Supplementary material

Studying waste separation behaviors and environmental impacts toward sustainable solid waste management: A case study of Bang Chalong Housing, Samut Prakan, Thailand

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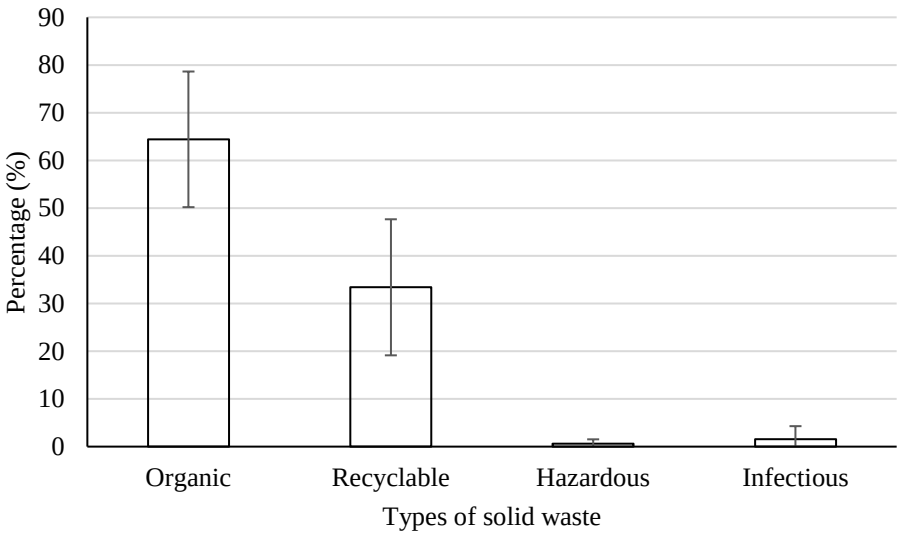

Figure S1. Municipal solid waste composition

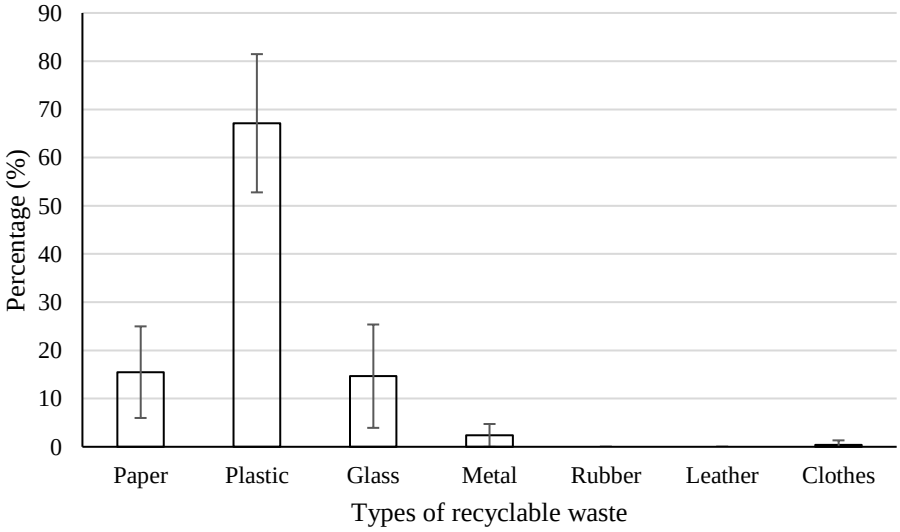

Figure S2. Recyclable waste composition

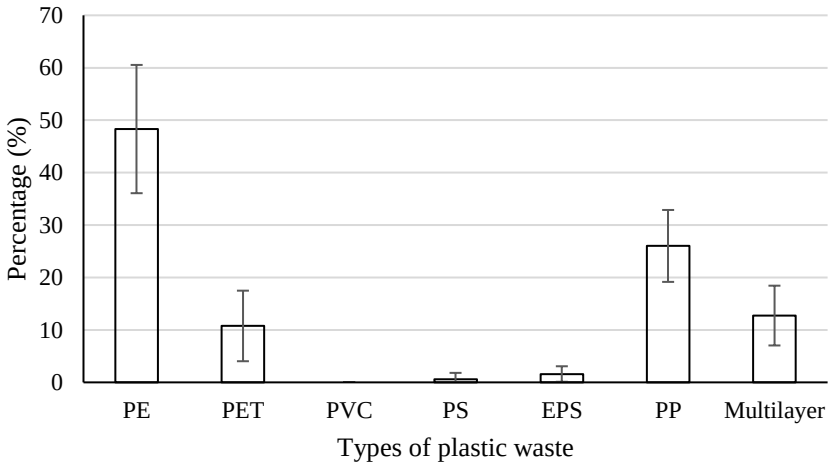

Figure S3. Plastic waste composition

Table S1. Effects of gender on waste separation behavior

Observed variable	Gender							
	Mann-Whitney		Male			Female		
	U	P	Mean Rank	Mean	SD	Mean Rank	Mean	SD
BE1	12050.0	0.536	164.40	3.98	0.85	158.60	3.96	0.78
BE2	12431.5	0.924	161.53	3.91	0.89	160.63	3.92	0.82
BE3	11921.0	0.465	156.63	2.92	1.21	164.09	3.01	1.27
BE4	11544.5	0.228	153.80	4.36	1.31	166.09	4.51	1.34

Table S2. Effects of age on waste separation behavior

Observed variable	Age				Kruskal-Wallis		Post hoc
	18–30	31–45	46–60	Above 60	λ^2	p	Interpretation
	Mean Rank	Mean Rank	Mean Rank	Mean Rank			
BE1	167.78	157.18	157.32	181.10	2.362	0.501	-
BE2	163.03	160.06	158.52	171.16	0.499	0.919	-
BE3	157.92	152.48	178.55	149.16	5.425	0.143	-
BE4	151.76	157.93	171.57	159.30	2.107	0.551	-

Table S3. Effects of education on waste separation behavior

Observed variable	Education				Kruskal-Wallis		Post hoc
	Below high school	High school	Bachelor's degree	Master's degree or above	λ^2	p	Interpretation
	Mean Rank	Mean Rank	Mean Rank	Mean Rank			
BE1	160.00	170.94	147.69	145.17	4.829	0.185	-
BE2	164.71	165.58	154.15	143.40	2.325	0.508	-
BE3	154.33	156.52	173.81	173.77	2.719	0.437	-
BE4	154.19	167.65	152.05	167.87	2.067	0.559	-

Table S4. Effects of monthly income on waste separation behavior

Observed variable	Kruskal-Wallis		Post hoc
	λ^2	p	Interpretation
BE1	11.826	0.019*	(1) > (2)
BE2	12.177	0.016*	(1) > (2)
BE3	6.998	0.136	-
BE4	7.898	0.095	-

(1) below 5,000 Baht; (2) 5,001–10,000 Baht

Table S5. Effects of occupation on waste separation behavior

Observed variable	Kruskal-Wallis		Post hoc
	λ^2	p	Interpretation
BE1	5.149	0.525	-
BE2	3.741	0.712	-
BE3	8.001	0.238	-
BE4	4.888	0.558	-

Table S6. Effects of ownership status on waste separation behavior

Observed variable	Ownership			Kruskal-Wallis		Post hoc
	Owner (1)	Renter (2)	Tenant (3)	λ^2	p	Interpretation
	Mean Rank	Mean Rank	Mean Rank			
BE1	163.32	162.41	153.80	0.675	0.714	-
BE2	161.76	159.86	160.86	0.031	0.985	-
BE3	168.22	156.80	150.53	2.147	0.342	-
BE4	169.59	164.94	136.09	6.885	0.032*	(1) > (3)

Table S7. Effects of household size on waste separation behavior

Observed variable	Household size (people)			Kruskal-Wallis		Post hoc
	1-2	3-4	5-6	λ^2	p	Interpretation
	Mean Rank	Mean Rank	Mean Rank			
BE1	160.80	154.49	195.20	4.038	0.133	-
BE2	163.86	148.55	193.73	5.429	0.066	-
BE3	158.88	159.57	189.50	2.143	0.343	-
BE4	159.31	165.52	155.75	0.388	0.824	-

Table S8. Measurement model before adjustment

Latent variable	items	Cronbach's alpha	Observed variables	Loading factor
AT	3	0.876	AT1	0.886
			AT2	0.894
			AT3	0.74
SN	7	0.666	SN1	0.452
			SN2	0.228
			SN3	0.627
			SN5	0.616
			SN6	0.876
			SN7	0.869
PBC	3	0.865	PBC1	0.746
			PBC2	0.855
			PBC3	0.888
SF	3	0.680	SF1	0.588
			SF2	0.624
			SF3	0.723
KN	3	0.910	KN1	0.895
			KN2	0.913
			KN3	0.827
IN	3	0.910	IN1	0.848
			IN2	0.715
			IN3	0.735
BE	3	0.323	BE1	0.893
			BE2	0.874
			BE3	-0.09

Table S9. Methods for environmental impact assessment using ecoinvent database from SimaPro 9.1.1.7

Scenario	Process	Method used for environmental impact assessment
S0	Recycling	PET (waste treatment) (GLO)| recycling of PET | APOS, U
		PE (waste treatment) (GLO)| recycling of PE | APOS, U
	Landfilling	Waste polyethylene terephthalate (GLO)| treatment of waste polyethylene terephthalate, unsanitary landfill, wet infiltration class (500mm) | APOS, U
		Waste polyethylene (GLO)| treatment of waste polyethylene, unsanitary landfill, wet infiltration class (500mm) | APOS, U
S1	Recycling	PET (waste treatment) (GLO)| recycling of PET | APOS, U
		PE (waste treatment) (GLO)| recycling of PE | APOS, U
S2	Landfilling	Waste polyethylene terephthalate (GLO)| treatment of waste polyethylene terephthalate, unsanitary landfill, wet infiltration class (500mm) | APOS, U
		Waste polyethylene (GLO)| treatment of waste polyethylene, unsanitary landfill, wet infiltration class (500mm) | APOS, U
S3	Incineration	Waste polyethylene terephthalate (RoW)| treatment of waste polyethylene terephthalate, municipal incineration | APOS, U
		Waste polyethylene (RoW)| treatment of waste polyethylene, municipal incineration | APOS, U
S4	Waste to Energy	Waste polyethylene terephthalate (RoW)| treatment of waste polyethylene terephthalate, municipal incineration | Conseq, U
		Waste polyethylene (RoW)| treatment of waste polyethylene, municipal incineration | Conseq, U
S5	Recycling	PET (waste treatment) (GLO)| recycling of PET | APOS, U
		PE (waste treatment) (GLO)| recycling of PE | APOS, U
	Landfilling	Waste polyethylene terephthalate (GLO)| treatment of waste polyethylene terephthalate, unsanitary landfill, wet infiltration class (500mm) | APOS, U
		Waste polyethylene (GLO)| treatment of waste polyethylene, unsanitary landfill, wet infiltration class (500mm) | APOS, U
Electricity use		Electricity, medium voltage (TH)| market for | APOS, U

Table S10. The result of environmental impacts assessed by CML-IA baseline ver.3.06

Impact category	Unit	S0_Current situation	S1_All recycling	S2_All landfilling	S3_All incineration	S4_All WtE	S5_Sorting plant
Abiotic depletion	kg Sb eq	-0.4600	-3.3028	0.0003	0.0169	-0.0187	-2.7325
Abiotic depletion (fossil fuels)	MJ	-108231	-2126157	2106	9126	-553070	-1721983
Global warming (GWP100a)	kg CO2 eq	2053	-57213	5972	98231	40541	-45342
Ozone layer depletion (ODP)	kg CFC-11 eq	-0.000142	-0.002005	0.000026	0.000079	-0.000081	-0.001632
Human toxicity	kg 1,4-DB eq	54300	-39148	60316	119545	80380	-20443
Fresh water aquatic ecotoxicity	kg 1,4-DB eq	144599	-21839	153088	299370	247042	11460
Marine aquatic ecotoxicity	kg 1,4-DB eq	146314676	-35236464	156241026	296425118	132661820	1090129
Terrestrial ecotoxicity	kg 1,4-DB eq	-2.94	-47.54	1.94	3.18	-166.62	-38.60
Photochemical oxidation	kg C2H4 eq	0.06	-20.08	1.18	0.15	-15.64	-16.05
Acidification	kg SO2 eq	-12.14	-196.32	1.17	9.60	-393.43	-159.43
Eutrophication	kg PO4--- eq	614.52	-30.88	647.25	8.37	-301.59	98.22