

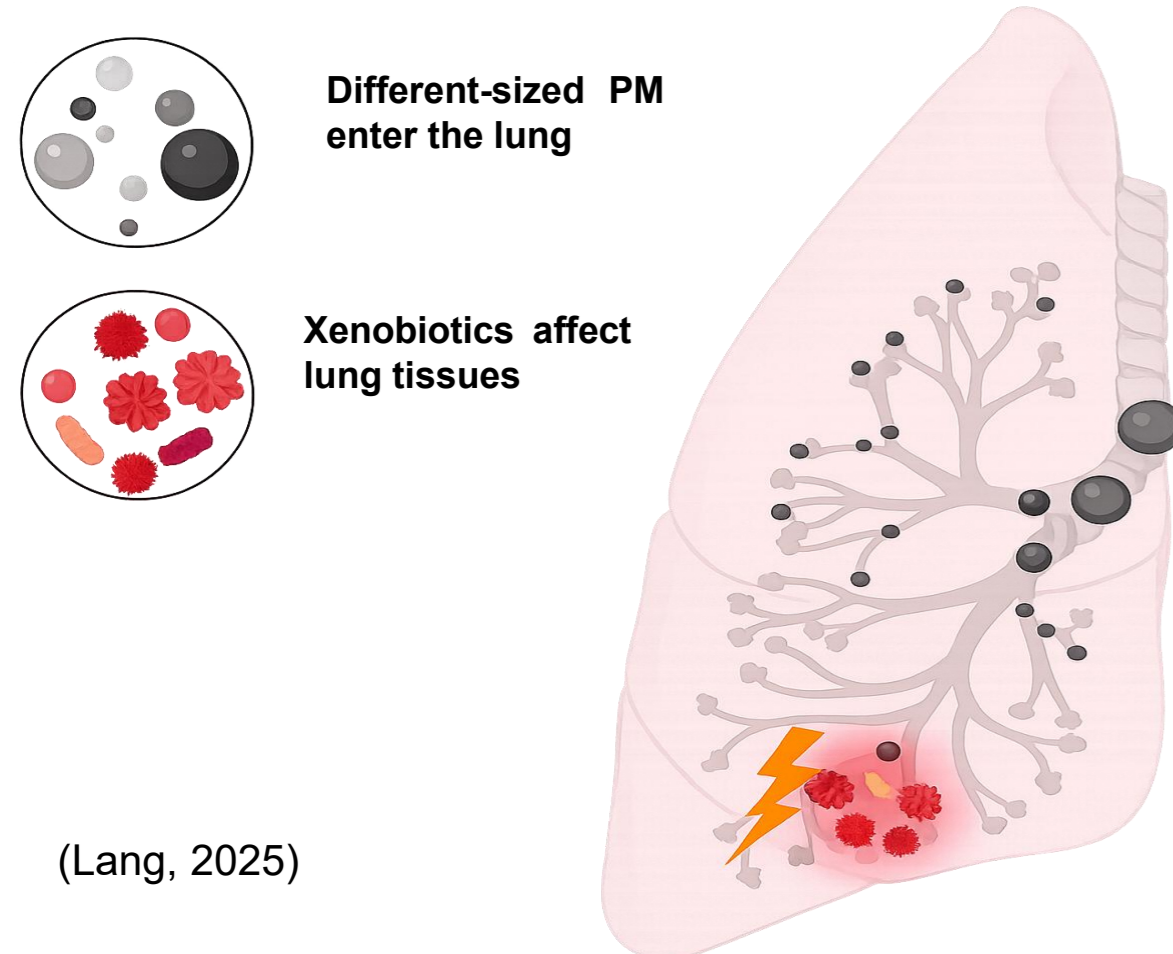
Surface-Specific Retention of Xenobiotic Airborne Particulate Matter (PM) on Adaxial and Abaxial Leaf Surfaces of *Ruscus aculeatus*

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INTRODUCTION & AIM



(Lang, 2025)

Figure 1. Schematic representation of airborne particulate matter and xenobiotic toxicant effects in lung tissue.

Airborne particulate matter (PM) is a complex environmental xenobiotic composed of mineral particles, heavy metals, and toxic pollutants that threaten ecosystem and human health (Figure.1).

Urban vegetation functions as a passive biofilter that captures Xenobiotic Airborne Particulate matter (PM).

Surface-specific PM retention remains poorly understood. This study investigates PM accumulation on adaxial and abaxial leaf surfaces of *Ruscus aculeatus*.

METHOD

Ruscus aculeatus shrubs located approx. 1 m from a main roadway at Kyushu University, Japan, were sampled during winter (n = 40 leaves). A modified gravimetric filtration method was used to quantify coarse (10–100 µm), fine (2.5–10 µm), and submicron (0.2–2.5 µm) particulate fractions (Figure 2).

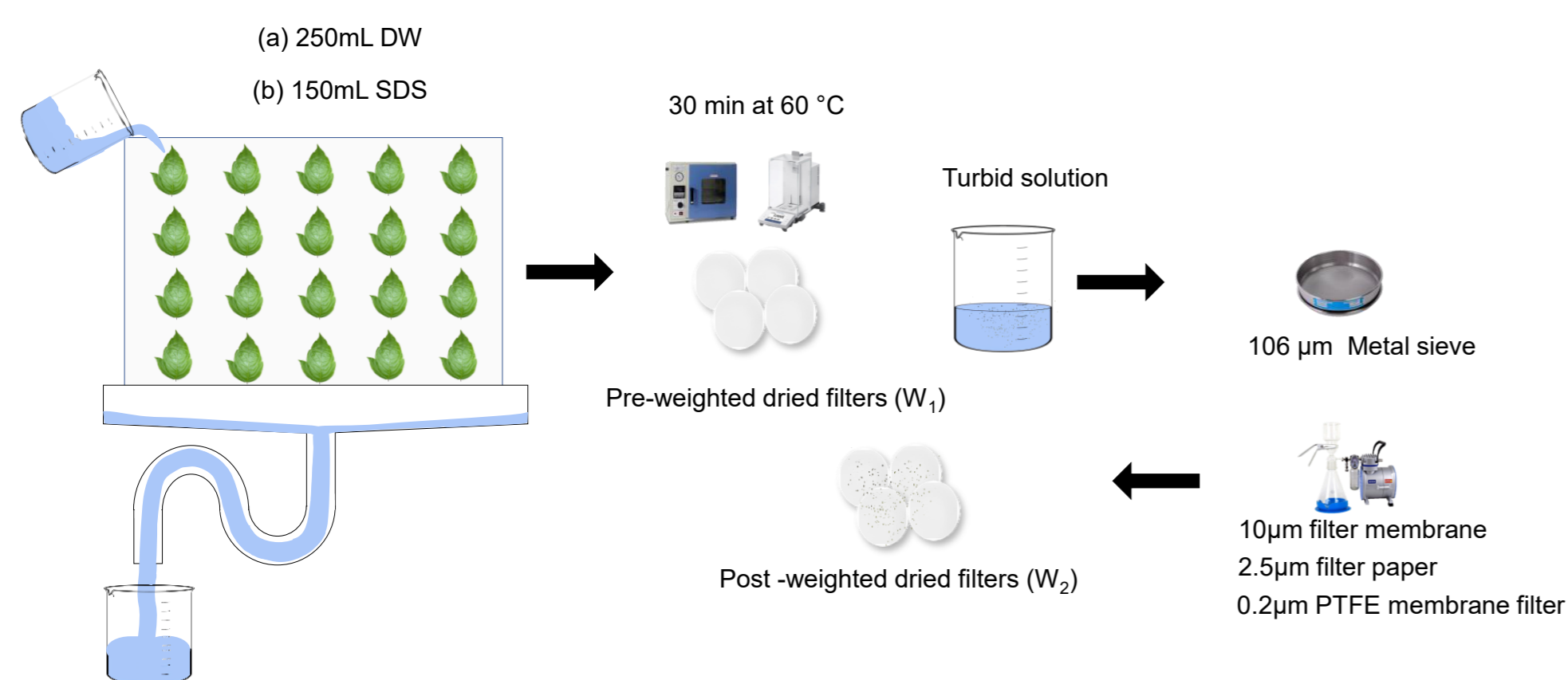


Figure 2. Gravimetric filtration workflow for surface-specific PM quantification

Leaf surface area was determined by scanning leaves at high resolution and analyzing the images using ImageJ software.

Particulate matter deposition was calculated as the mass of particles per unit leaf area ($\mu\text{g}\cdot\text{cm}^{-2}$) using the following equation.

$$PM = \frac{W_{f+PM} - W_f}{A}$$

RESULTS & DISCUSSION

Total xenobiotic particulate load accumulated by *Ruscus aculeatus*

54.8 $\mu\text{g}\cdot\text{cm}^{-2}$

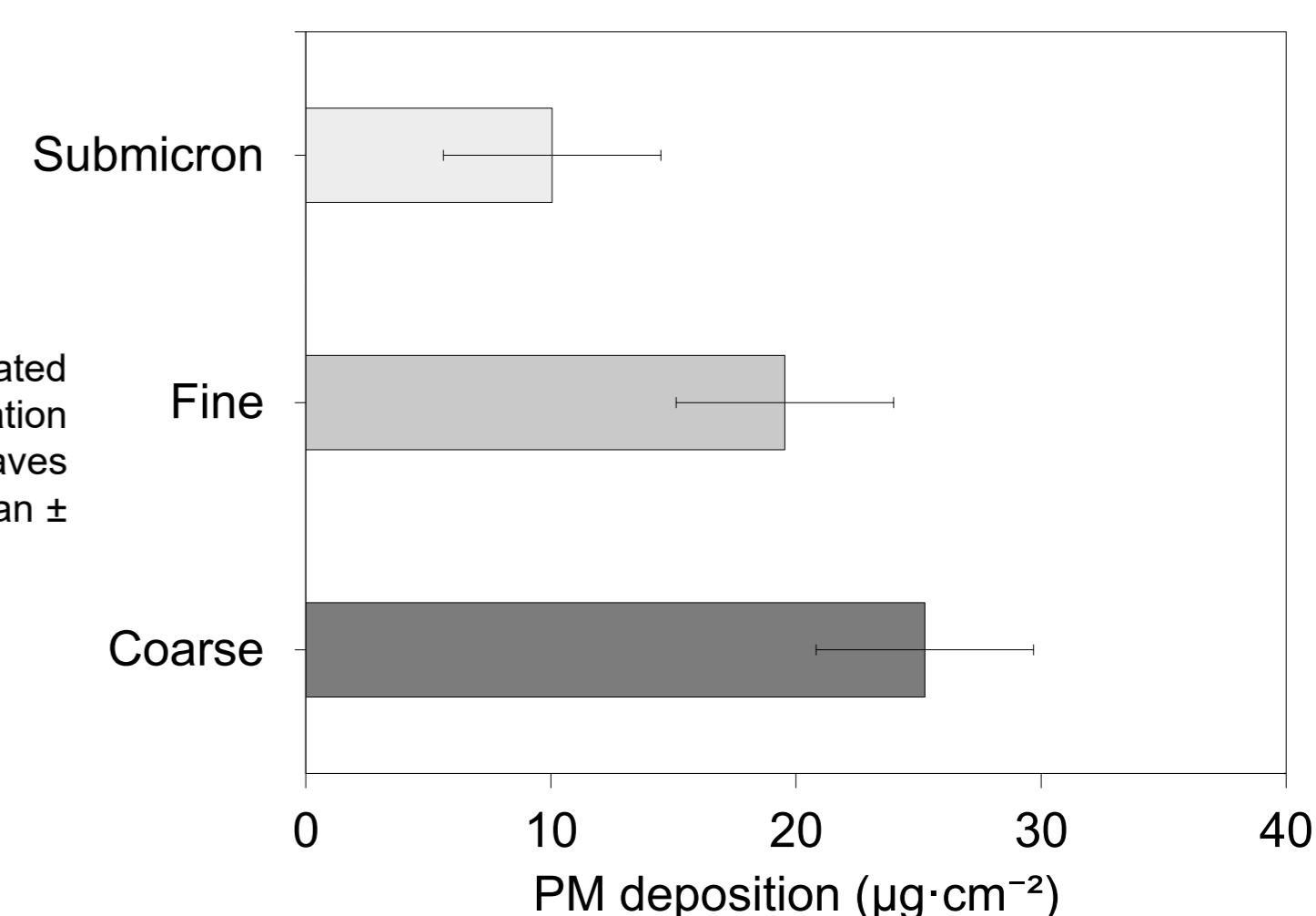


Figure 3. Size-fractionated particulate mass accumulation on *Ruscus aculeatus* leaves expressed as $\mu\text{g}\cdot\text{cm}^{-2}$ (mean \pm SE).

The abaxial surface retained significantly higher particulate loads than the adaxial surface ($p < 0.05$).

Table 1. Surface-specific particulate mass accumulation and dominant deposition patterns on adaxial and abaxial leaf surfaces of *Ruscus aculeatus*.

Surface	Accumulation ($\mu\text{g}\cdot\text{cm}^{-2}$)	Main Pattern
Adaxial	24.5	Dominated by coarse particles from direct deposition
Abaxial	30.3	Enriched in fine/submicron particles due to sheltered retention and microstructural stabilization.

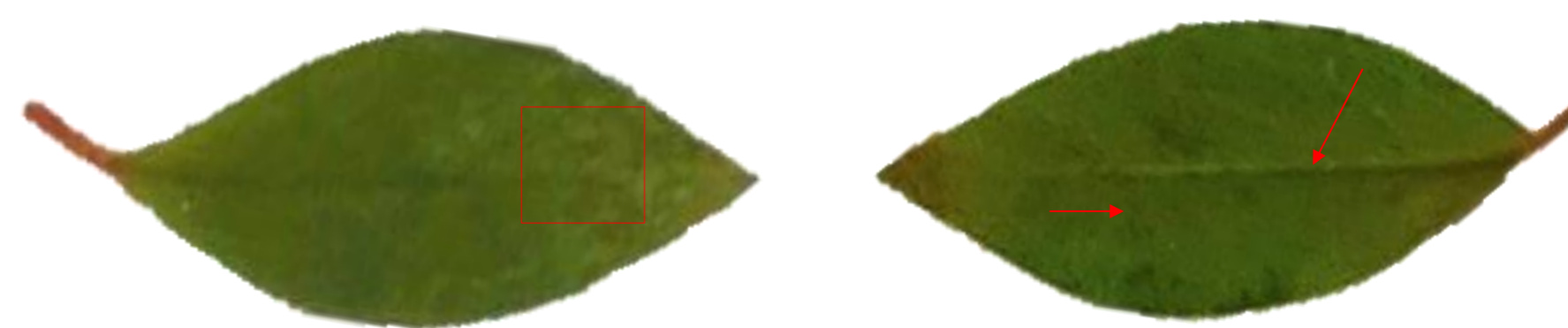


Figure 4. Morphological features of *Ruscus aculeatus* cladodes, including surface roughness, grooves, vein networks, and lanceolate geometry, that enhance particulate retention and reduce particle resuspension.

CONCLUSION

- **54.8 $\mu\text{g}\cdot\text{cm}^{-2}$** total xenobiotic PM, *Ruscus aculeatus* confirmed as effective passive biomonitor.
- **Abaxial > Adaxial** (30.3 vs. 24.5 $\mu\text{g}\cdot\text{cm}^{-2}$; $p < 0.05$) driven by sheltered orientation, microstructural trapping, and reduced wash-off.
- **Coarse particles dominate** total mass; submicron dominates toxicological load per unit mass.
- **Leaf microstructures** (grooves, vein networks, surface roughness) are primary determinants of trapping efficiency.

FUTURE WORK / REFERENCES

- **Chemical and SEM characterisation:** Spectroscopic, chromatographic & microstructural analysis of captured PM.
- **Phyllosphere microbiology:** Microbial response to xenobiotics and biodegradation pathways.

References

Lang, T., Lipp, A. M., & Wechselberger, C. (2025). Xenobiotic toxicants and particulate matter: effects, mechanisms, impacts on human health, and mitigation strategies. *Journal of Xenobiotics*, 15(4), 131.