


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

 Microbial exposures are the leading inducers of several respiratory health symptoms, such as asthma, decline in lung function, bronchial hyper-responsiveness, chronic bronchitis, wheeze, and cough.


Schenker et al., 1998; Linaker and Smedley, 2002; Sigsgaard and Schlünssen, 2004; Cleave et al., 2010; Basinas et al., 2012; Reynolds et al., 2013




INTRODUCTION

 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) is mandatory in the Portuguese waste industry.

Viegas et al., 2019

 Some hygienic measures taken by workers (such as where the FRPD is kept when not in use) or even the FRPD frequency replacement can impact on the FRPD microbial contamination.

Jachowicz et al., 2019

 Bioaerosols in the waste sorting industry consist of complex mixtures of organic and inorganic dust suspended in the air, including bacteria and endotoxins, fungi and mycotoxins, as well as particles of plant and animal origin

Douwes et al., 2003; Corrao et al., 2012; Rim and Lim, 2014







STUDY GOAL

To our knowledge, this is the **FIRST** study that will allow to characterize the risk resulting from the FRPD conditions of use and identifying the most suitable risk management measures.




MATERIALS AND METHODS

-  One waste sorting industry in Lisbon was selected
-  **Multi-approach sampling strategy – Passive methods:**
 - Filtering Respiratory Protection Devices (RPD) (n=118)
 - Mechanic protection gloves (MPG) (n=67) used by workers
-  The MTT formazan assay was used to determine cell viability of different cells exposed to contaminated RPD (interior layer (IL) and exhalation valves (EV)) and MPG.
-  Human epithelial lung (A549) and swine kidney (SK) cells were exposed to test dilutions of RPD; 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 **RPD-IL** than **RPD-EV**, with interior layer exhibiting higher overall cytotoxicity than exhalation valves (**z = -4.455, p = 0.000**).

Workstation (n.º 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



RESULTS

 **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 RPD exhibited moderate cytotoxicity on epithelial lung cells, whereas contaminated MPG exhibited high cytotoxicity on hepatic cells.
- 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.
- The result of an evaluation of the risk associated with exposure during waste collection will differ dependent on whether the average of all workers' exposure or the individuals are considered.



THANK YOU
for your attention

