The Synergy of Tradition and Innovation to Assess Plastic Pollution

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<Program as of Aug 1st> Online Study Program on Waste Management FY2022

OCambodia (Online) Date : Aug 09-Aug 15, 2022 Time:13:00-15:30, 15:00-17:30 JST Language: English Draft Program

Date		Time <u>(JST)</u> *Japan Time	Time(TLT) *Cambodia	Program	Lecturer / Person in charge	
1st Week	Aug 09th (Tue)	15:00-15:45	13:00-13:45	Opening Program Orientation	JESC, MoEJ	
		16:00-17:30	14:00-15:30	[Discussion 1] <material 1=""> Policy and Legal Framework of Waste Mangement in Japan-History and Current System - <material 2=""> Current Situation of Solid Waste Management and the Technology</material></material>	Takashi MIYAGAWA(JESC) Kana NAKAMURA(JESC)	
	Aug 10th (Wed)	15:00-16:30	13:00-14:30	[Workshop] Presentation from Local Government Discussion and Information Exchange	Fukuoka City Taisei Kanri Kaihatsu Co., LTD	
	Aug 11th (Thu)	15:00-16:30	13:00-14:30	【Lecture1】 Planning and Management for Final Disposal Site Fukuoka Method	Prof.Emerius MATSUFUJI (Fukuoka University)	
	Aug 12th (Fri)	15:00-16:30	13:00-14:30	【Online Site Visit 】 Final Disposal Site of Fukuoka Method	Fukuoka City	
		16:30-17:30	14:30-15:30	[Lecture 2] Plastic Pollution and Assessment	Amila Abeynayaka Institute for Global Environmental Strategies (IGES)	
2nd Week	Aug 15th (Mon)	15:00-17:00	13:00-15:00	Comments and Answers	JESC	
				Wrap Up Session /Closing Ceremony		





Content

Plastic Waste

• Numbers

Plastic Waste and MSW Profiling Tools

- Waste Profiling tools
- Plastic Waste Estimation Tools
- National Plastic Waste Flow

Innovative Methods

- Citizen science and anti-litter apps
- Urban Litter survey with smartphones and street cameras
- Microplastics









Marine Plastic Litter





Global primary plastic production: 270 million tonnes per year



within 50km of coastline

- Longevity of plastic is estimated to be hundreds to thousands of years. Hence, the plastics released into the environment will remain for hundreds of years.
- The adverse effects of plastic litter in the environment have been widely discussed in the literature. Plastic contaminants in environment is a threat to the ecosystem and a potential health hazard to humans.
- About 80% of plastic that reaches oceans comes from rivers.
- Major sources of the marine plastic litter that is transported through rivers originate from improper waste management practices, wastewater treatment plant effluent, and inland transportation related activities.

Plastic in surface waters: 10,000s to 100,000s to 100,



Plastic Waste



•Waste-Inventories

• Fate (Where/When)

• Exposure (How, How much)

• Effects (Health, Economic, etc.)



Plastic Waste Inventories













Adverse Effects



Marine life

- Suffocation
- Starvation
- Injury

Human

Toxic effects



Many seabirds starve to death when their stomachs fill with plastic waste and they lose their sense of hunger. (Photo: © NOAA)



Sea turtle entangled in plastic waste (Photo: © Michel Gunther / WWF)



Fish Ingestion of Microplastics (Photo: © BBC)

• Drinking water and Food chain related ingestions, airborne micro and nano plastic inhalation.

• Currently being researched the toxicity effects. Some evidence on the human health impacts due to plastics and associated chemical







Plastic Waste Estimation

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- Established methods
 - Waste sample collection
 - Sorting and Measuring





- Innovative Methods
 - Drones surveys
 - Smartphones/Satellites
 - AI/ML





Baseline Report

- Stakeholder coordination
- Policy review
- Digital readiness
- Waste profiling

- Mapping Tool
 - Data, hotspots, etc.





		PLASTIC POLLUTION CALCULATOR	UN CHABITAT FOR A BETTER URBAN FUTURE	CCCET Trades Contracting with UNP or Environmental Technologies	Emission Quantification Tool (201) for Estimation of CHONSECP from Sold Water Sector Version 3 SOLID WASTE EMISSIONS ESTIMATION TOOL GWEET Version 31 Way 2020
Properties	WFD	РРС	WaCT	CCET-Plastic Leakage Tracker	EQT/SWEET
Software/Platform	MS Excel	GIS and MS Excel	MS Excel	MS Excel	MS Excel
Pollutant	Waste	Plastic waste	Waste in Cities	Plastic Waste	Air Pollution (GHG)
Data	Waste survey (includes data derived parameters)	Waste survey, proxy values, and big data	Waste survey, proxy values	Waste survey, proxy values	Waste system survey and data
Impact Quantification and/or Decision making	Quantification based on the fate (disposal, landfill, recycle, etc.).	Quantification based on the fate, Spatial distribution and hotspots	Quantification based on the fate Spatial distribution and hotspots	Quantifies Plastic leakage and impacts	Quantifies GWP
Limitations	no spatial data, no hotspot identification.	Right protected, Affordability and limitations in skills/resources.	no spatial data, no hotspot identification.	How accurate to quantify the health impacts?	GHG emissions.





- Collection
- Reduction
- Sorting
- Weighing

















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CCET-IGES Plastic Leakage Tracker





- Agree on scope of the inventory: which sectors should be prioritized? Which types of plastic waste?
- > Understand methodologies to be applied:
 - Data sources
 - Gaps
- Agree on modalities for data collection:
 - Who can provide data?
 - How will it be collected? E.g surveys, phone calls, site visits
 - What is needed to obtain access to data? E.g official letters, agreements between ministries
 - Confidentiality issues e.g private sector data
- Agree on how results will be reviewed and validated:
 - E.g set up technical coordinating committee
 - Validation workshop

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Scope of the Waste Statistics

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This approach provides an estimate of total plastic waste generated and, in the toolkit, it has been adapted to estimate the plastic waste generated by type of polymer per sector and per plastic KEYs (i.e. HS code).

- i. PE (polyethylene)
- ii. PP (polypropylene)
- iii. PS (polystyrene)



- iv. PVC (polyvinylchloride)
- v. PET (polyethylene terephthalate)
- vi. PUR (polyurethane)

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Market category PE PS **PVC** PET PUR Other PP Transportation 13% 38% 0% 4% 0% 24% 21% Packaging 51% 18% 5% 2% 23% 0% 0% **Building and** 23% 43% 0% 13% 3% 6% 12% Construction EEE 25% 18% 23% 15% 10% 0% 10% 38% 32% 5% 0% 2% Consumer and 15% 8% Institutional Industrial 0% 38% 25% 0% 0% 38% 0% Machinerv Other 20% 32% 5% 11% 0% 19% 13%



Transboundary Movement

National Inventory

Developing factors for different Architype cities and extrapolation for a country



Digital Tools and Citizen-Science





The world's largest waste clean-up social media platform.

Tracks litter distribution through AI & smartphone

Low-cost microplastics survey system can be used anywhere



Anti-Litter App





By visualizing previously unseen litter, Pirika actively encourages cleaning efforts by ordinary people.



Anti-Litter App



Since 2011 more than 190 million collection

















Urban Litter Survey





③ Heat map visualization provide useful insight to inform future sanitation policy



Urban Litter Survey



Drones

Street cameras

Google Street View





Urban Litter Survey



Data validation is important









- Concentrations
- Leakageestimations
- Hotspotidentification
- Source tracking





Candidate plastic particles were separated from natural particles such as sand, plants and corpses using a solution for density separation and an oxidizing agent for purification



Chemicals used for density separation Water surface sample: NaCl, 1.2 g/cm³ Water bottom sample: Nal, 1.5 g/cm^3 Chemicals and conditions for water purification 30 wt% H₂O₂+0.05 M Fe(II) (1:1), 50°C, 1h





Parameters such as composition, color, size, thickness and shape of the candidate plastic particles were obtained using Fourier-Transform Infrared Spectroscopy (FTIR), microscopes and calipers.







Developing database to find MPs source







- 1. Local partners collect macroplastics
- 2. Transported to research institute in Japan
- 3. Analyze for composition and thickness, etc...
- 4. Create a database that can be compared with microplastics



Styrofoam in ASEAN Countries



- Pollution is different from country to country
- Mekong river, Styrofoam gained more attention
- Which type of Styrofoam is contributing more?
- Polystyrene sheets (food packaging)
 - or the EPS (such as fisherman buoyant).
- Policy measures





PSP











- Past and Present LCA do not consider the impacts of plastic litter.
- Most of the case studies indicate plastics with least impacts compared to the alternatives.



		Glass bottle	Aluminium can	PET bottle (0.5 l)	PET bottle (2 l)			
IMPACT INDICATORS	Abiotic depletion potential		Medium Impact	Medium Impact	Least Impact			
	Acidification		Medium Impact	Medium Impact	Least Impact			
	Eutrophication	Medium Impact	Least Impact	Highest Impact	Medium Impact			
	Freshwater aquatic ecotoxicity potential	Medium Impact	Medium Impact	Highest Impact	Least Impact			
	Climate change	Highest Impact	Medium Impact	Medium Impact	Least Impact			
	Human toxicity potential	Medium Impact	Highest Impact	Medium Impact	Least Impact			
	Marine aquatic ecotoxicity potential	Medium Impact	Highest Impact	Medium Impact	Least Impact			
	Ozone layer depletion potential	Highest Impact	Least Impact	Medium Impact	Medium Impact			
	Photochemical oxidant creation potential Highest Impac		Medium Impact	Medium Impact	Least Impact			
	Terrestrial ecotoxicity potential	Terrestrial Highest Impact		Medium Impact	Medium Impact			
	Primary energy demand	Highest Impact	Medium Impact	Medium Impact	Least Impact			



正在讲话: Olivier J Jolliet

 Marine Litter Integration into LCA high stakeholder demand activity. However, still not achieved due to lack of inventory and impact assessment models.

• LCA Community is still working on this

scoping workshop & criteria

Poznan workshop 30-31 August 2019	Environmental relevance	Scientific validity & maturity	Potential for consensus	Stakeholder needs	Applicability	Overall priority	Comments
Integration of HH						****	
Integration of EQ						****	
Integration of natural resources and							
ecosystem service endpoints	-					****	
Normalisation and weighting		**		***	***	****	
Nutritional impacts	***	••	?	•	?	***	For specific food LCA
Ocean acidification		••	?	*	••	***	
POCP effects on ecosystem quality		**	**	*	**	***	
Biotic resources			?		?		Start exploring/ include if consensus reached
Noise impacts					7	**	
Impacts caused by plastic pollution/litter	?	•	-	***	?	*	check results of Marilea
Invasive species			?			*	Explore existing work
Light pollution		*					
Antibiotic resistance		?					
Hormones & Endocrine							
Heat effects in water	•						
Urban heat island effects			?	**	?		
Non ionising radiation	-	?	?	**			







• Data?

- Established approaches such as waste profiling tools and emission trackers should recognized as important tools to tackle marine plastic pollution.
- Innovative approaches such as, AI based litter survey with drones, smartphones are gaining attention and have high potential. However the data validation, and finding proper partners for the development is essential.
- Innovative technologies for Microplastic Pollution is a good example of developing new methods and continuous improvement.
- Plastics and LCA needs to be handled with care, specially in countries with poor plastic end of life management.





Thank You!

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