

Summary report on the 10th 3R International Scientific Conference on Material Cycles and Waste Management (3RINCs2024)

3RINCs2024 steering committee
(JSMCWM)

15 – 17 March 2024

I. Introduction

Japan Society of Material Cycles and Waste Management (JSMCWM) has been hosting a successful world congress of the “3R International Scientific Conference on Material Cycles and Waste Management” (3RINCs), since 2014 held in Kyoto, followed annually in Daejeon, Hanoi, New Delhi and Bangkok, respectively. In the 3RINCs, researchers, experts and concerned parties from all over the world are participating to discuss the latest scientific findings and outcomes on waste management from the aspects of the 3Rs, resource circulation and circular economy as well as the latest information and trends in policy development, private sector technology development, and NGO activities. In particular, in recent years, efforts to deal with global issues such as climate change and plastic pollution have become more active, and unique research, activities and trials have been introduced. Moreover, JSMCWM are keen to strengthen knowledge sharing and network building with related parties around the world through the platform of 3RINCs.

The 10th 3R International Scientific Conference on Material Cycles and Waste Management (3RINCs2024) was held both onsite in Sydney, Australia (15 – 17 March 2024) and online, co-organized by JSMCWM, Korea Society of Waste Management (KSWM), Solid Waste Management Association Thailand (SWAT), India International Society of Waste Management, Air and Water (ISWMAW), and Transformation of Reclaimed Waste into Engineered Material and Solutions research hub (TREMS research hub). Ministry of the Environment Japan (MOEJ), Japan International Cooperation Agency (JICA), and United Nations Centre for Regional Development (UNCRD) and 33 companies and organizations also cooperated and sponsored, with special cooperation from the Kyoto Cho-SDGs Consortium, Hokkaido University, and SUM2024.

The three-day conference consisted of four sessions; Plenary session, General session, Special session, and Poster session with highlighting a variety of topics on 3Rs and waste management in driving scientific knowledge and technologies, advancing policy and behavioural changes, and increasing outreach and awareness to accelerate the sustainable society to achieve the SDGs. The expansion of its scope to critical issues such as circular economy, disaster waste management, and plastic pollution, and also a new trend of the Digital Transformation (DX) was also showcased.

In result, more than 195 participants including academia, experts, national authorities, international agencies, private sector, and civil society from 17 countries/regions joined the 3RINCs2024.

More information is shown in the following links.

- Homepage: <https://www.3rincs.org/2024/>
- Programme: <https://www.3rincs.org/2024/program/>

II. TREMS research event

On 15th March, TREMS research hub presented the latest research in Australia in collaboration with industry. The TREMS research hub is the network bringing together leading scientists, researchers and industrial experts from nine Australian universities and 36 state, industry and international partners and will be led by RMIT and Melbourne Universities. Prof Vivian Tam (Western Sydney University) and Prof Sujeeva Setunage (RMIT University) gave opening remarks and introduced the TREMS research hub. Presentations were followed by a general discussion hosted by Prof Priyan Mendis (University of Melbourne) on the following four topics.

- i. Ash Development Association of Australia (Craig Heidrich)
- ii. A W Edwards | Australian Construction and Fitouts (Tanzin Authoi)
- iii. Vital Chemical (Letiscia Xavier)
- iv. Apartment waste management: challenges and opportunities (hosted by Prof Ralph Horne)

III. General Session

In the 3RINCs2024, five (5) general sessions were held during the conference from 16 & 17 March. Each session consisted of pitch talks and online presentations. The topics of general sessions covered i) Waste utilization and treatment, ii) Demolition, disaster, industrial, hazardous waste, iii) Technology, iv) LCA and Flow Analysis, v) Policy and behavior. The Pitch Talks were fascinating scientific presentations that briefly described the presenters' research and invited discussion about each poster. In the online presentations, presentations from around the world were followed by a lively discussion during the Q&A session.



Photo. A scene from the Poster Session

Session 1: Waste utilization and treatment

Experts from countries such as Korea, Japan, Thailand, India, and China participated in this session, which covered a wide range of the latest research on waste utilization. Pitch Talk presentation topics included evaluation of waste incineration systems using CO₂ capture technologies, enhanced resource extraction from waste (including organic and inorganic waste), analysis of resident behavior and motivation, and carbon footprint studies of home-delivered plastics. Online presentations included livestock manure processing methods, efficient removal of methyl orange, activation energy of biomass decomposition, carbon footprint of plastic packaging by food delivery, and livestock waste utilization.

Session 2: Demolition, disaster, industrial, hazardous waste

This session featured 11 pitch talks and 5 online presentations from around the world, including Japan, Austria, Korea, Indonesia, and Vietnam. Pitch Talk topics ranged from greenhouse gas emissions from marine plastic recovery and recycling, graphene reinforced concrete, wood biomass fly ash, e-waste, stabilization of contaminated soil with steel slag, soil remediation, and other construction waste upcycling. Online presentations were given on topics such as E-Waste management in Vietnam, asbestos detection methods in disaster waste, and waste tire rubber reinforced cement, with lively discussions following each presentation.

Session 3: Technology

In this session, 14 pitch talks and 4 online presentations were given. The pitch talks presented research results using the latest IT technologies, including AI-based plastic waste sorting robot technology and machine learning to improve the performance of fly ash-based geopolymers. In addition, research results on cutting-edge technologies, mainly waste treatment technologies, were presented, including proper treatment of solar panels, microplastics, biomimicry, and bioplastics. Online presentations were given on topics such as the interaction between polyvinyl chloride and biomass, mathematical model for the strength of alkali-activated materials, and digital platforms for a circular construction economy.

Session 4: LCA and Flow Analysis

The session featured 13 pitch talks and 4 online presentations with an international flavor from China, Cambodia, Indonesia, Japan, Ecuador, the Philippines, Bangladesh, and Korea. The pitch talks included LCA and material flow analysis for electrical and electronic waste, batteries, lithium, and biodegradable plastics, as well as cost-benefit analysis of resource recovery facilities and economic analysis of plastics recycling. Online presentations included the potential for resource recycling in Vietnam, the informal sector in Indonesia, the distribution of plastic generation using remote sensing technology, a cost-benefit analysis of community waste collection services in Indonesia, and household composting in cities in developing countries.



Photo. A scene from the pitch-talk of general session 4

Session 5: Policy and behavior

The session featured 12 pitch talks and 4 online presentations focusing on waste management

policies and citizen behavior change. Pitch Talks included a comparison of greenhouse gas emissions from reusable vs. single-use plastics, citizen reuse of plastic products in Benin, citizen participation in sorting under Sri Lanka's organic farming policy, Australian purchasing policies, trends in food waste use in Japan, a comparison of consumption behavior for green brand toothbrushes in different countries, and a barangay waste management system in the Philippines were some of the specific examples presented from around the world. Online presentations were given on topics such as obsolete cell phone recycling in China, plastic recycling in Samoa, and improving collection and its impact on citizen behavior in isolated area of Kosovo. The online presentations were followed by comments and questions from the audience, which led to lively discussions with the presenters.

IV. Special Session

Ten (10) special sessions were held concurrently with the general sessions. The topics of special sessions covered 1) "Material flow structure in a carbon neutral society" by Prof NANSAI and Prof HIRAI, 2) "Disaster Waste Management" by MOEJ and JSMCWM, 3) "How to manage vehicles in a circular economy – Toward utilizing DPP (Digital Products Passport)" by Prof TAKAOKA and Prof ASARI (JSMCWM and SIP project), 4) "Energy from Biomass and Waste" by Prog Lu and Prof Kalpit Shah (TREMS research hub), 5) "Plastic Circular Economy and Global Plastic Treaty" by KSWM and Solving Plastic Waste CRC (Australia), 6) "Expert consultation on new 3R and Circular Economy Declaration" by UNCRD/DSDG/UN DESA & 3RINCs2024, 7) "Engineered Materials from Reclaimed Resources: Moving from Research to Practice" by Prof Sujeeva Setunage and Prof Priyan Mendis (TREMS research hub), 8) "Policy and social change" by Prof Ralph Horne and Dr Bhavna Middha (TREMS research hub), 9) "Impact of COVID-19 pandemic on waste management and proper waste handling in post-COVID-19 era" by JGSEE and Kasetsart University/NIES 10) "Digital Transformation (DX) and Monitoring Technologies in Environmental Management of Mines and Landfill Sites" by JSMCWM, Hokkaido University and others. In each session, the latest research was shared and discussions were filled with insights from a wide range of perspectives through presentations, panel discussions, and interactive discussions including Q&A sessions with participants.

Session 1: Material flow structure in a carbon neutral society

This session, organized by the NIES and Kyoto University, discussed changes in material flows associated with various changes in the social environment toward a carbon neutral society, including waste collection and transportation, the cement and construction industries, and renewable energy use. In addition to estimating the material consumption of each resource due to changes in society's industries and systems, the economic burden and cost-benefit of recycling were discussed. In addition to the impact in Japan, studies on material flow transition in other Asian countries, such as China, were also shared.

Session 2: Disaster Waste Management

This session was organized by the Ministry of the Environment of Japan and the JSMCWM. The session began with a keynote speech by the Ministry of the Environment of Japan, which described three Asia-Pacific guidelines on disaster waste management and introduced various approaches to mainstreaming disaster waste management. Of particular importance was the association of disaster waste management with hot topics such as sustainability. In addition, since disaster waste is treated and disposed of by local governments, it was emphasized that strengthening the capacity of local governments will lead to the creation of a resilient system in the event of a disaster.

Session 3: How to manage vehicles in a circular economy – Toward utilizing DPP (Digital

Products Passport)

This session was organized by JSMCWM and SIP Project. The session shared knowledge on the current status and trends of end-of-life vehicles and discussed issues for end-of-life vehicle recycling in the Asia-Pacific region toward the achievement of a resource-recycling society and circular economy. In the keynote speeches, the importance of the end-of-life vehicle and lithium-ion battery recycling system framework in Japan and incentives for the utilization of recycled materials were shared. In the panel discussion, environmentally friendly design for efficient automobile recycling and good practices of existing recycling legal systems were introduced.

Session 4: Energy from Biomass and Waste

This session was organized by TREMS research hub. It was emphasized that biomass and organic waste are renewable resources for energy production in the form of heat and electricity and for solid, liquid, and gaseous fuel production. Numerous conversion technologies and processes have been developed and applied to various biomass and waste categories, and examples were presented. In this session, knowledge on the principles and practices of energy generation and fuel production from biomass and waste was shared.

Session 5: Plastic Circular Economy and Global Plastic Treaty

This session was organized by the Korea Society of Waste Management and Solving Plastic Waste CRC (Australia). As international initiatives to prevent plastic pollution are being developed, this session shared academic knowledge on plastic circularization policy and circular economy. The importance of accumulating scientific data based on life cycle assessments and inventory studies was emphasized in promoting plastics recycling policies. In addition, the expected benefits and barriers to the widespread use of alternative plastic materials, such as bioplastics, were shared. It was also discussed that dialogue and coordination among stakeholders in the supply chain are essential to promote the circular economy of plastics.

Session 6: Expert consultation on new 3R and Circular Economy Declaration

This session, organized by UNCRD and 3RINCs2024, emphasized the importance of social and behavioral changes, such as material consumption with improved resource efficiency, in achieving the 2°C carbon budget target, and that we are at a stage where immediate action is required to realize the circular economy. Discussions and results of the Asia-Pacific 3Rs and Circular Economy Promotion Forum to date were shared, and the importance of various initiatives (policy application, lifestyle change, waste data accumulation, etc.) to achieve more ambitious goals and solve problems in the future was recognized.

Session 7: Engineered Materials from Reclaimed Resources: Moving from Research to Practice

This session, organized by TREMS research hub, featured presentations on cutting-edge technologies for converting recycled resources into higher quality construction materials for the circular economy. Six presentations by researchers from Australia, Japan, and Korea discussed how to move from the research stage to the industrial/market level.



Photo. A scene from the presentation of Special Session 7

Session 8: Policy and social change

This session was organized by TREMS research hub and shared the results of a field study that investigated changes in consumer attitudes toward the use of biodegradable straws and reusable containers and packaging plastics, as well as promotional methods effective in changing attitudes.

Session 9: Impact of COVID-19 pandemic on waste management and proper waste handling in post-COVID-19 era

This session, organized by JGSEE, Kasetsart University, and NIES, focused on the impact of the COVID-19 pandemic on waste management and explored adaptation measures for post-pandemic resilience and sustainable waste management. While the pandemic had a temporary impact on each country, including a temporary drop in the amount of municipal solid waste generated, that amount is gradually recovering; on the other hand, infectious waste continues to be generated, and examples of its actual generation and collection and transportation to prevent secondary infections were shared. In Thailand, in particular, issues regarding the disposal of infectious waste at medical institutions were introduced, such as the lack of waste disposal infrastructure, which prevents progress in the disposal process. In Japan, the results of a field survey were reported, including changes in the actual situation of plastic waste generation.

Session 10: Digital Transformation (DX) and Monitoring Technologies in Environmental Management of Mines and Landfill Sites

This session was organized by JSMCWM and Hokkaido University. It was emphasized that mining waste from landfills and utilizing it as a resource will be an important topic in the future. Although cost is an issue at present, it was introduced that mining will become a realistic option if the prices of metals and other resources soar. The possibility of utilizing mined waste as a raw material for cement was also discussed, as well as the possibility of future collaboration between the mining and landfill sectors for previously disposed waste.

V. Networking

On March 15, a total of 54 participants, including researchers, experts, international organizations, national and local institutions, and private companies from around the world, visited the Sydney

Opera House, the Royal Botanic Gardens, and the Harbor Bridge, and made networks among participants.

After the poster session, the networking social event on the evening of March 16 was a great success with Aboriginal performance viewing and speeches from participants and sponsors.



Photo. Technical Tour (the Harbor Bridge, Sydney)

VI. Summary

From March 16 to 17, 2024, a total of 78 general sessions (55 pitch talks and 23 online presentations) and 22 special sessions (22 keynote speeches and panel discussions) were successfully held. In addition, presentations and videos were presented by six sponsors. More than 200 participants from 17 countries (Japan, China, Cameroon, Cambodia, Korea, Samoa, Australia, Thailand, Ecuador, Bangladesh, Indonesia, Taiwan, Vietnam, Austria, Sri Lanka, India, and the Philippines) engaged in lively discussions during the event. All presentations reported cutting-edge research and activities and were highly motivated and future-oriented toward building a sustainable society. Each session was managed by 41 internationally renowned chairpersons, and as in previous conferences, students and young researchers actively participated in the discussions and tried to expand their networks through the conference.



Photo. Participants built networks and enjoyed discussions

VII. Public relation, outreach and networking

3RINCs2024, including the schedule, call for submissions, and registration, was widely communicated to a large number of interested parties, including members of the Japan Society of Material and Waste Management, co-organizers, sponsors, cooperating and supporting organizations, past 3RINCs participants, and international conferences around the world. All communication and outreach materials, including flyers and brochures, were distributed via e-mail and uploaded to the 3RINCs web page (<https://www.3rincs.org/2024/>). Information on general and special sessions was uploaded to the website and social networking sites as soon as it was available, successfully engaging participants, presentation materials were shared with registered participants in advance, and sponsor introductions were incorporated into the e-Proceedings.

The analysis on access of the 3RINCs website was conducted by a member of the steering committee and the following results were introduced.

- The number of accesses to the website between November and March ranged from about 3000 to 11000. The month with the highest number of accesses was January, when the website was renewed this year.

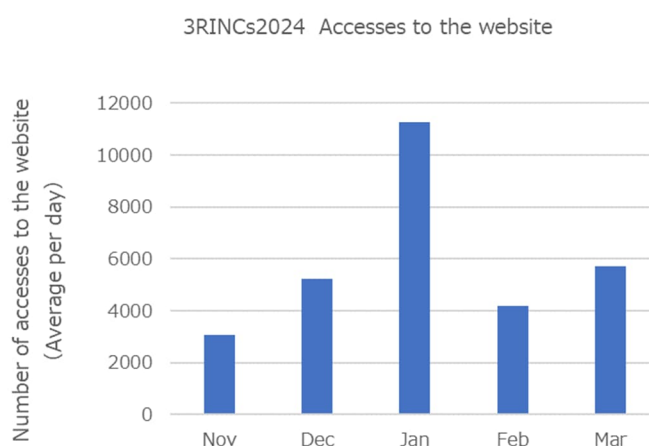


Figure. The number of 3RINCs webpage access in 2024

In addition, the steering committee of the 3RINCs updated the list of stakeholders such as international, national and regional organizations and groups who are engaged in 3Rs and waste management in the world, and invited some representatives from the list to strengthen the collaboration and networking with them for further enhancement of the 3RINCs platform.

VIII. Acknowledgement

The steering committee thanks especially for the following stakeholders who vitally organized and supported the 3RINCs2024. Their continuous supports enable 3RINCs to play a role of a knowledge platform to share latest findings and experiences, and to enhance networking among stakeholder all over the world to overcome challenges, difficulties, and constraints of the global, regional and local crises on waste management.

Organizer

- Japan Society of Material Cycles and Waste Management
- Korea Society of Waste Management
- Solid Waste Management Association Thailand (SWAT)
- India International Society of Waste Management, Air and Water (ISWMAW)
- Transformation of Reclaimed Waste into Engineered Material and Solutions research hub (TREMS research hub)

Supporter

- Ministry of the Environment Japan (MOEJ)
- Japan International Cooperation Agency (JICA)
- United Nations Centre for Regional Development (UNCRD)

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Sponsor (C)

- Vital Chemicals
- ELECSOME

Sponsor (Advertising sponsorship)

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- Japan Industrial Waste Information Center
- JAPAN INDUSTRIAL WASTE MANAGEMENT FOUNDATION
- Japan Waste Research Foundation
- KAJIMA CORPORATION
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- KUBOTA Corporation
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- Kyoto Environmental Preservation Public Corporation
- METAWATER Co., Ltd.
- Nomura Kohsan Co., Ltd.
- NTT DATA INSTITUTE OF MANAGEMENT CONSULTING, Inc.

- Panasonic Corporation
- Plantec Inc.
- ShinMaywa Industries, Ltd.
- TAIHEIYO CEMENT CORPORATION
- Yachiyo Engineering Co., Ltd.

Special Partner (Supporter and collaborator)

- Kyoto Cho-SDGs Consortium (SDGs operation)
- HOKKAIDO UNIVERSITY
- SUM 2024 - 7th Symposium on circular economy and urban mining