

Cytotoxicity of contaminated protection devices used in waste sorting industry

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INTRODUCTION




Waste sorting is one of the most critical working environments since waste is frequently contaminated by organic matter that functions as a nutrient substrate to microorganisms.



In many occupational environments of waste industry, workers are exposed during long periods to high concentrations of microbial contamination. Several studies have lately stressed health risks related with those environments.

Marth et al., 1997; Eker et al., 2012



 Due to the recognized increased risk of microbiologic agents' exposure and the need of the employer to protect workers from the exposure risks, the use of Filtering Respiratory Protective Devices (FRPD) and Mechanic Protection Gloves (MPG) is mandatory in the Portuguese waste industry.

Viegas et al., 2020

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Are workers from waste sorting industry really protected by wearing Filtering Respiratory Protective Devices? The gap between the myth and reality



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Assessment of the microbial contamination of mechanical protection gloves used on waste sorting industry: A contribution for the risk characterization



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This study evaluated the cytotoxicity of contaminants present in protection devices used at work in a waste sorting industry.


MATERIALS AND METHODS


 One waste sorting industry in Lisbon was selected.

 **Multi-approach sampling strategy – Passive methods:**

- Filtering Respiratory Protection Devices (FRPD) (n=118)
- Mechanic protection gloves (MPG) (n=67) used by workers


 Protection devices were collected from Feeding machines with waste (FMW), Sorting waste (SW); Machines inspection (MI) and; Machines and special vehicles operator (MSVO).

 The MTT formazan assay was used to determine cell viability of different cells exposed to contaminated FRPD (interior layer (IL) and exhalation valves (EV)) and MPG.

 Human epithelial lung (A549) and swine kidney (SK) cells were exposed to test dilutions of **FRPD**; SK and hepatocellular carcinoma (Hep G2) cells were exposed to test dilutions of **MPG**.




RESULTS


 Half-maximal inhibitory concentration (IC50) in lung cells was **LOWER** for **FRPD-IL** than **FRPD-EV**, with interior layer exhibiting higher overall cytotoxicity than exhalation valves (**z = -4.455, p = 0.000**).

Workstation (n.° samples)	FRPD - Interior Layer (N)								FRPD - Exhalation valves (N)							
	A549				SK				A549				SK			
	10	5	2.5	1.25	10	5	2.5	1.25	10	5	2.5	1.25	10	5	2.5	1.25
FMW (40)	0	23	0	0	0	2	0	0	13	0	0	0	5	0	0	0
MI (4)	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MSVO (13)	0	5	1	0	0	0	0	0	3	0	0	0	0	0	0	0
SW (53)	0	23	2	1	0	2	0	0	18	1	0	0	1	1	0	0
n.s. (8)	0	5	0	0	0	1	0	0	4	0	0	0	0	0	0	0



 **HIGH** cytotoxicity (**IC₅₀ < 0.05 mm²/ml**) was observed in HepG2 cells for **31.6%** (18 out of 57) **MPG**.

IC ₅₀ (mm ² /ml)	MPG (N)	
	Hep G2	SK
5	8	21
2,5	3	14
1,25	5	5
0,625	13	6
0,3125	5	6
0,25	1	0
0,156	3	3
0,08	1	0
0,04	17	1
0,02	1	0
n.d.	10	13



MAIN FINDINGS DISCUSSION

- Contaminated FRPD exhibited moderate cytotoxicity on epithelial lung cells (A549), whereas contaminated MPG exhibited high cytotoxicity on hepatic cells (Hep G2).
- The effects on workers' health resulting from exposure to contaminants present in the waste sorting industry, either by inhalation or ingestion route must be further investigated.



THANK YOU

for your attention

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