

INFLUENCE OF FILTERING MATERIAL ON THE MICROBIOLOGICAL SAFETY OF PROTECTIVE HALF MASKS

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Introduction

Filtering materials in protective half masks should stop microorganisms whose diameter is greater than 0.1 μm . Moreover, they must not restrict the air flow during breathing too much, otherwise asphyxia or anoxemia may occur [1]. The aim of the presented research was to evaluate the microbiological hazards related to the use of protective half masks.

Materials and Methods

1. Protective half-mask made of a medical fabric composed of 50% cotton, 50% polyester; 2. FS-17V FFP1 NR D half mask (three-layer structure with a welded periphery, needle-punched polyester non-woven fabric, melt-blown polypropylene non-woven fabric. Nose seal made of polyethylene foam); 3. Antibacterial hygienic half mask with silver ions (microfibers with silver ions in phosphate glass); 4. Three-layer surgical half-mask (1st layer of polypropylene non-woven fabric; 2nd layer of melt-blown paper filter; 3rd propylene non-woven fabric. Latex-free) 5. Double-layer cotton half-mask (100% cotton, hand-sewn). The bacteria used in the study came from the American Type Cultures Collection: *Pseudomonas aeruginosa* ATCC 27853.

The evaluation of the antimicrobial activity of the masks was performed using the direct Koch method in accordance with ASTM E2922. The material's susceptibility to adhesion of microorganisms was assessed in accordance with the procedures included in the ISO 22196: 2011 standard with modifications concerning the assessment of the viability of microorganisms. The microbiological cleanliness of the masks used for two hours was assessed by the impression method. The effectiveness of the disinfection methods was assessed for boiling water, water with detergent and alcohol using the Koch method.

Results and Discussion

The medical cloth mask and the FFP1 mask filter had the best bacteriostatic effect (TABLE 1).

TABLE 1. Bacteriostaticity of the mask material in relation to *Pseudomonas aeruginosa*.

The inner part of the mask		The outer part of the mask	

After two hours of use (TABLE 2) the highest number of microorganisms was present on half-mask with silver ions and on the hand-sewn cotton mask.

TABLE 2 Assessment of microbiological purity and adhesion of bacteria after two hours of mask usage.

Assessment of microbiological purity		Adhesion of bacteria to the mask material	
Inner part of mask	Outer part of mask	Inner part of mask	Outer part of mask
Protective half-mask made of a medical fabric			
FS-17V FFP1 NR D half mask			
Hygienic half mask with silver ions			
Surgical half-mask			
Double-layer cotton half-mask			

Applied methods of masks disinfection (TABLE 3) turned out to be ineffective. The presence of microorganisms was found on each of the tested materials.

TABLE 3. Assessment of the effectiveness of disinfection methods.

Disinfection method		
Boiling water	Water with detergent	Alcohol
Protective half-mask made of a medical fabric		
FS-17V FFP1 NR D half mask		
Hygienic half mask with silver ions		
Surgical half-mask		
Double-layer cotton half-mask		

Conclusions

The obtained test results indicate that the material from which the masks are made should be static for microorganisms, e.g. in the case of masks made of medical cloth and the FFP1 mask filter. In order to achieve a high safety effect i.e. elimination and reduction of adhering microorganisms disinfection methods for reusable masks should be combined in the following order: dipping in boiling water then washing with detergent and alcohol. Based on the research, it was found that the time of masks usage should be limited to a maximum of two hours.

References

[1] I. Krucińska, W. Strzembosz, K. Majchrzycka, A. Brochocka, K. Sulak: Biodegradable Particle Filtering Half Masks for Respiratory Protection, FIBRES & TEXTILES in Eastern Europe (2012) 20 6B(96) 77-83.