Exposure to fungi in dockers

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ABSTRACT
Several activities are ensured by dockers increase occupational exposure to several risk factors, being one of them the fungal burden from the load. In this study we aim at characterizing fungal contamination in one warehouse that storage sugar cane from a ship, and also in one crane cabinet that unload the same sugar cane from the ship. Air samples were collected from the warehouse and from inside the crane cabinet. An outdoor sample was also collected, from each sampling site, and regarded as reference. Sampling volume was selected depending in the contamination expected and the air samples were collected through an impaction method with a flow rate of 140 L/min onto malt extract agar (MEA) supplemented with chloramphenicol (0.05%), using the Millipore air Tester (Millipore). Surfaces samples from the warehouse were collected by swabbing the surfaces of the same indoor sites, using a 10 by 10 cm square stencil according to the International Standard ISO 18593 (2004). The obtained swabs were then plated onto MEA. All the collected samples were incubated at 27ºC for 5 to 7 days. After laboratory processing and incubation of the collected samples, quantitative (colony-forming units - CFU/m^3 and CFU/m^2) and qualitative results were obtained with identification of the isolated fungal species. *Aspergillus fumigatus* present the highest fungal load and WHO guideline was overcome in both indoor sampling sites. The results obtained in this study highlight the need to know better the exposure burden from dockers, and specifically to fungi contamination.

Keywords: Fungi contamination; Occupational exposure; Dockers

1. INTRODUCTION
"Bioaerosol" in the occupational health context is normally defined as "particles with biological origin suspended in the air" (Eduard and Halstensen, 2009) causing health effects, especially in the upper airways (Bunger et al., 2000; Heldal et al., 2003). These are often fragments of larger organisms and microorganisms such as fungi (Bunger et al., 2000; Heldal et al., 2003). The genus *Aspergillus* is broadly distributed in nature, with a large number of species frequently causing opportunistic infections (Ramos et al., 2002). Within this genus, *Aspergillus fumigatus* is one of the most ubiquitous saprophytic fungi and is considered the species with higher clinical relevance (Dagenais and Keller, 2009; McCormick et al., 2010).
Regarding dockers, several activities are ensured by these workers, namely: the loading/unloading of ships in ports, crane operation, driving forklifts, trucks, or caterpillars, and also transporting, and lifting commodities. These tasks always implicate indirect contact of dockers with the load, enhancing occupational exposure to several risk factors, being one of them the fungal burden from the load that is handled. In this study we aim at characterizing fungal contamination in one warehouse that storage sugar cane from a ship, and also in one crane cabinet that unload the same sugar cane from the ship.

2. MATERIALS AND METHODS
Air samples were collected from the warehouse and from inside the crane cabinet. An outdoor sample was also collected, from each sampling site, and regarded as reference. Sampling volume was selected depending in the contamination expected and the air samples were collected through an impaction method with a flow rate of 140 L/min onto malt extract agar (MEA) supplemented with chloramphenicol (0.05%), using the Millipore air Tester (Millipore).
Surfaces samples from the warehouse were collected by swabbing the surfaces of the same indoor sites, using a 10 by 10 cm square stencil disinfected with 70% alcohol solution between samples according to the International Standard ISO 18593 (2004). The obtained swabs were then plated onto MEA.
All the collected samples were incubated at 27ºC for 5 to 7 days. After laboratory processing and incubation of the collected samples, quantitative (colony-forming units - CFU/m^3 and CFU/m^2) and qualitative results were obtained with identification of the isolated fungal species. For species identification, microscopic mounts were performed using tease mount or Scotch tape mount and lactophenol cotton blue mount procedures. Morphological Identification was achieved through macro and microscopic characteristics as noted by Hoog et al. (2002).

3. RESULTS AND DISCUSSION
The fact that there is no stipulated limit with regard to fungal contamination makes it essential to compare fungal contamination indoors and outdoors (Viegas et al., 2010). Outdoor sampling sites present less fungal load than inside warehouse and crane cabinet. Although the most frequent species indoor – *A. fumigatus* – was the only found in outdoor this still can mean that the fungal contamination is coming from within, since as it was already reported, indoor air can influence outdoor samples until 40 m near the facilities (Grisoli et al., 2009).
The World Health Organization (WHO) considers the value of 150 CFU/m^3 a reason for concern, especially when potentially pathogenic species are found (Goyer et al., 2001), such as the most frequent species found indoors. Both indoor sampling sites surpass 150 CFU/m^3 and present *A. fumigatus* as the most frequent found.

Aspergillus fumigatus presents the highest prevalence in warehouse air (90.0%) and from the crane cabinet (uncountable). Other fungi were also isolated, namely: *Alternaria* sp. (10%) in the warehouse and *Penicillium* sp. and *Eurotium herbarium* in the crane cabinet.

Three different species were isolated in surfaces samples from warehouse, namely: *A. niger* (33.3%), *A. fumigatus* (33.3%) and *Mucor* sp. (33.3%). Our results showed that surfaces sampling, in addition to air sampling, are essential to characterize and evaluate fungal contamination (Stetzenbach et al., 2004; Klánová and Hollerová 2003), since *A. niger* and *Mucor* sp. were only isolated in surfaces. This situation can occur due to different fungal characteristics and environmental variables (Górny, 2004; Roussel et al., 2008).

According to the American Industrial Hygiene Association (AIHA 1996) in the *Field Guide for the Determination of Biological Contaminants in Environmental Samples*, the identification of the species *A. fumigatus*, identified in both indoor sampling sites, requires implementation of corrective measures. Since is impossible to know what is the fungal burden from the load brought in each ship, respiratory protection devices, and also protection clothes must be used by dockers. However, occupational health interventions may be complex and need to consider all risk factors present in this occupational setting (Whyte, 2002).

4. CONCLUSIONS

The results obtained in this study highlight the need to know better the exposure burden from dockers, and specifically to fungi contamination. Future assessments must be performed to better characterize exposure to this risk factor, during the handling of different loads, since this risk factor, among others, is dependent from the material that is handle.

5. REFERENCES

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