary Arts and Management final year student and upon graduation, he was hired as part-time research assistant for the CIFU.
6. – Worked under the FBCL, trained to use the gel permeation chromatography instrument for analysis of the wood waste-derived electro-spun nanofibers for filtration applications.
7. – Trained on making mill for grinding up and preparation of freeze-dried food by-products soy okara and spent grain as natural food ingredients and dietary-fiber supplement to enrich plant-based meats and sausage.

6.6 Specific products
(e.g. patents, software or netware, instruments or equipment, infrastructure developed)

The following new products and techniques had been produced from the CIFU:

- Novel eggshell-derived PLA bio-polymers had been generated.
- Pet snacks had been synthesized from meat straps.
- Edible utensils had been made from soy okara.
- Soy okara replaced flour for making sponge cakes

6.7 Other education activities and / or training and development

- Training sessions for all new equipment were organized for THEi's staff members and students.
- Education activities for the new products and techniques mentioned in 6.6 were organized for secondary students and visitors in various occasion to promote the concepts of "Sustainable Living" and the importance of sustainability and innovation to academics, external stakeholders, and the general public.

6.8 Please highlight any deliverables indicated in the project implementation timetable endorsed by RGC, which have not been covered or achieved as per sections 6.1 to 6.7 above, and explain / elaborate.

N/A

6.9 Please elaborate the role of the managing team in coordinating and managing the project.

The managing team consists of the management and research teams for the CIFU had been set up. They monitored and reviewed the progress and development of all activities at the CIFU, including establishment of the two new Labs, acquisition of equipment, recruitment of research assistants, networking among academia, relevant industry partners, and other stakeholders. The managing team also discussed and provided solutions and advice to any obstacles and problems encountered. Regular meetings among the CIFU team members had been organized in a regular basis. Minutes of the meetings are shown in Appendix 37.

The CIFU is organized as follows:

Team leader is the Manager of the CIFU and all team members are the Project Officers. They monitor all daily research and administrative work of the two Labs. The team leader leads the CIFU in setting up new research initiatives and conducting networking activities with external stakeholders for collaboration. He also provides guidance to team members in drafting research projects, project management, and the preparation of

manuscript for publication. The Project Officers supervise research assistants recruited for different research projects and execute research work in accordance with pre-set timelines. All expenditure was spent strictly in accordance with the RGC-approved budget. All new equipment obtained for the CIFU had been properly managed by the Manager and the Project Officers. They had taken the role and responsibility to keep user records, training, daily operation, and maintenance. All new equipment had been made available to all THEi staff members, students, and other local tertiary education institutes.

7. Awards And Recognition

7.1 Have any research grants been awarded that are **directly** attributable to the results obtained on this IDS Research Infrastructure Grant project? *(Please provide details)*

The following eight new research proposals were awarded:

Principal Investigator	Title of the Research Proposal	Funding Sources and Reference No.	Amount Awarded
TSANG Chi Wing	Development of intrinsically safe rechargeable nickel-zinc batteries with tunable hydrogel electrolyte-integrated covalent organic frameworks	Faculty Development Scheme UGC/FDS25/P01/24	HK$1,059,747
CHAN Cho Yin	Development of a novel energy saving-low CO_2 emission wastewater treatment approach by using microalgae-bacteria consortia immobilized with magnetic biochar nanocomposites	Faculty Development Scheme UGC/FDS25/E01/24	HK$1,088,369
TSANG Chi Wing	Development of synergistic dual-atom catalysts with high activity and superior durability for catalytic hydrogen release reactions	Faculty Development Scheme UGC/FDS25/E04/22	HK$1,199,610
CHAN Cho Yin	Feasibility study on innovative hybrid wastewater treatment design for achieving carbon and energy neutrality by using forward osmosis-anaerobic membrane bioreactor (FO-AnMBR) with microalgae post-treatment	Faculty Development Scheme UGC/FDS25/E05/22	HK$1,439,096
LU Xiaoying	Development of a green catalyst for bio-jet fuels production and its techno-economic evaluation of different process options	Research Matching Grants	HK$525,000
LU Xiaoying	Encapsulation of transition metal oxides (TMOs) in electrospun carbon nanofibers (CNFs) as advanced anode materials for lithium-ion batteries	Research Matching Grants	HK$437,500
TSANG Chi Wing	Techno-economic evaluation of hydrogen storage materials recycling processes and sensitivity analyses of power-to-hydrogen processes	Research Matching Grants	HK$525,000
LU Xiaoying	Evaluation of sustainable development capability in the Greater Bay Area based on the data envelopment analysis (DEA) method	Research Matching Grants	HK$615,000

7.2 Other awards and recognitions as a result of this IDS Research Infrastructure Grant project *(Please specify)*

- Recognition of participation in Hong Kong Green Innovation Awards 2023 (Title: New polymer to reducing carbon footprint: eggshell PLA bio-polymer)
- One of the research deliverables had been transformed into a start-up proposal for a local competition (Food Waste Recycling Promotion Campaign) organized by The Hong Kong Community & Construction Association (HKCCA) in 2023. U-Treats, a team led by team member LEUNG Tsui Yan and her research assistant and student of the Culinary Arts and Management program, developed a new idea to revitalize meat straps to pet snacks (upcycled pet treats) and won the 2nd runner-up and awarded HK$100,000 as entrepreneurship start-up fund.
- The U-Treats further obtained start-up fund and award (HKSTP Ideation Award; HK$100,000) in Jan 2024 and the 2nd THEi – Lions Clubs Enterprise Start-Up Competition (HK$100,000) in July 2024.

8. Other Impacts

8.1 What are the current and expected impacts of the project in terms of its contribution to the local and regional economic and societal well-being? *(e.g., technology transfer, collaboration with external organizations, etc.)*

The establishment of the CIFU had fulfilled all pre-set objectives to enhance the research capacity and expertise of THEi's staff members, researchers, and students; to strengthen research synergy; to encourage interdisciplinary research among staff members, students, and external stakeholders relevant to sustainability and innovation; to establish a platform to showcase the research deliverables of the CIFU and promote the concepts of "Sustainable Living" to the general public and industry partners.

Through numerous promotion and networking activities, the CIFU had gained both local and regional recognition and new collaborative projects had been initiated, some of them were successfully completed and some are still in progress.

THEi was approached by an industry partner, the Integral Institute located at Guilin, Guangxi recently to explore potential collaboration in institutional dining and employee well-being. In view of the objectives of the establishment of the CIFU, the CIFU team arranged a couple of meetings with the representatives of the Integral Institute and a site visit to Guilin in December 2024 to plan and develop two new interdisciplinary research projects on institutional dining and employee well-being. The two projects are: 1) Study of well-being and competencies of employee under institutional dining via cognitive approach; and 2) Circular landscape practices design and management of a sustainable development garden. The first project focuses on three areas: 1) employee physical well-being; 2) employee perceived well-being and work-related competencies; and 3) cognitive approach for sustainable dining practices. The second project focuses on incorporation of circular landscape practices and sustainable management and recycling of food by-products.

The two projects not involve the staff members of the Integral Institute, but also the staff members and students of the Department of Sport and Recreation, Department of Hospitality and Business Management, and Department of Design and Architecture, and the CIFU team leader and members. This collaboration will pave ways for the establishment of a new applied research centre between THEi and industry to promote cross-disciplinary research and external research funding support.

8.2 Others *(Please specify)*

N/A

9. Statistics on Research Outputs

	Peer-reviewed Journal Publications	Conference Papers	Scholarly Books, Monographs and Chapters	Patents Awarded	Other Research Outputs (please specify)	
No. of outputs arising directly from this project	11	16	N/A	N/A	Type	No.
					N/A	N/A

10. Sustainability of The IDS Research Infrastructure Grant

10.1 Whether there are new ideas evolved **directly** from the project?

- Team member CHOY Yip Hong led a new research project on the synthesis of eggshell-derived PLA bio-polymer.
- Team member LEUNG Tsui Yan revitalized soy okara for making edible utensils and to replace flour for making sponge cakes
- Team member LEUNG Tsui Yan revitalized meat straps for making pet snacks.
- Team member TSANG Chi Wing original employed the gel permeation chromatography to evaluate the properties of covalent organic framework (COF) for catalysis. After structural elucidation, he then discovered that it could also be used in NiZn battery research because of the specific pore size of the COF tunnel. Afterwards, TSANG Chi Wing successfully generated another new research proposal to employ the COF to solve the intrinsic problems in the NiZn battery.

10.2 Whether there are new projects evolved **directly** from the project?

- Synthesis of eggshell-derived PLA bio-polymer
- Production of pet snacks from meat straps
- Production of edible utensils from soy okara
- Replacement of flour by soy okara for the production of sponge cakes
- Making of plant-based meat, sausages, crispy chips, and taco pastry using food by-products (e.g. bread crust, unsold white toast, and spent grains)
- Use of lignocellulosic biomass for preparation of single-atom catalysts for efficient hydrogen generation from hydrogen storage materials (e.g. ammonia borane)

10.3 Whether there are new collaborations developed **directly** from the project?

Intra-institutional collaborations

- Team leader TSANG Wai Kei and team member TSANG Chi Wing initiated collaborative

inter-disciplinary projects with staff members of the Fashion Design programme of the Department of Design and Architecture for research on sustainable textile materials and the processing techniques such as electrospinning. They co-authored a journal publication.

- Team leader TSANG Wai Kei and team member TSANG Chi Wing prepared a new research proposal for lignin revitalization which was submitted to UGC in 2022.
- Team member CHOY Yip Hong collaborated with team member FONG Lai Ying to work on eggshell-derived bio-polymers.

Collaborations with external stakeholders

- Team member TSANG Chi Wing engaged in joint research studies on thermogravimetric analysis and catalytic processes of food by-products such as *Camellia oleifera* seed by-products, contributing to advancements in energy storage (with Dalian University of Technology) and waste conversion (with Jiangxi University of Science and Technology).
- Team member LEUNG Tsui Yan engaged in joint research studies on food by-products with industry partners Drinks330, The New Life Psychiatric Rehabilitation Association, and The Meat Lab to revitalize soy okara and meat straps to value-added products.
- Team members CHOY Yip Hong and Fong Lai Ying collaborated with iBakery to revitalize eggshell to create eggshell-derived PLA bio-polymer.
- Team leader TSANG Wai Kei and team member LEUNG Tsui Yan facilitated two new collaborative projects with an industry partner, the Integral Institute located at Guilin, Guangxi. Staff members from other departments (i.e Department of Sport and Recreation, Department of Hospitality and Business Management, and Department of Design and Architecture) joined these two projects, together with students from their departments. The two projects are: 1) Study of well-being and competencies of employee under institutional dining via cognitive approach; and 2) Circular landscape practices design and management of a sustainable development garden.

10.4 Please give details on how much money and from which sources has been obtained for the specific purpose of continuing the work started under this IDS Research Infrastructure Grant project.

- Team member LEUNG Tsui Yan and her research assistants developed protocols to revitalize meat straps to pet snacks and won three competitions (i.e. Food Waste Recycling Promotion Campaign; HKSTP Ideation Award; THEi – Lions Clubs Enterprise Start-Up Competition) for a total of HK$300,000 to support the research work.

11. Public Access Of Completion Report

(Please specify the information, if any, that cannot be provided for public access and give the reasons.)

Information that Cannot Be Provided for Public Access	**Reasons**
N/A	N/A

RGC Ref. No.:
UGC/IDS(R)25/20
(please insert ref. above)

INSTITUTIONAL DEVELOPMENT SCHEME (IDS)
RESEARCH INFRASTRUCTURE GRANT

Summary of Completion Report
(Please list all the stages since project inception)

Project Title: Establishment of the Centre for Interdisciplinary Research on Food By-products Utilization (CIFU)

Stage Completed	**Period**						**Milestones**	
	(Month / Year) to (Month / Year)						**Deliverables to be Achieved[2] (Please summarize in three bullet points where details should be left to the report proper)**	**% of Each Deliverable Achieved[3]**
Year 1	Jan / 2021 to Dec / 2021						1. Established the Centre for Interdisciplinary Research on Food By-products Utilization (CIFU) 2. Established the two new labs: Food By-products Revitalization Lab and Food By-products Conversion Lab 3. Procured and installed all new equipment in the two new labs	1. 100% 2. 100% 3. 100%
Year 2	Jan / 2022 to Dec / 2022						1. Developed research proposals and supported participation of local and / or international conferences 2. Organized research symposia and developed training and promotion materials for the CIFU 3. Organized workshops, taster programs, and promoted collaborative activities among THEi's staff members, researchers, and different stakeholders	1. 100% 2. 100% 3. 100%

Stage Completed	Period						Milestones	
	(Month / Year) to (Month / Year)						Deliverables to be Achieved[2] (Please summarize in <u>three</u> bullet points where details should be left to the report proper)	% of Each Deliverable Achieved[3]
Year 3	Jan / 2023 to Dec / 2023						1. Developed research proposals and supported participation of local and / or international conferences 2. Organized workshops, taster programs, and promoted collaborative activities among THEi's staff members, researchers, and different stakeholders 3. Organized annual staff research symposium and student research symposium	1. 100% 2. 100% 3. 100%
Total to-date:								

Note: [1] Justifications for significant under-spending or over-spending (≥ ±10%) should be given in **section 5.1** of the completion report.
[2] The key milestones to be achieved by the project within the respective stage as indicated in the approved implementation timetable.
[3] Justifications for significant slower rate of progress compared with the approved implementation timetable should be provided in detail in **section 4** of the completion report.