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Assessment of Microbiological Contamination Exposure in the Plastic Waste Industry Using Passive Sampling Methods

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OBJECTIVE

This study assessed occupational exposure to microbiological contamination in the plastic waste sorting industry using passive sampling methods, and aimed to identify suitable analytical approaches for characterizing microbial contamination in this environment.

MATERIALS & METHODS

A sampling campaign was conducted at a waste sorting plant in Lisbon, Portugal to evaluate workers' exposure to microorganisms and their metabolites. A passive multi-matrix approach was applied.

6× EDC

Electrostatic dust collectors placed in the work environment

20× EDC-T

Electrostatic dust cloths worn on workers' T-shirts

6× Swabs

Frequently touched surfaces (door handles, TV remote, keyboard & mouse)

3× Settled dust

Deposited dust samples from the facility

ANALYTICAL PIPELINE

Culture-dependent methods → Azole-resistance screening (EUCAST) → Mycotoxin quantification (LC-MS/MS)

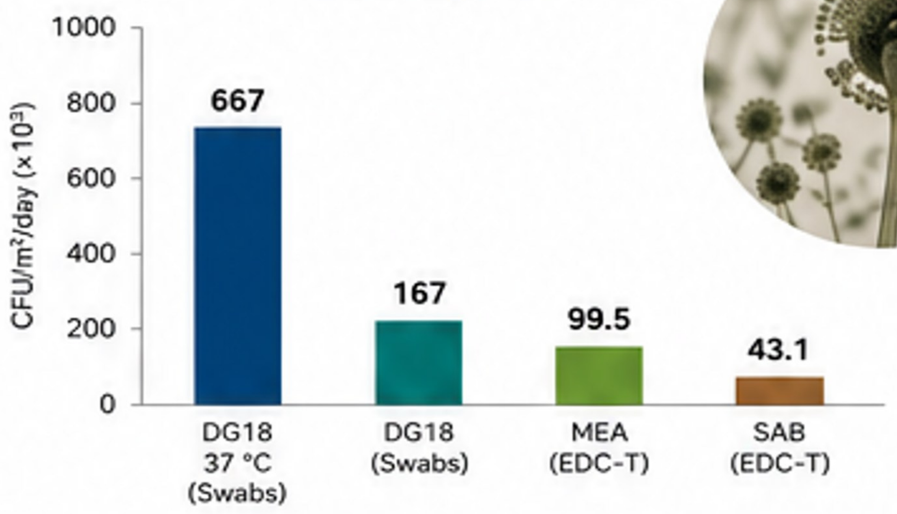
SAMPLING & ANALYTICAL WORKFLOW

1. **Plastic waste sorting plant** — Lisbon, Portugal – occupational setting
2. **Passive multi-matrix sampling** — EDC · EDC-T · swabs · settled dust
3. **Culture-dependent analysis** — Fungal & bacterial contamination
4. **Azole-resistance screening** — EUCAST-guided isolate testing
5. **Mycotoxin quantification** — LC-MS/MS of fungal metabolites

RESULTS

HIGHEST FUNGAL CONTAMINATION

CFU/m²/day (×10³)



The highest fungal contamination occurred in swab samples (DG18 37 °C and DG18) and in EDC-T samples (MEA and SAB).

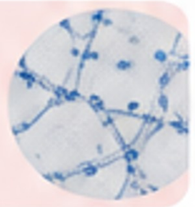
KEY FINDINGS

ASPERGILLUS SECTIONS

Sections *Nigri*, *Fumigati*, *Flavi* & *Circumdati* were detected across all matrices.

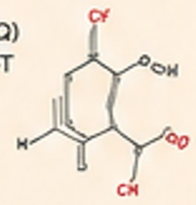
AZOLE RESISTANCE

100% growth of *Mucor* sp. on azole-supplemented media in selected samples.



MYCOTOXINS

Only roquefortine C (<LoQ) was detected in one EDC-T sample. However, the presence of toxigenic fungal genera suggests additional mycotoxins may occur.



CONCLUSIONS

Passive multi-matrix sampling revealed relevant occupational exposure to fungal contamination in plastic waste sorting. Despite limited mycotoxin detection, exposure to fungal metabolites cannot be excluded, highlighting the need for enhanced monitoring and risk management in this **occupational setting.**

RELEVANT EXPOSURE

Workers in plastic waste sorting facilities are exposed to significant levels of fungal contamination.

EFFECTIVE APPROACH

Passive multi-matrix sampling (EDC, EDC-T, swabs, settled dust) is effective to assess exposure.

MONITOR & MANAGE

Enhanced monitoring of fungal contamination and metabolites is essential for risk prevention and worker protection.

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References

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