

Study of the presence of microplastics in the air of the municipality of Rionegro, Antioquia

James Londoño Valencia
María Isabel Ríos Pulgarín
Mariana Botero



UNIVERSIDAD NACIONAL AUTÓNOMA DE MÉXICO
INSTITUTO DE CIENCIAS DEL MAR Y LIMNOLOGÍA
UNIDAD ACADÉMICA MAZATLÁN



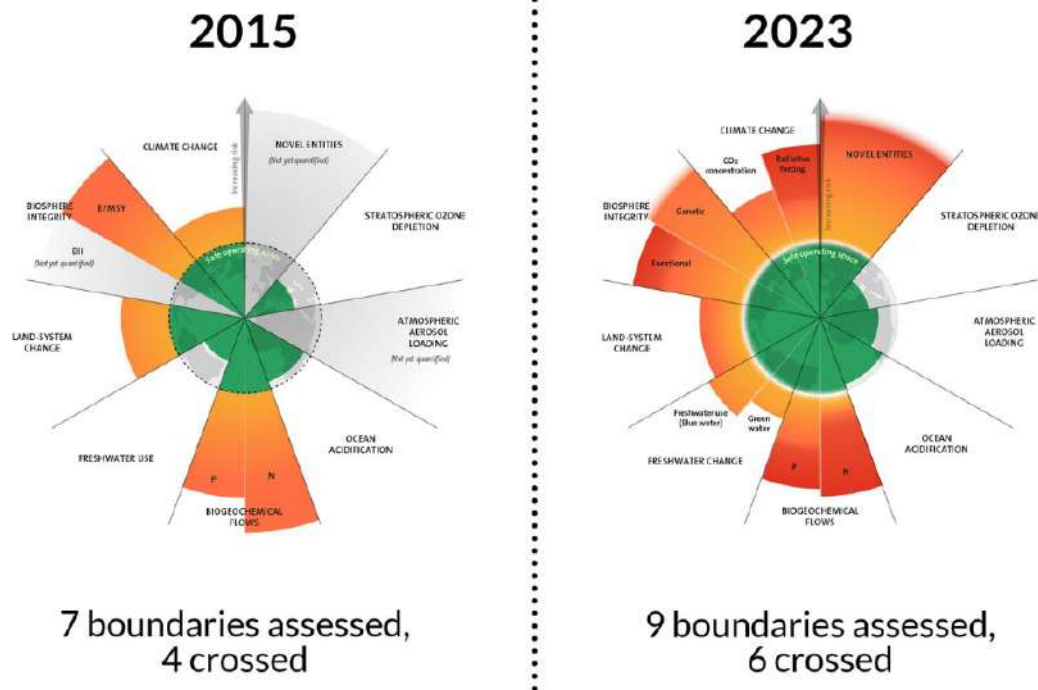


Agenda

1. Context
2. Study area
3. Method and materials
4. Results
5. Conclusions
6. References

Context - A plastic society?

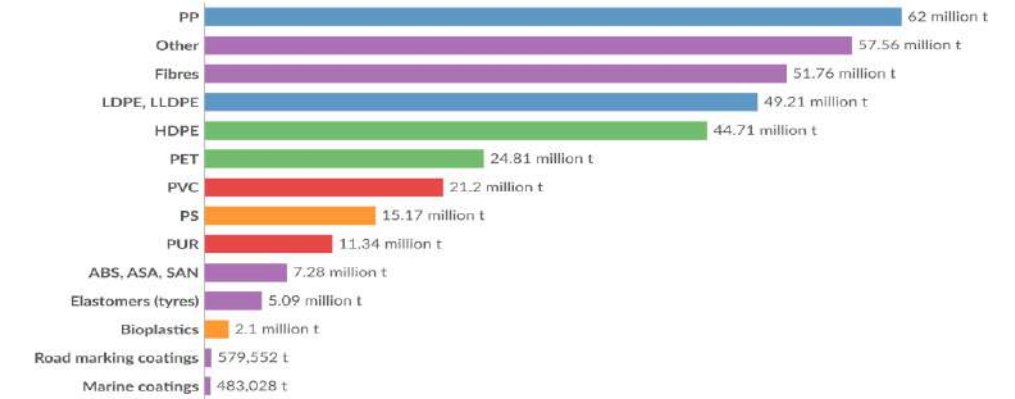
A 9 planetary boundaries ¿novel entities?



Stockholm Resilience Centre

Global primary plastic waste generation by polymer, 2019

Polymers are color-coded to indicate recyclability: green for widely recycled, blue for moderately recycled, orange for limited recyclability, red for usually non-recycled, and violet for unknown recyclability.



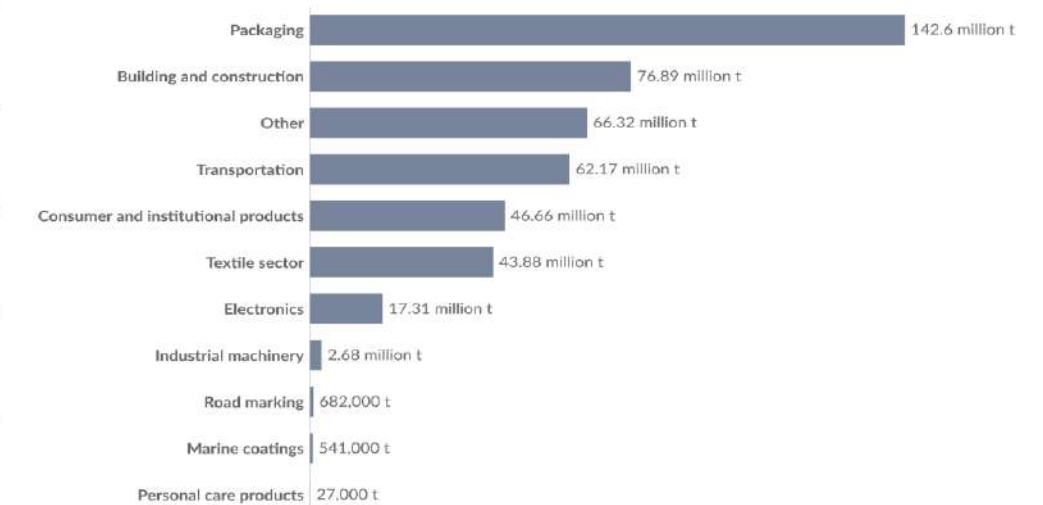
Data source: OECD (2022)

OurWorldinData.org/plastic-pollution | CC BY

Note: Polymer types are as follows: Acrylonitrile Butadiene (AB), Acrylonitrile Styrene Acrylate (ASA), Styrene Acrylonitrile (SAN), Polyurethane (PUR), Polyvinyl Chloride (PVC), Polystyrene (PS), Linear Low-Density Polyethylene (LLDPE), Polypropylene (PP), Polyethylene Terephthalate (PET), High-Density Polyethylene (HDPE).

Annual global plastic use, 2019

Measured in tonnes per year.



Data source: OECD (2022)

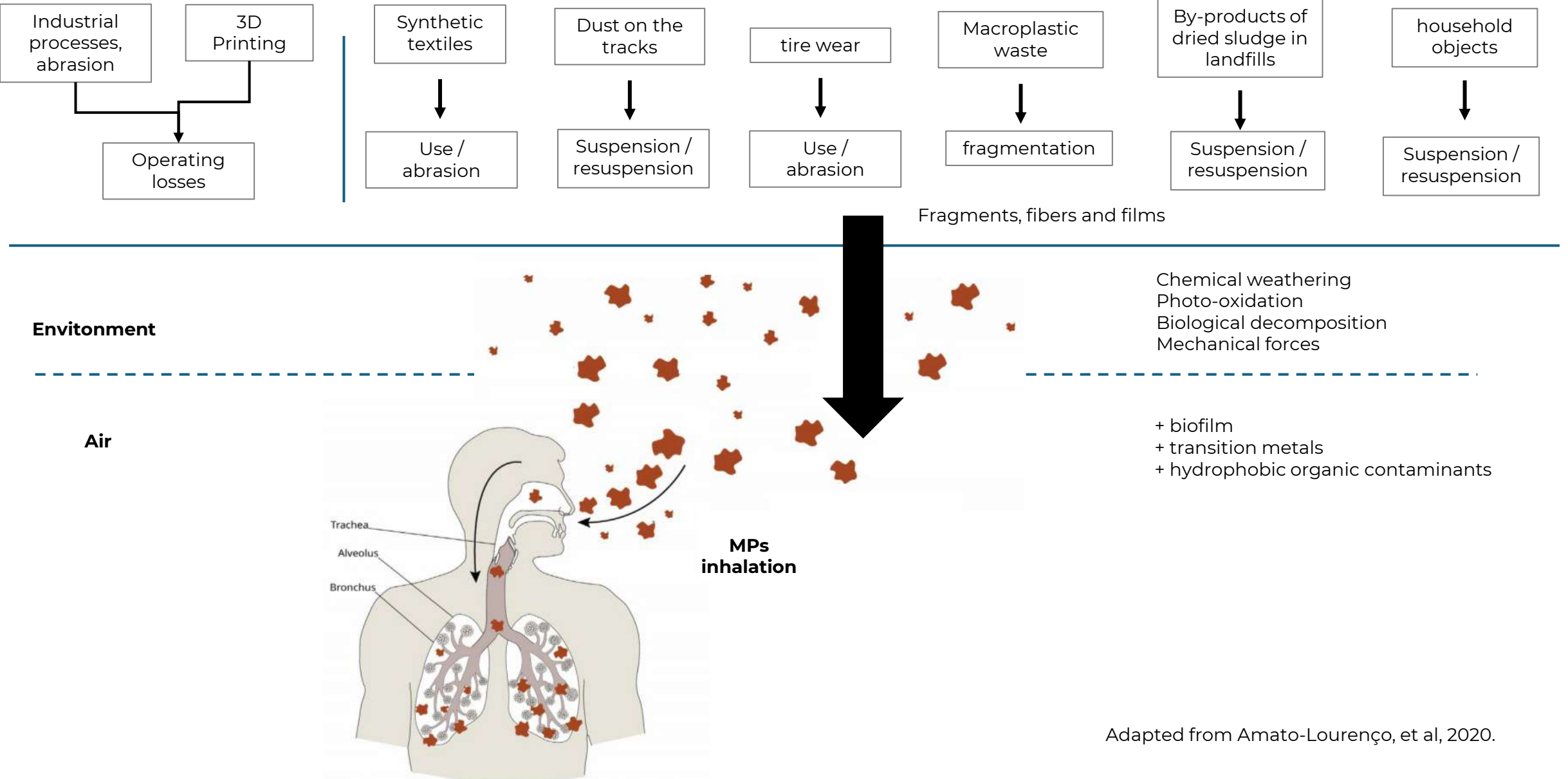
OurWorldinData.org/plastic-pollution | CC BY

Data source: OECD (2022)

OurWorldinData.org/plastic-pollution | CC BY

Our World in data

Context - “Indoor” & “Outdoor” sources of plastics



Adapted from Amato-Lourenço, et al, 2020.

Expertos discuten el impacto de los microplásticos en la salud y alertan del aumento de su propagación



19 Ago 2023



Plástico hasta en el aire que respiras

Dos estudios alertan de la presencia de microplásticos en la atmósfera y de cómo estos afectan a las bacterias que producen el 10% del oxígeno de la Tierra.



Héctor Rodríguez

EDITOR Y PERIODISTA ESPECIALIZADO EN CIENCIA Y NATURALEZA

Actualizado a 03 de enero de 2023, 11:54

Guardar Compartir



nature COMMUNICATIONS

ARTICLE

<https://doi.org/10.1038/s41467-021-27454-7>

OPEN

Evidence of free tropospheric and long-range transport of microplastic at Pic du Midi Observatory

S. Allen^{1,2,3,6}, D. Allen^{1,2,6}, F. Baladima⁴, V. R. Phoenix¹, J. L. Thomas^{1,4}, G. Le Roux^{1,2} & J. E. Sonke^{1,5}

Check for updates

Los microplásticos también están presentes en el aire

Los científicos han descubierto grandes cantidades de micropartículas de plástico transportadas a través del aire en una remota zona montañosa.

Por STEPHEN LEAHY

PUBLICADO 22 ABR 2019, 13:52 GMT-5



EL TIEMPO

EDUCACIÓN VIAJAR MEDIO AMBIENTE MUJERES RELIGIÓN MASCOTAS

MEDIO AMBIENTE

SUSCRIBETE

Microplásticos en las costas de Colombia: altas cantidades y tóxicos



Luchar contra los millones de toneladas de plástico que llegan a las costas, el igual que los microplásticos. FOTO: Greenpeace-Nicol Cuevas.

Resultados del primer estudio sobre la abundancia del microplástico en los mares del país.

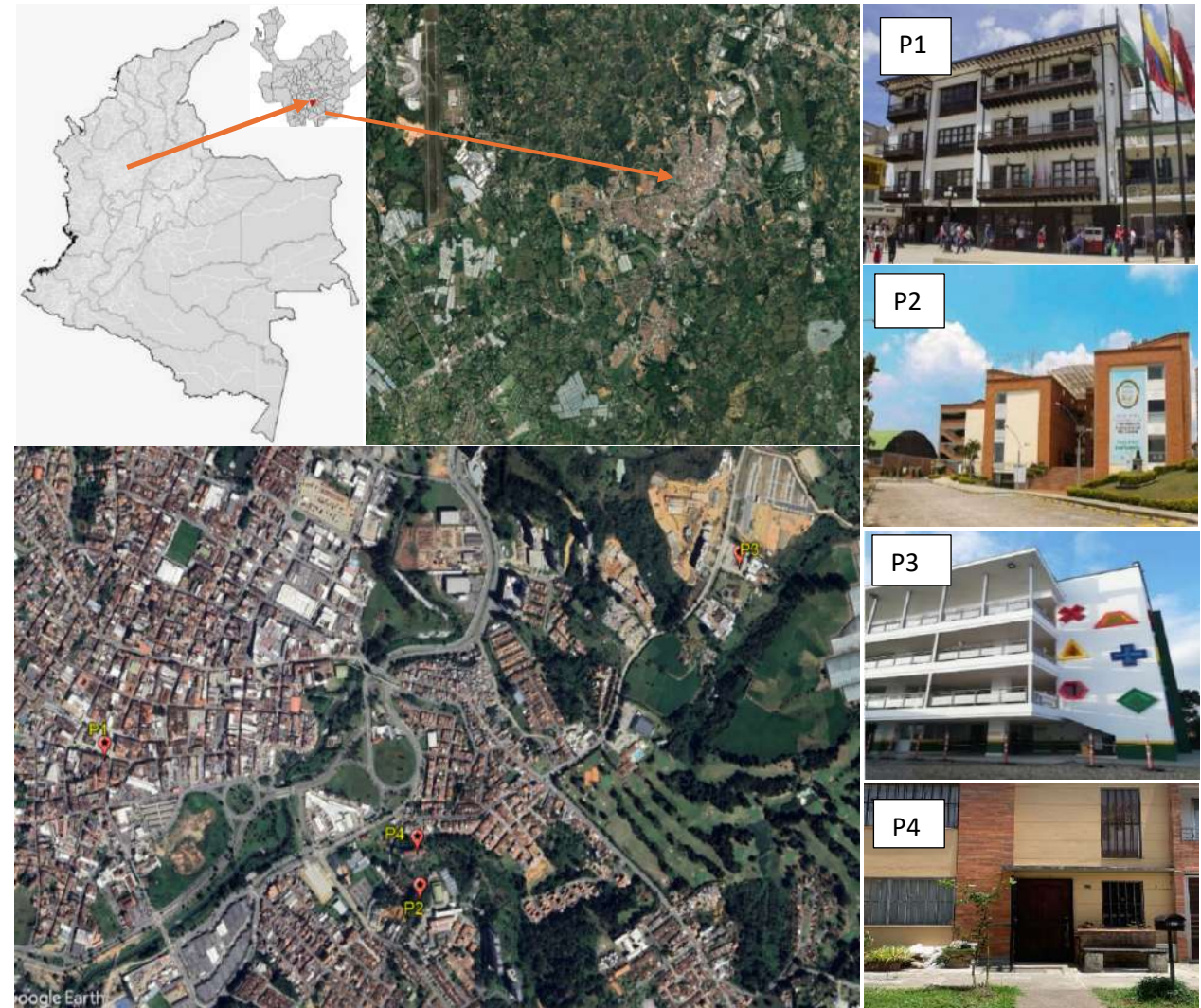
Study area

Main municipality of the eastern Antioquia subregion. (aprox 147.000 hab, 64% urbana)

The subregion has doubled its PIB between 2009 (\$5.8 billion) and 2018 (\$11.1 billion).

New challenges for sustainable competitiveness (industry, trade, tourism, agriculture, livestock, and fishing, etc.)

Sampling site	Ambient
COLEGIO COLMAUJ	Indoor & Outdoor
SECRETARIA DE HÁBITAT	Indoor
EDIFICIO UCO INNOVAMATER	Outdoor
OFICINAS FACULTAD DE INGENIERÍAS	Indoor
VIVIENDA	Indoor & Outdoor



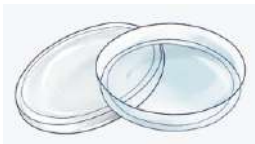
Puntos de muestreo P1 (Secretaria de Hábitat), P2 (UCO), P3 (Colegio) y P4 (Vivienda). Fuente: Elaboración propia

Methods and materials

- 2 sampling campaigns
- 3 outdoor sites - Passive sampling with a funnel/flask
- 4 indoor sites - Passive sampling with Petri dishes
- 3 replicates
- Time: 15 days per site



Active/Passive sampling



Vacuum filtration



Packaging and transportation



Digestion with H_2O_2 30%



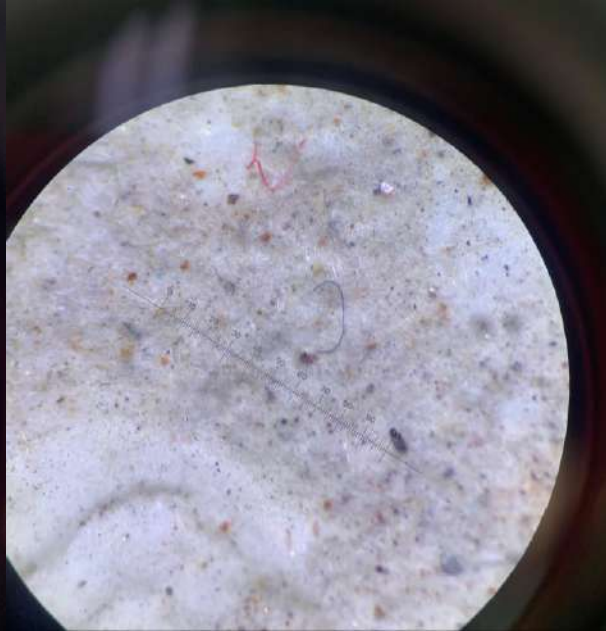
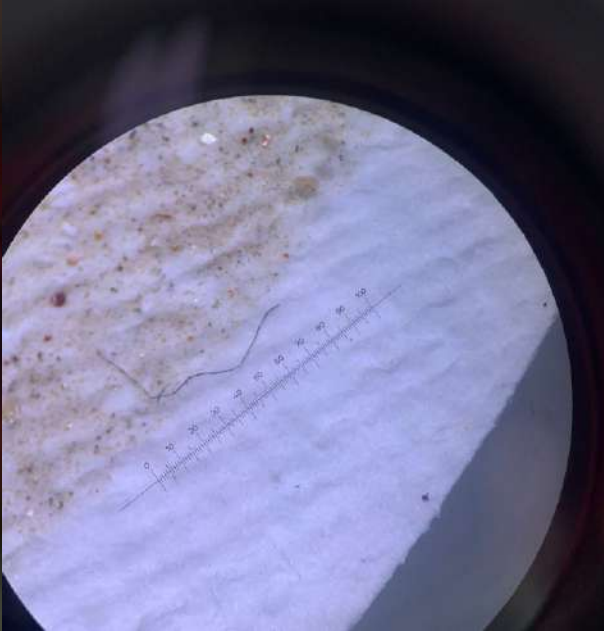
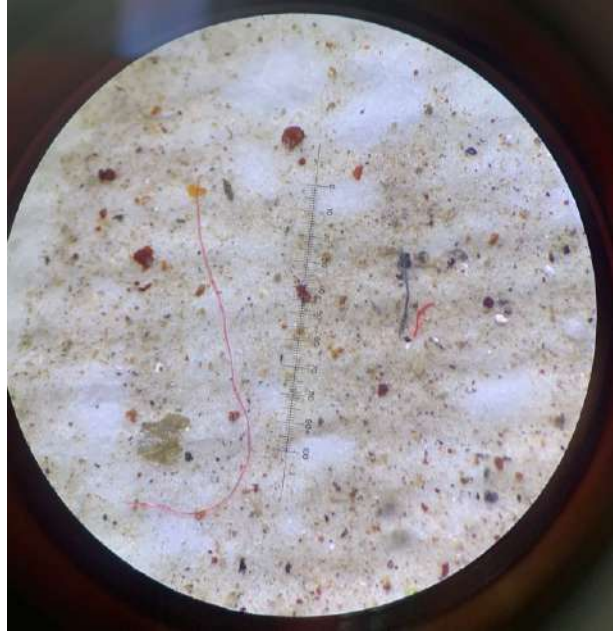
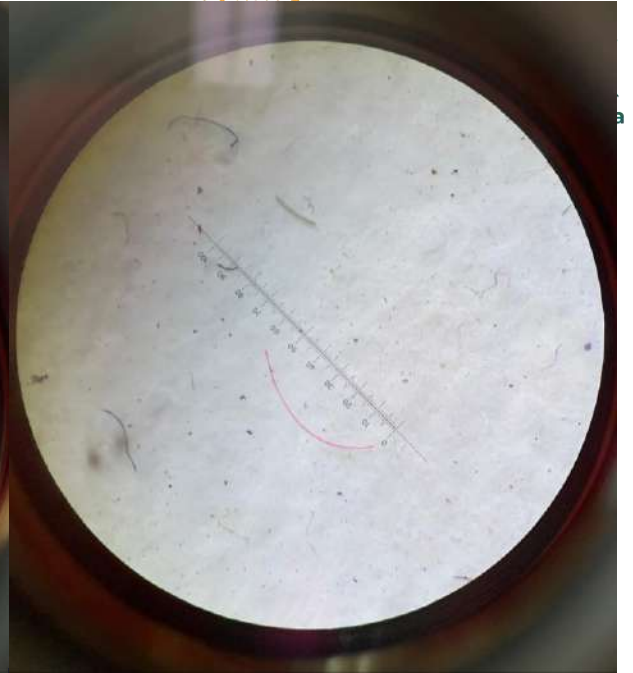
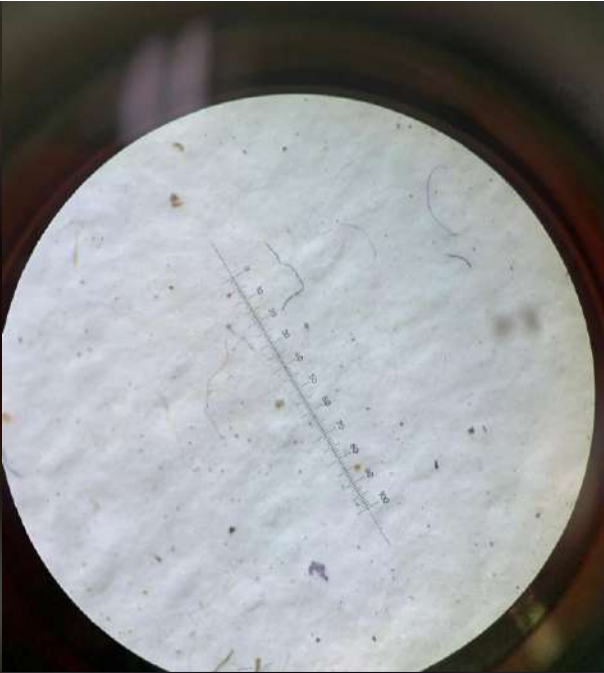
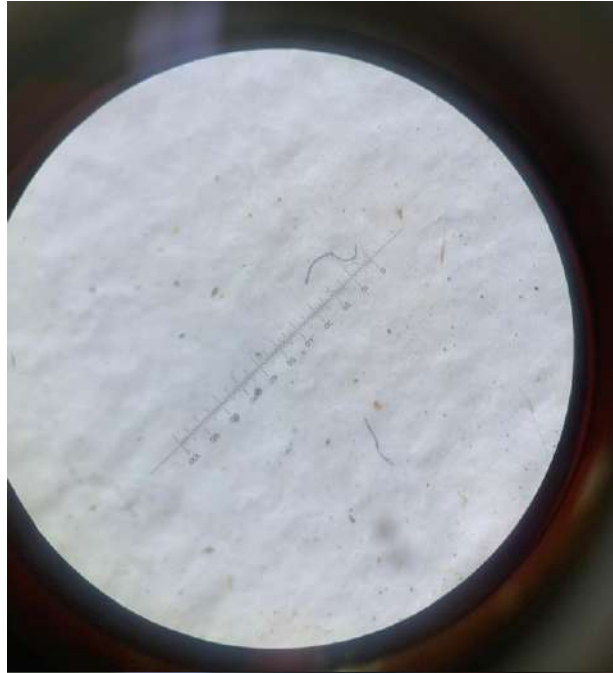
Drying



chemical
characterization



Physical characterization

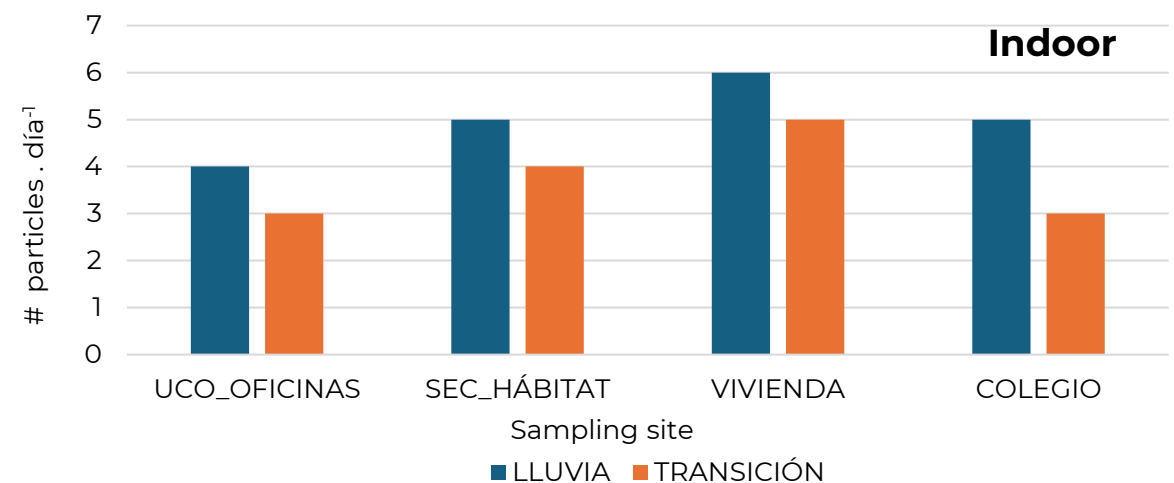
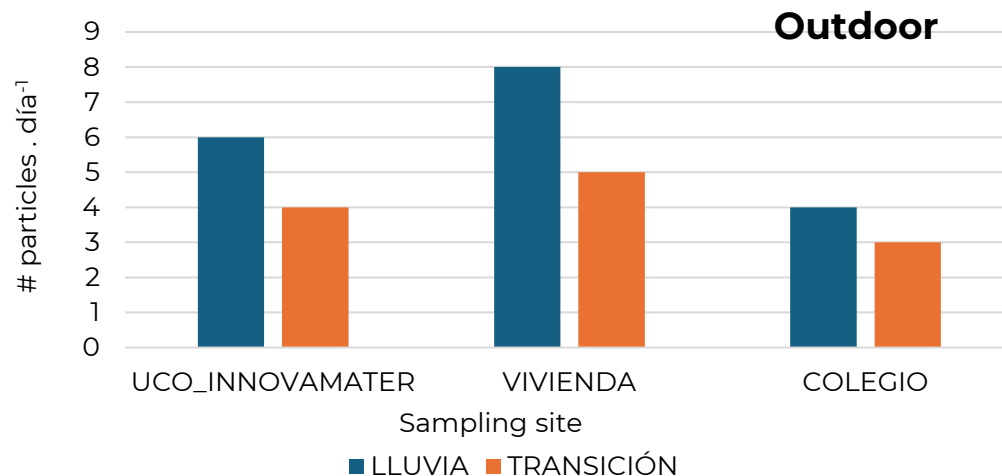
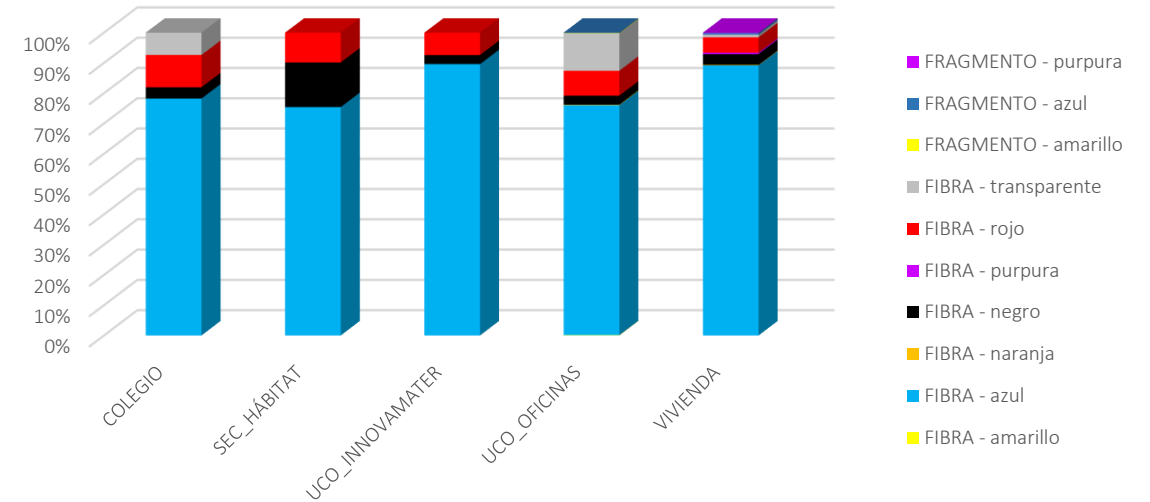


Results - Abundance of microplastics

Form distribution of MPs

Sampling site	MPs form		Total
	Fibers	Fragments	
COLEGIO	2361	Not found	2361
SEC_HÁBITAT	1290	Not found	1290
UCO_INNOVAMATER	809	Not found	809
UCO_OFICINAS	1640	4	1644
VIVIENDA	2351	16	2367
Total general	8451	20	8471

Color distribution of MPs (%)

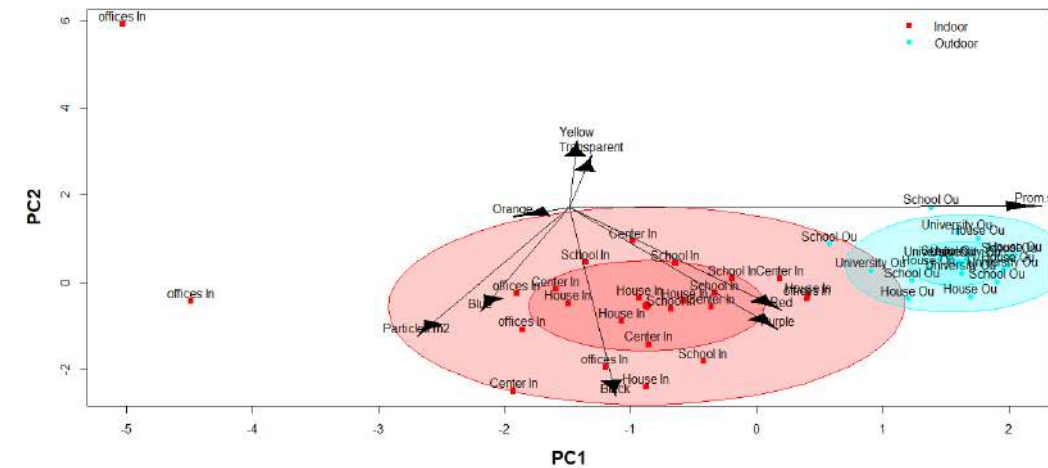
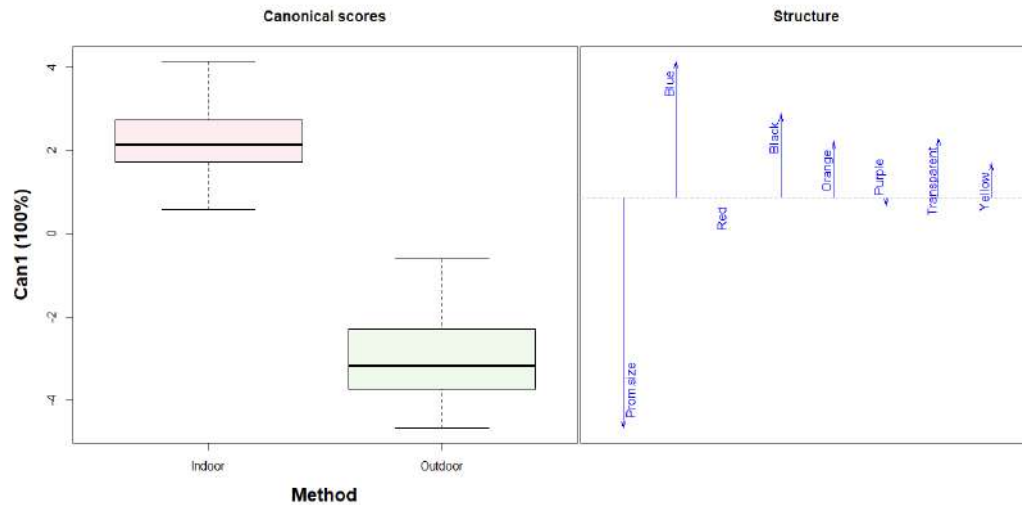
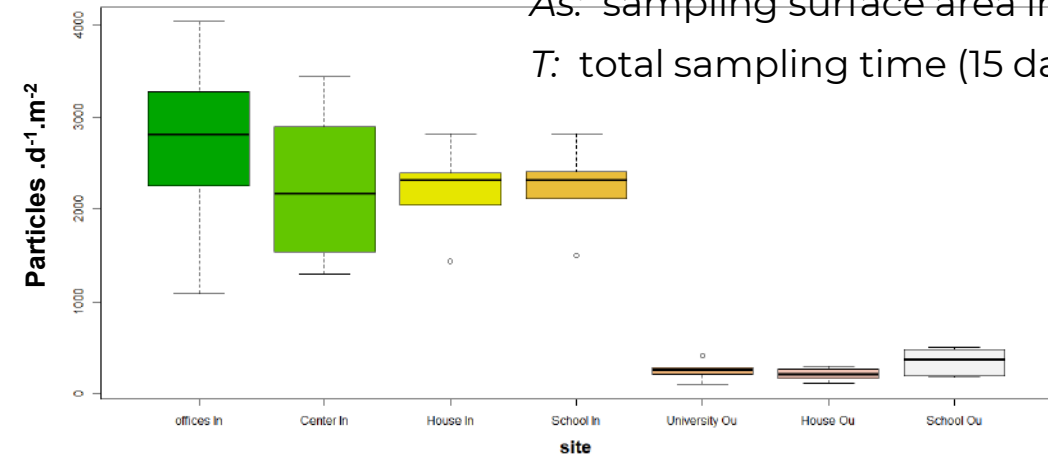
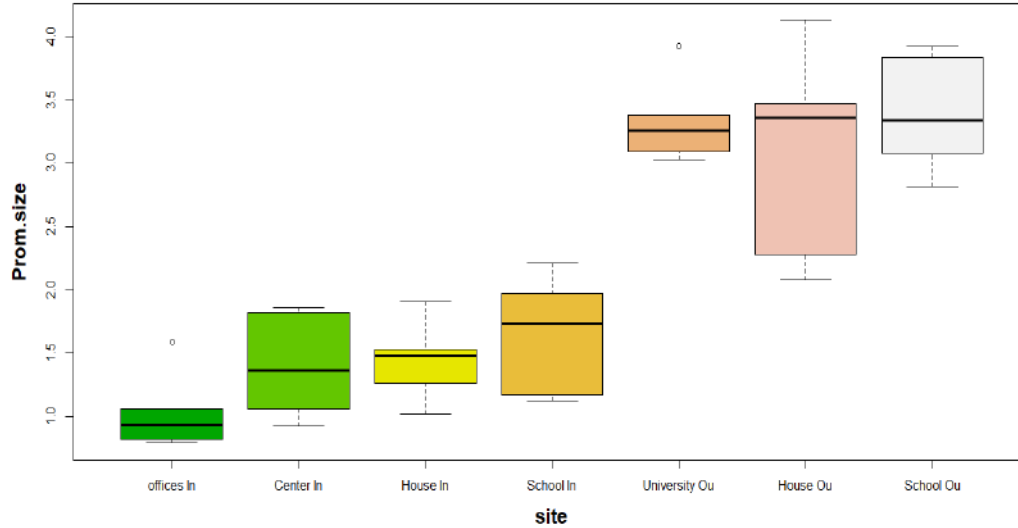


Total deposition

Results - atmospheric deposition

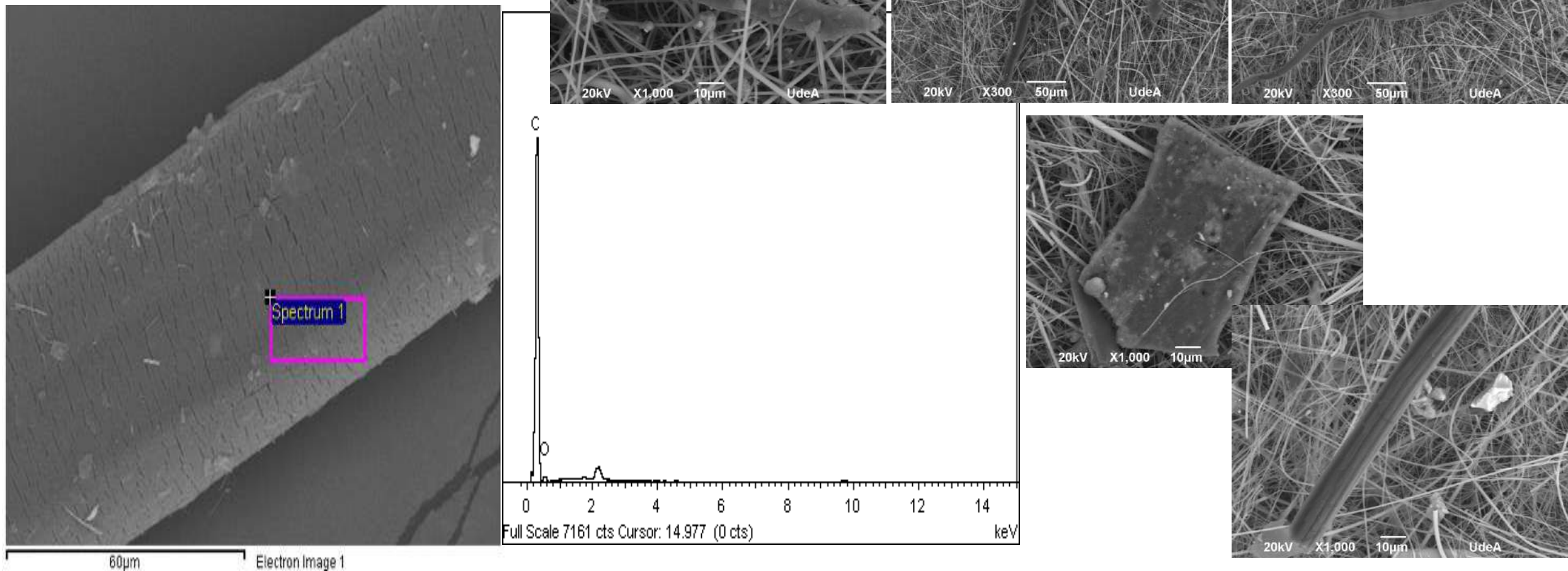
$$Deposition_{rate} = \frac{N_{sub}}{A_s \times T}$$

Deposition rate in #particles/m²-d
 N_{sub} : number of particles collected
 A_s : sampling surface area in m²
 T : total sampling time (15 days)



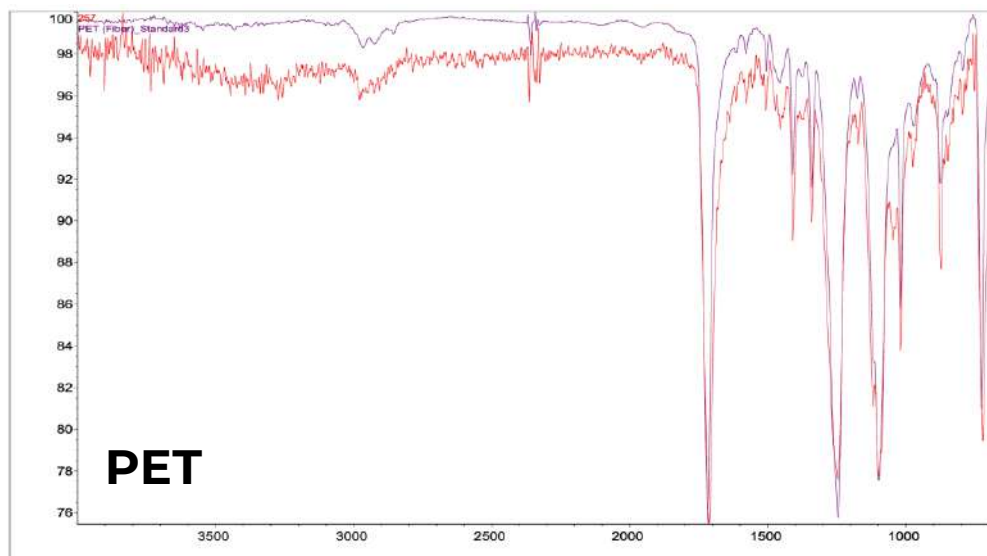
Results - SEM-EDS

110 particles observed in 20 filters

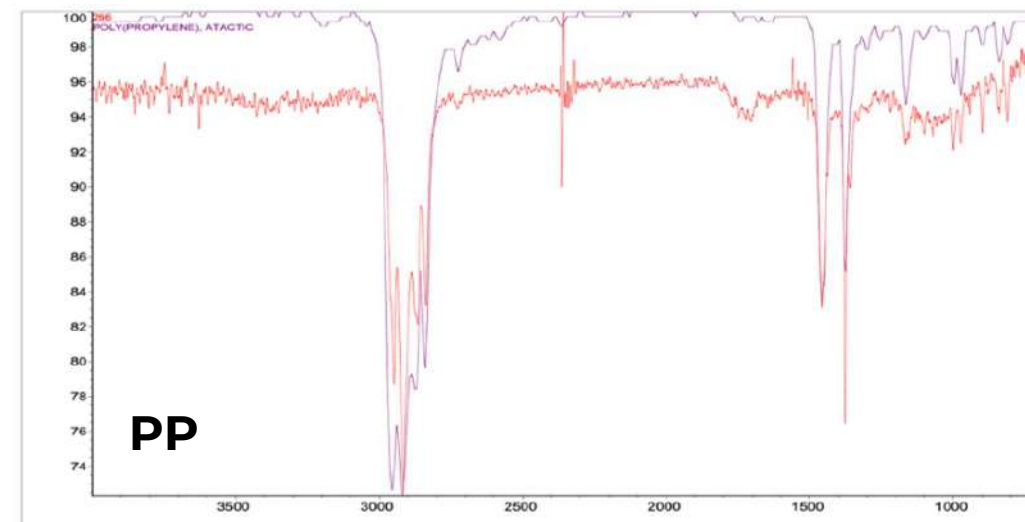


Results - FTIR

18 filters analyzed



	Índice	Comparar	Nombre del compuesto
1	17	84.63	PET (Fiber)_Standard3
2	16	82.39	PET (Fiber)_Standard
3	11	82.34	PET (300 um)
4	57	82.14	Poly(ethylene terephthalate)
5	19	81.11	PET (Fiber)_Standard4
6	13	80.98	PET (Fiber)_Standard
7	40	77.40	Poly(butylene terephthalate)
8	3	50.96	POLYESTER, TERE-&ISO-PHTHALATE
9	4	49.86	POLYESTER, TEREPHTHALATE
10	114	38.28	Poly(Acrylic Acid) 49-24% in water



	Índice	Comparar	Nombre del compuesto
1	41	89.55	POLY(PROPYLENE), ATACTIC
2	25	86.67	Polipropileno
3	20	84.79	Polypropylene
4	67	83.78	Polypropylene, isotactic
5	38	80.57	POLY(PROPYLENE), SYNDIOTACTIC
6	39	80.19	POLY(ETHYLENE:PROPYLENE)
7	32	70.67	POLY(ETHYLENE:PROPYLENE:DIENE)
8	21	50.35	POLY(ACRYLONITRILE)
9	88	47.74	Styrene/isoprene, ABA block copolymer
10	66	47.55	Polypropylene, isotactic, chlorinated

Other polymers identified were cotton, rayon and acrylic



Conclusions

1. Fibers dominated at all sampling sites.
2. Blue was the main color observed in the particles found.
3. The MPs deposition rate in indoor samples was between 8 and 10.5 times higher than in ambient (outdoor) air samples.
4. The total deposition rates were 2.358 ± 699 PM particles in indoor air and 271 ± 117 particles per day per m² in ambient air.
5. Similar studies in New Jersey, London, Paris, and Bangkok yielded similar deposition rates.
6. SEM characterization allows for a comparison of the elemental composition and morphology of PM found in indoor and outdoor air in Rionegro with the results of other studies, with oxygen and carbon as the main elements.
7. FTIR analysis showed an approximate polymer distribution of 26,1% cotton, 15,6% PET & PP, 5,2 % acrylic & rayon Indoors.
8. The next step is to research about relationship between PM₁₀ and PM_{2.5} and microplastic particles in ambient air.

References

- Allen, D., Allen, S., Le Roux, G., Simonneau, A., Galop, D., & Phoenix, V. R. (2021). Temporal archive of atmospheric microplastic deposition presented in ombrotrophic peat. *Environmental Science & Technology Letters*, 8(11), 954–960. <https://doi.org/10.1021/acs.estlett.1c00697>
- Dahal, Y., Babel, S. Abundance and characteristics of atmospheric microplastics deposition in indoor and outdoor environments in Bangkok, Thailand. *Air Qual Atmos Health* 18, 425–445 (2025). <https://doi.org/10.1007/s11869-024-01652-w>
- Yao, Y., Glamoclija, M., Murphy, A., & Gao, Y. (2022). Characterization of microplastics in indoor and ambient air in northern New Jersey. *Environmental Research*, 207(112-142). <https://doi.org/10.1016/j.envres.2021.112142>
- S.L. Wright, J. Ulke, A. Font, K.L.A. Chan, F.J. Kelly, Atmospheric microplastic deposition in an urban environment and an evaluation of transport, *Environment International*, Volume 136, 2020, 105411, ISSN 0160-4120, <https://doi.org/10.1016/j.envint.2019.105411>.
- Sajjad Abbasi, Neamatollah Jaafarzadeh, Amir Zahedi, Maryam Ravanbakhsh, Somayeh Abbaszadeh, Andrew Turner, Microplastics in the atmosphere of Ahvaz City, Iran, *Journal of Environmental Sciences*, Volume 126, 2023, Pages 95-102, ISSN 1001-0742, <https://doi.org/10.1016/j.jes.2022.02.044>.
- Khadija Sharaf Din, Muhammad Fahim Khokhar, Shahid Ikramullah Butt, Abdul Qadir, Farhan Younas, Exploration of microplastic concentration in indoor and outdoor air samples: Morphological, polymeric, and elemental analysis, *Science of The Total Environment*, Volume 908, 2024, 168398, ISSN 0048-9697, <https://doi.org/10.1016/j.scitotenv.2023.168398>.



Medellín, Colombia

CASAP X

CONGRESO COLOMBIANO Y
CONFERENCIA INTERNACIONAL

DE CALIDAD DE AIRE, CAMBIO CLIMÁTICO Y SALUD PÚBLICA



Más información

That's all folks!

jlondono@uco.edu.co

<https://casap.science/>

casap@casap.science