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Supplementary materials

Comprehensive evaluation of dioxins and furans occurrence in river sediments from a Secondary Steel Recycling craft village in northern Vietnam

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Citation: Nguyen, H.X.; Nguyen, X.T.; Mai, H.T.H.; Nguyen, H.T.; Vu, N.D.; Pham, T.T.P.; Nguyen, T.Q.; Nguyen, D.T.; Duong, N.T.; Le Tuan Hoang, A.; et al. Comprehensive evaluation of dioxins and furans occurrence in river sediments from a Secondary Steel Recycling craft village in northern Vietnam. *Molecules* **2024**, *29*, 1788. https://doi.org/10.3390/molecules29081788

Academic Editor(s): Name

Received: 12 March 2024
Revised: 7 April 2024
Accepted: 10 April 2024
Published: 15 April 2024

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Table S1: Method detection limit of dioxins and furans in sediment

Compound	Method detection limit (ng/kg d.w)
2,3,7,8-TCDD	0.031
1,2,3,7,8-PeCDD	0.026
1,2,3,4,7,8-HxCDD	0.112
1,2,3,6,7,8-HxCDD	0.062
1,2,3,7,8,9-HxCDD	0.060
1,2,3,4,6,7,8-HpCDD	0.181
OCDD	0.193
2,3,7,8-TCDF	0.107
1,2,3,7,8-PeCDF	0.062
2,3,4,7,8-PeCDF	0.052
1,2,3,4,7,8-HxCDF	0.056
1,2,3,6,7,8-HxCDF	0.082
1,2,3,7,8,9-HxCDF	0.133
2,3,4,6,7,8-HxCDF	0.064
1,2,3,4,6,7,8-HpCDF	0.113
1,2,3,4,7,8,9-HpCDF	0.276
OCDF	0.199

Table S2: The recovery efficiency (%)of ^{13}C label compounds in blank and sediment samples

Compounds	DH 1	DH 2	DH 3	DH 4	DH 5	DH 6	DH 7	Blank
^{13}C-2,3,7,8-TCDD	64	54	49	61	60	42	60	67
^{13}C-2,3,7,8-TCDF	65	52	46	58	62	34	64	79
^{13}C-1,2,3,7,8-PeCDD	56	52	52	79	53	62	55	68
^{13}C-1,2,3,7,8-PeCDF	55	63	58	60	66	56	64	68
^{13}C-2,3,4,7,8-PeCDF	63	62	58	70	60	57	60	71
^{13}C-1,2,3,4,7,8-HxCDF	61	76	73	58	70	53	69	75
^{13}C-1,2,3,6,7,8-HxCDF	48	67	63	50	64	48	68	76
^{13}C-2,3,4,6,7,8-HxCDF	56	63	62	52	47	44	61	72
^{13}C-1,2,3,7,8,9-HxCDF	67	82	76	67	58	57	75	86
^{13}C-1,2,3,4,7,8-HxCDD	64	61	65	52	55	55	69	69
^{13}C-1,2,3,6,7,8-HxCDD	48	51	53	50	55	48	54	60
^{13}C-1,2,3,4,6,7,8-HpCDD	59	63	63	62	65	57	87	59
^{13}C-1,2,3,4,6,7,8-HpCDF	53	51	57	45	55	44	65	64
^{13}C-1,2,3,4,7,8,9-HpCDF	77	81	79	60	72	60	50	75
^{13}C-OCDD	70	61	58	61	76	52	61	41

Table S3: The concentration of PCDD/Fs (ng/kg) in blank sample

Compounds	**Blank sample**
2,3,7,8-TCDD	N.D.
1,2,3,7,8-PeCDD	0.008
1,2,3,4,7,8-HxCDD	N.D.
1,2,3,6,7,8-HxCDD	N.D.
1,2,3,7,8,9-HxCDD	N.D.
1,2,3,4,6,7,8-HpCDD	N.D.
OCDD	0.032
2,3,7,8-TCDF	0.038
1,2,3,7,8-PeCDF	0.024
2,3,4,7,8-PeCDF	N.D.
1,2,3,4,7,8-HxCDF	0.014
1,2,3,6,7,8-HxCDF	N.D.
1,2,3,7,8,9-HxCDF	0.006
2,3,4,6,7,8-HxCDF	N.D.
1,2,3,4,6,7,8-HpCDF	0.013
1,2,3,4,7,8,9-HpCDF	0.007
OCDF	0.079

N.D. = not detected

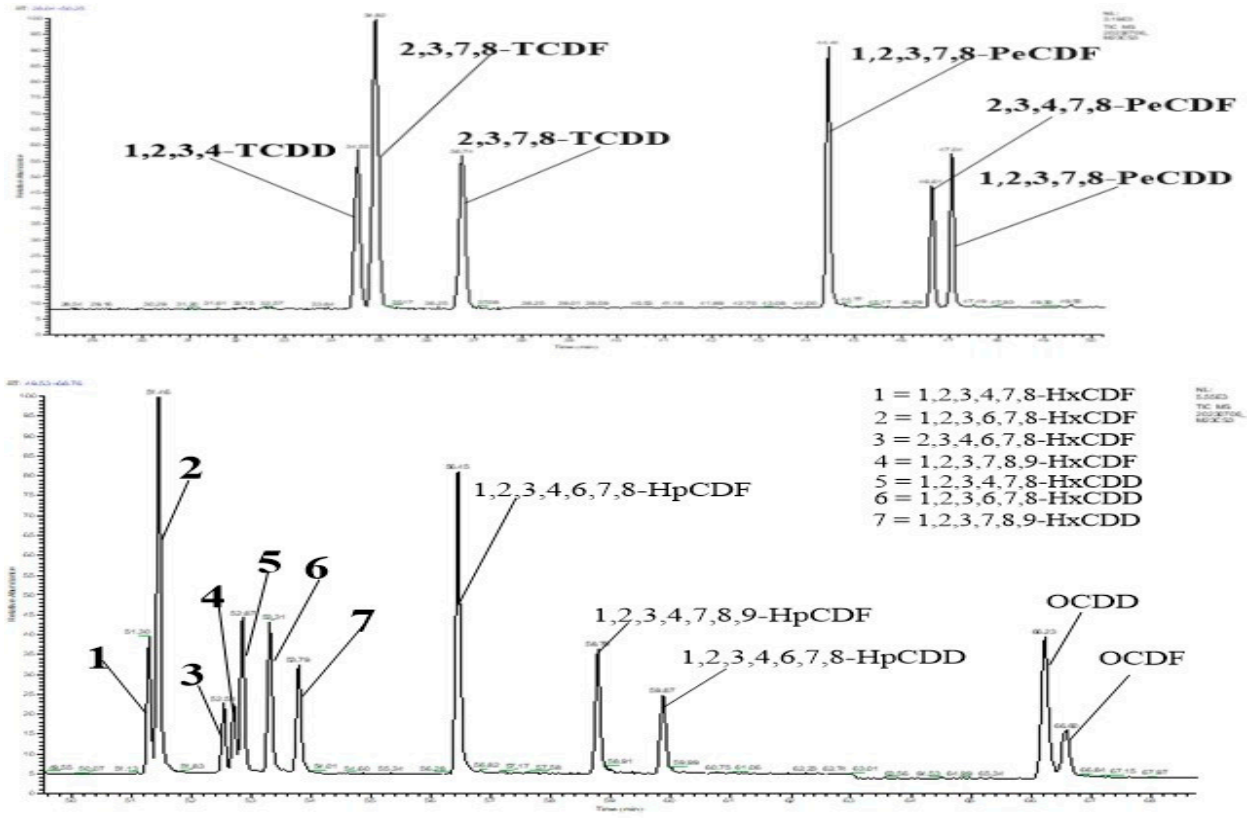

Figure S1: The total ion chromatography of PCDD/Fs

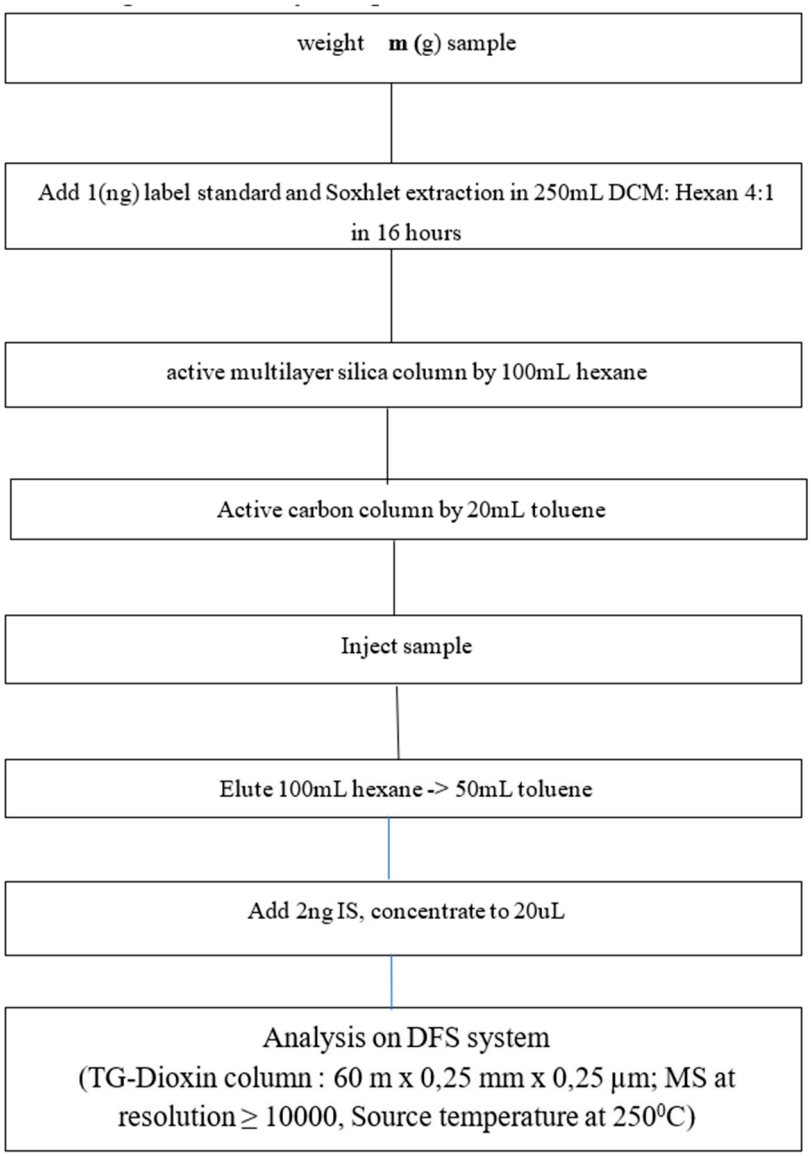

Figure S2. Dioxins and furans nalytical procedure by DFS system

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Z-scores - SEDIMENT

PCDD/F	Lab&replicate	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	Lab228-A	Lab228-B	Lab228-C
	GC/MS system	High	High	High	NA	NA	NA	High	High	High
2,3,7,8-TeCDD		-2.06	-2.63	-1.92	NA	NA	NA	0.22	0.66	0.79
1,2,3,7,8-PeCDD		-1.47	-1.56	-1.34	NA	NA	NA	0.48	0.28	-0.10
1,2,3,4,7,8-HxCDD		-1.57	-1.86	-1.57	NA	NA	NA	0.28	0.00	0.37
1,2,3,6,7,8-HxCDD		-1.57	-1.41	-1.25	NA	NA	NA	-0.38	-0.79	-0.79
1,2,3,7,8,9-HxCDD		-1.25	-1.33	-1.23	NA	NA	NA	-0.28	-0.42	-0.73
1,2,3,4,6,7,8-HpCDD		-1.56	-1.51	-1.65	NA	NA	NA	0.02	-0.43	0.65
OCDD		-1.26	-1.26	-1.31	NA	NA	NA	0.16	-0.16	0.95
2,3,7,8-TeCDF		-1.71	-1.76	-1.56	NA	NA	NA	0.66	0.00	0.01
1,2,3,7,8-PeCDF		-1.50	-1.52	-1.36	NA	NA	NA	-0.20	-0.43	-0.24
2,3,4,7,8-PeCDF		-0.48	-0.46	-0.28	NA	NA	NA	-0.36	-0.60	-0.63
1,2,3,4,7,8-HxCDF		-1.44	-1.52	-1.35	NA	NA	NA	-0.15	-0.30	0.07
1,2,3,6,7,8-HxCDF		-1.56	-1.51	-1.21	NA	NA	NA	0.36	-0.02	0.16
1,2,3,7,8,9-HxCDF		-0.35	-0.36	-0.25	NA	NA	NA	0.94	0.89	0.97
2,3,4,6,7,8-HxCDF		-0.98	-1.03	-0.94	NA	NA	NA	-0.30	-0.52	-0.49
1,2,3,4,6,7,8-HpCDF		-1.33	-1.36	-1.32	NA	NA	NA	0.02	-0.10	0.06
1,2,3,4,7,8,9-HpCDF		-1.42	-1.48	-1.49	NA	NA	NA	0.04	-0.02	0.07
OCDF		-1.14	-1.13	-1.14	NA	NA	NA	0.30	0.29	0.07
TEQ (PCDD/F)		**-4.46**	**-4.58**	**-3.93**	NA	NA	NA	0.17	-0.69	-0.20
TEQ (PCDD/F) Upperbound (UpB)		**-4.46**	**-4.58**	**-3.93**	NA	NA	NA	0.17	-0.69	-0.20

Figure S3: the result of the inter-laboratory testing program InterCinD IC10POP's ed 2022

Figure S4. High-resolution gas chromatography coupled with high-resolution mass spectrometry system Model DFS Thermo-USA

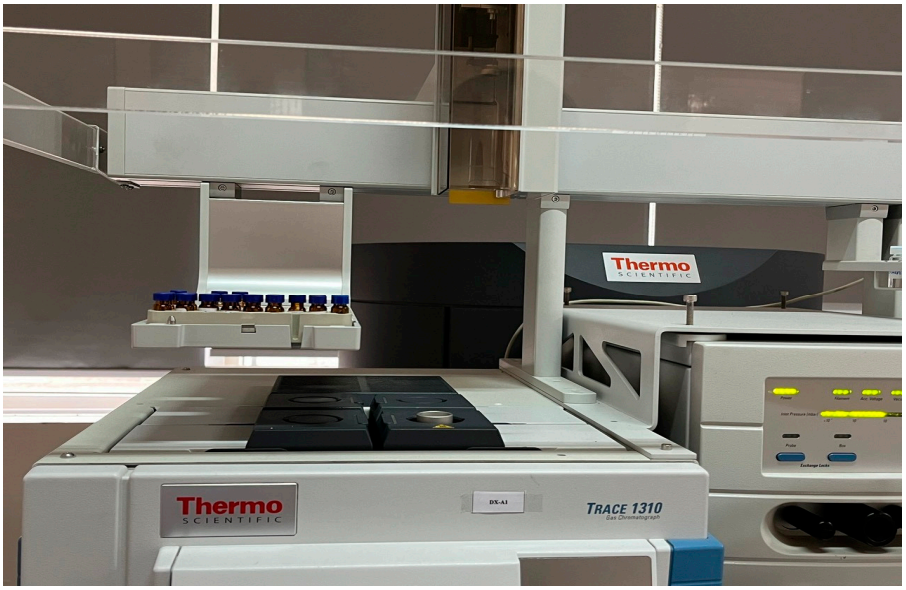

Figure S5. Final sample after processing transferred into an 150µl insert vial and placed in a 2ml dark vial

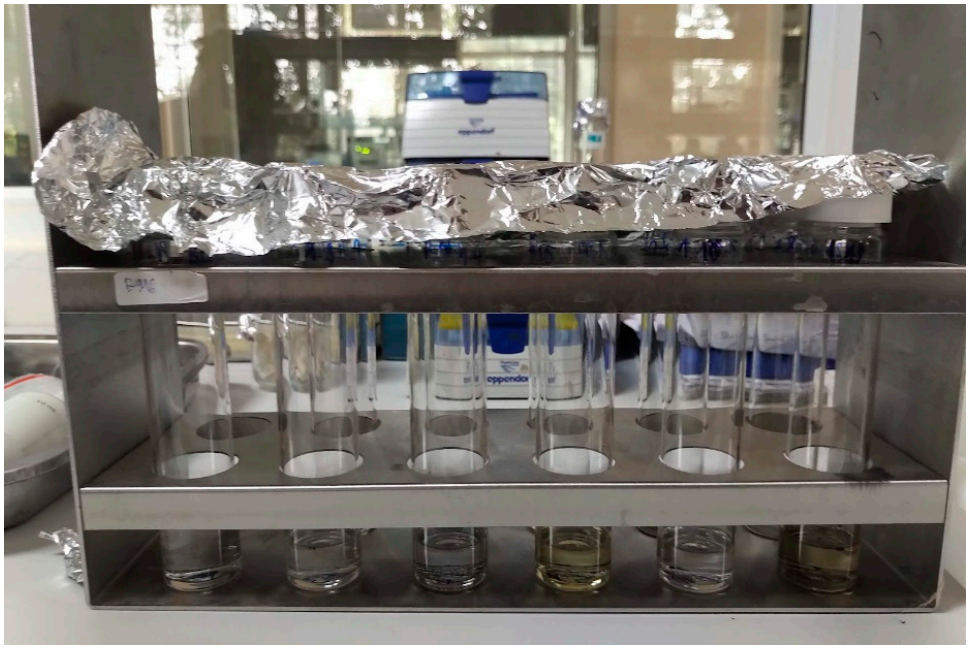

Figure S6: Sample after cleaning, removing impurities, transferred to a test tube for nitrogen gas blowing to remove all solvents, enriching the sample

Figure S7: The sample after passing through the multilayer column is impregnated onto an activated carbon column, then washed to clean and remove interfering impurities.

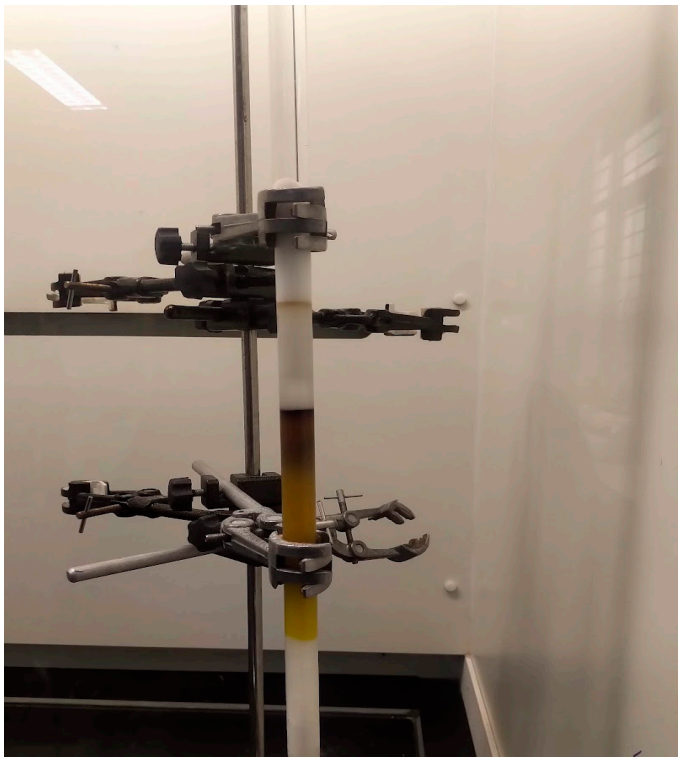

Figure S8: The sample after extraction contains many impurities, therefore it needs to be cleaned by impregnating onto a multilayer carbon column, then washed to remove dirt and interfere with the dioxin signal.

Figure S9: The sample after Soxhlet extraction may have a large volume, therefore it needs to reduce the sample volume by vacuum rotary evaporation to remove excess extraction solvent before cleaning through the chromatography column

Figure S10: The sample is placed into the Soxhlet extraction apparatus and extracted for 16 hours using a mixture of 300mL DCM:Hexane (1:4) to ensure complete separation of dioxin compounds from the sample

Figure S11: The sediment sample, approximately 100 (g), which has been cleaned and dried, is finely ground and sieved using the IKA MF 10 Basic grinding device

Figure S12: An Ekman grab was utilized for sediment sampling from the river

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