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SIMI

THE CONTAMINATION POTENTIAL OF MEDICAL FACE MASKS

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Introduction

Human masks made of materials with larger pore size, such as cotton or synthetic fabric were not be able to effectively filter viruses or tiny virus-laden droplets as compared with the tight-filtering N95 respirators. During the COVID-19 pandemic, the use of face masks become increasingly recommended and even mandatory in the community settings. Unfortunately, there were in 2020-2021 some reports on side effects or secondary infections due to protective masks wearing. Lab investigations haven't discover a precise cause, yet. Very few studies were carried out on the supervision and control of quality biological conditions in the manufacture and sale. Most of the checked parameters were related to the size filtration of the mask and very little (micro)biological parameters were analyzed. The present study, focused on the (micro)biological analysis studies on masks available from the Romanian national market, such as the (micro)biological potential contamination of unused protective masks.

Materials and Methods

4 batches of face masks of different types were analysed during 2021-2022: MA and Mb – FFP2 mask from China, MChi – blue protective mask from China and MRO – blue protective mask from Romania.

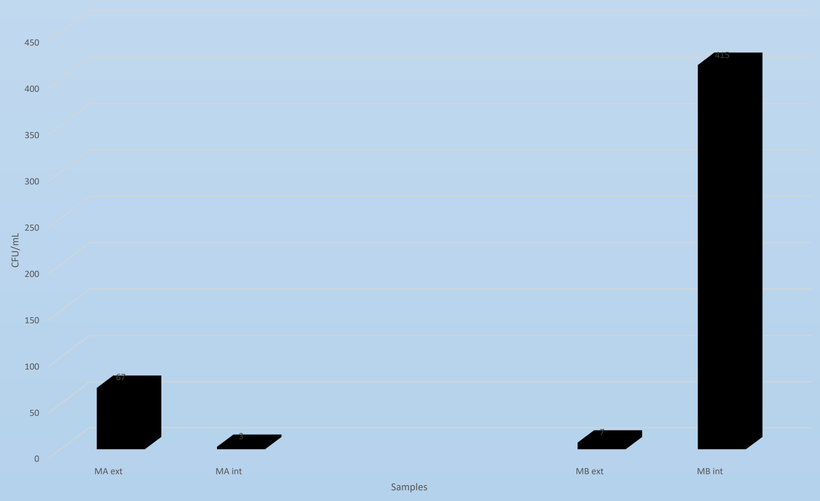
Mask type	Standard	Filtration efficiency	
FFP 2 – respiratory mask	China: GB2626	KN95 0,3 Microns ≥ 95%	KN99 0,3 Microns ≥ 99%
Blue protective mask	China: YY0469	3,0 Microns: ≥ 95% 1,0 Microns: ≥ 30%	

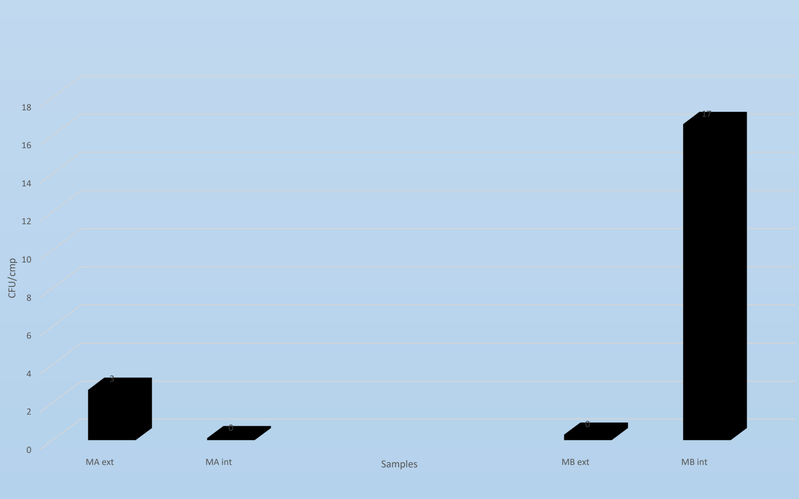
3,0 Microns: BFE – Bacterial Filtration Efficiency
0,1 Microns: PFE – Particulate Filtration Efficiency

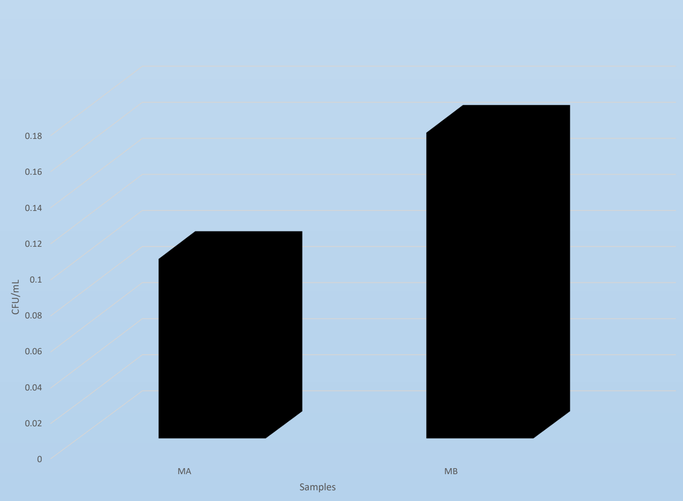
The methods preceding the bacterial identification analysis were immersion method and swabbing method. The first technique involved immersing each mask in a volume of 300 mL buffered peptone water – AP (Oxoid, UK) under 250 rpm agitation. A volume of 100 mL from each immersed sample was used to isolation and identification bacterial species. The swabbing technique was applied to inner and outer side of each mask, wiped with a swab moistened in Sodium Lauryl Sulfate Broth – SLSB (Oxoid, USA). 0.1 mL of bacterial suspension was transferred onto solid culture media, Tryptic Soy Agar - TSA (Oxoid, UK), Sabouraud Agar (Oxoid, UK), and Czapek-Dox Agar - CZD (Oxoid, UK), then incubated 48 hours at 37°C for Tryptic Soy Agar and Sabouraud Agar or incubated 5 days at 25°C for Czapek-Dox Agar. Positive and negative controls with standardized reference strains, Escherichia coli ATCC 25922, Enterococcus faecalis ATCC 29212, Pseudomonas aeruginosa ATCC 27853, Bacillus stearothermophillus ATCC 7953, Staphylococcus aureus ATCC 6538, were analyzed for all culture media used. Also, before being used, the culture media also went through the blank control test. Bacterial colonies isolated were identified based on their metabolic reactions by Omnilog automated system (Biolog, USA).

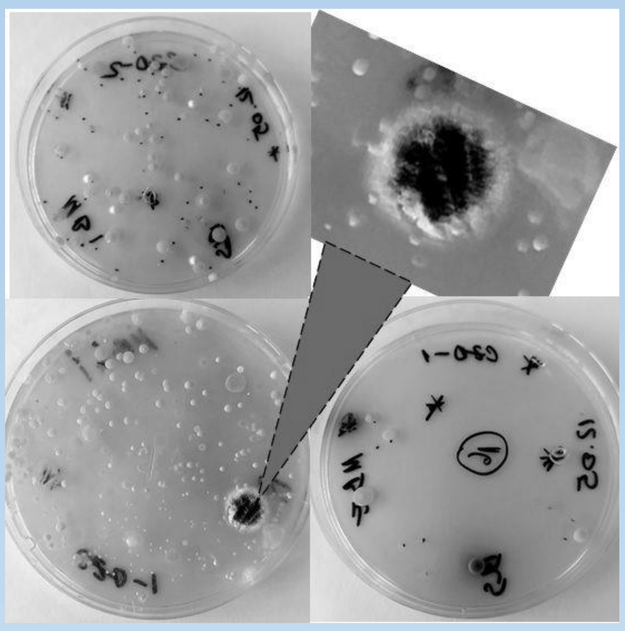
Results and Conclusions

Human welfare has been always based on their direct interest, so the economy was built on the expenses of the environment protection. The compounds resulted from anthropogenic activities, including wastes generated through industrial and domestic activities could be very harmful to the environment, threatening the existence of entire populations and species. The isolated colonies were incubated at 30°C for 3 days on general growth medium and bacterial colonies were developed. Among them, representatives of *Bacillus sp* were abundantly detected, with a higher frequency for *Bacillus pumilus*, especially on the MA and MB lots. This microorganism is found ubiquitously in soil and is pathogenic to plants. The samples grown on Sabouraud Agar culture medium incubated at 20-25°C for 7 days triggered the development of filamentous fungi, perhaps due to packaging conditions.









Genus Staphylococcus bacteria, pathogenic for animals, were detected on specimens from the MA batch. Also, bacteria with a lower risk of danger to humans were also identified on the MB and MChi specimens. Most of them have been showing pathogenicity characters for plants and animals and they have been present on many environmental matrices such as water, soil, surface. The MRO samples did not develop bacterial colonies on the filter membranes incubated on Tryptic Soy Agar and Sabouraud Agar, but the presence of filamentous fungi was observed on both media, especially better developed on Sabouraud Agar.

Swabbing tests indicated the presence of several bacterial strains on the MB mask. While no microorganisms were identified on the MRO mask, the presence of filamentous fungi was detected on the MChi mask and they could cause respiratory ailments if these devices were constant and prolonged used. At the same time, one can observe the presence of Corynebacterium terpenotabitum on the MAE sample, Streptococcus oralis on the MBE sample and Micrococcus luteus on the inner and outer MB mask, bacteria that were identified by both alternative methods of analysis. These results confirm the certainty of the existence of these microorganisms in the tested materials.