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An investigation into the leaching of micro and nano particles and chemical pollutants from disposable face masks - linked to the COVID-19 pandemic

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Outline



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Highlights

- We investigated the impact of disposable plastic facemasks (DPFs) on environment.
- Micro and nano particles emitted from DPFs were deposited on Al₂O₃ membranes.
- Particles emitted from DPFs were identified as silicon-based and plastic fibres.
- Leachate was analysed using mass spectrometry for heavy metals and polar organics.
- Lead, cadmium, [antimony](#) and various organics species were detected in the leachate.

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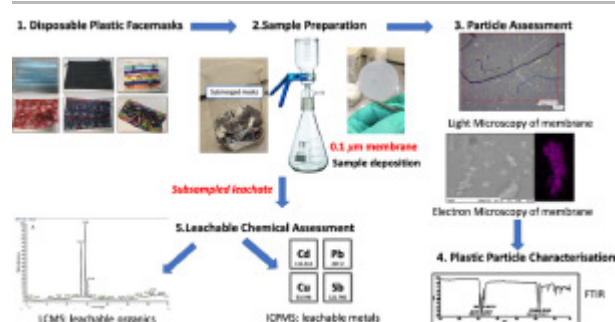
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environmental conditions if these DPFs were littered. The DPF leachates were filtered by inorganic membranes, and both particle-deposited organic membranes and the filtrates were characterized using techniques such as FTIR, SEM-EDX, Light Microscopy, ICP-MS and LC-MS. Micro and nano scale polymeric fibres, particles, siliceous fragments and leachable inorganic and organic chemicals were observed from all of the tested DPFs. Traces of concerning heavy metals (i.e. lead up to 6.79 $\mu\text{g/L}$) were detected in association with silicon containing fragments. ICP-MS also confirmed the presence of other leachable metals like cadmium (up to 1.92 $\mu\text{g/L}$), antimony (up to 393 $\mu\text{g/L}$) and copper (up to 4.17 $\mu\text{g/L}$). LC-MS analysis identified polar leachable organic species related to plastic additives and contaminants; polyamide-66 monomer and oligomers (nylon-66 synthesis), surfactant molecules, dye-like molecules and polyethylene glycol were all tentatively identified in the leachate. The toxicity of some of the chemicals found and the postulated risks of the rest of the present particles and molecules, raises the question of whether DPFs are safe to be used on a daily basis and what consequences are to be expected after their disposal into the environment.

Graphical abstract


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