02502
Application of atmospheric pressure cold plasma to disinfect face masks.

08. Healthcare-associated infections, infection prevention & control

8h. Disinfection & biocides

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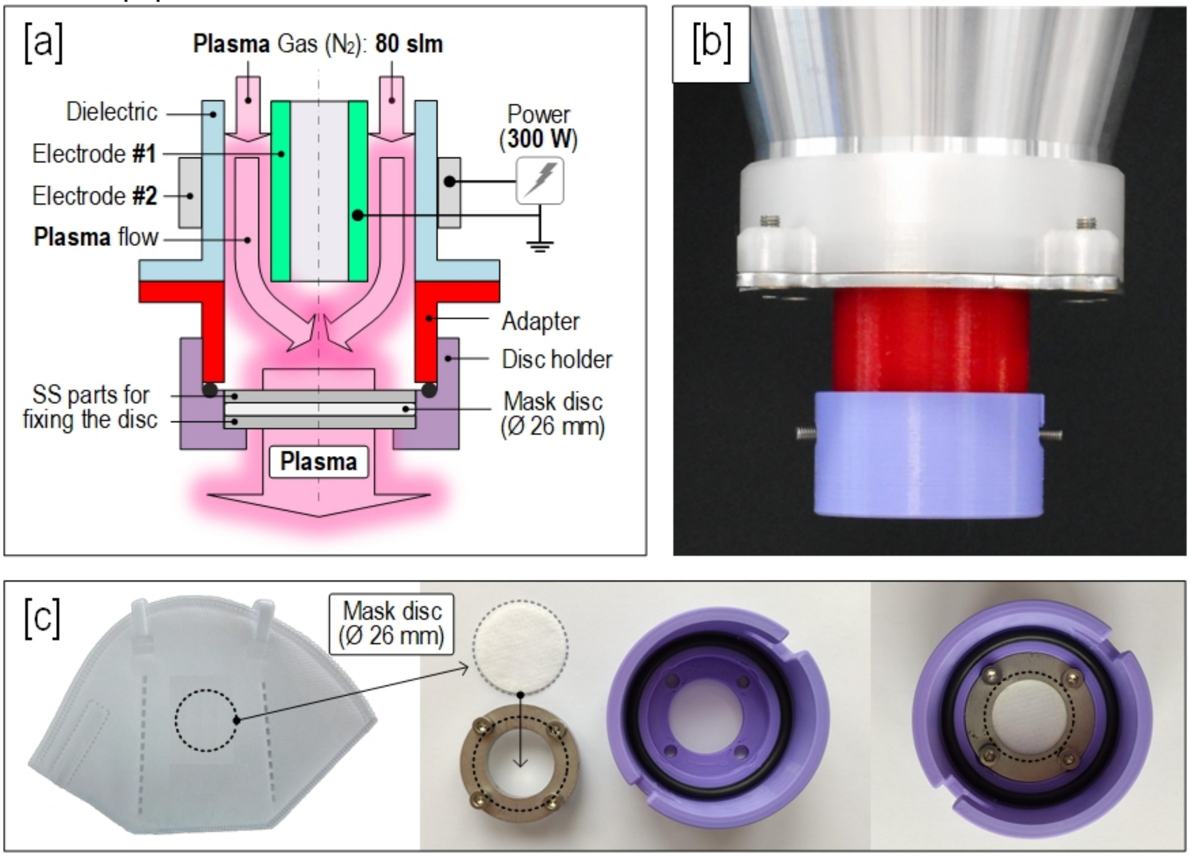
Background The mask usage has increased over the last year due to COVID-19 pandemic. Their prolonged use causes skin problems related to bacteria overgrowth. To overcome those problems, atmospheric pressure cold plasma -APCP- was studied as an alternative technology for disinfection of masks.

Methods Ten clinical, environmental and reference strains of Pseudomonas aeruginosa, Escherichia coli, Staphylococcus aureus, Staphylococcus epidermidis, Staphylococcus hominis, Staphylococcus haemolyticus, and Staphylococcus saprophyticus species were selected, and were inoculated (108 UFC/mL) in mask disks and complete FFP2/KN95 masks. Nitrogen, air and argon plasma gases, at 300 W and 90 W, and different treatment times (0.75, 1.5, 2.5 and 5 minutes) were applied (Figures 1 and 2). The effect of nitrogen treatment over GFP protein levels in P. aeruginosa ATCC15692GFP strain was analysed. Reactive species of different plasmas were studied using optical emission spectroscopy (OES). Thermal treatment at 100ºC was performed to discard heat effect. The best treatment was chosen for subsequent breathing, filtering and visual analysis after one and five disinfection cycles.

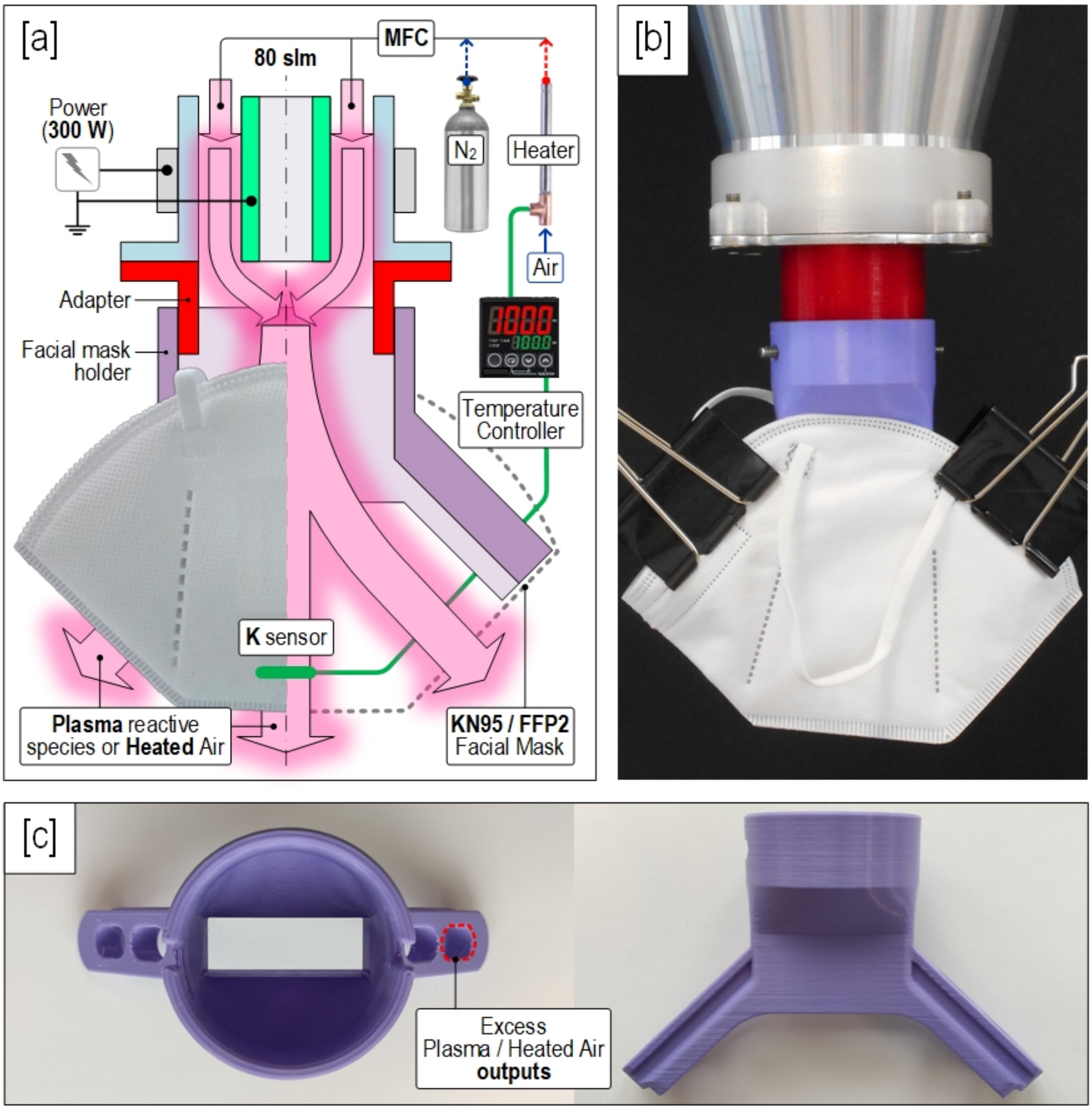
Results A total reduction (>5log) for E. coli and P. aeruginosa strains was reached with all APCP-treatments applied. However, S. aureus strains were inactivated only after 1.5 and 2.5 min of nitrogen plasma at 300 W. Both treatments caused a significant reduction in the quantification of the GFP fluorescence in P. aeruginosa-ATCC15692GFP (Figure 3). The 1.5 min-treatment reached 100ºC, but the thermal treatment at 100ºC on the masks was active only against P. aeruginosa and E. coli. Thus, nitrogen plasma at 300 W during 1.5 min was chosen as the best treatment. These results were confirmed with nitrogen species identified by OES analysis. No morphological modifications or visual deformations were identified in the masks after the APCP treatment. Additionally, 5 plasma cycles treatments showed no negative effects in masks filtration capacity and breathability.

Conclusions APCP is a promising technology to disinfect face masks, even after five cycles, without affecting the mask morphology or reducing its functional capacity. Disinfecting used masks with APCP is an emergency solution to solve the mask shortages; as well as the environmental problems associated with discarding masks.

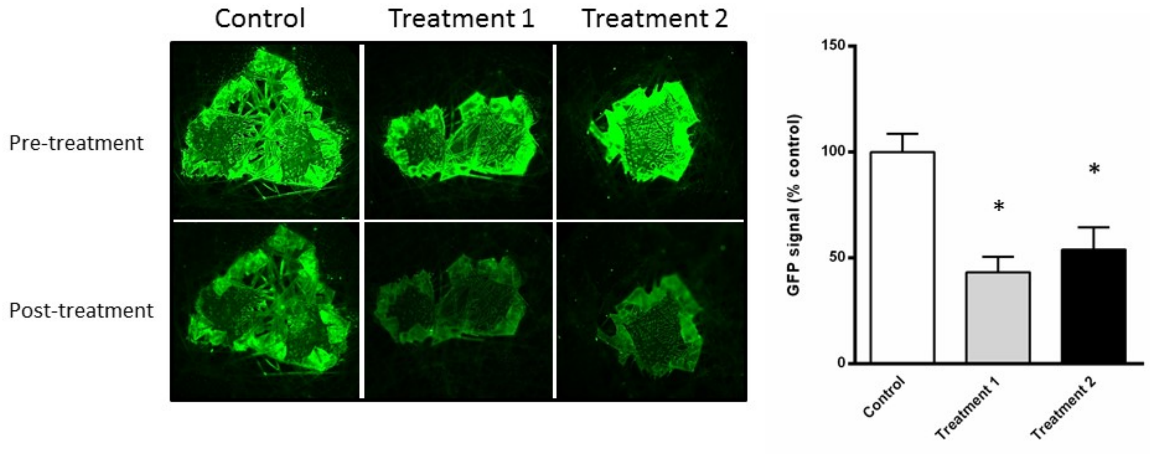
APCP equipment to treat mask disks



APCP equipment to treat complete masks



GFP quantification



Keyword 1
atmospheric pressure cold plasma
Keyword 2
mask
Keyword 3
bacterial disinfection

Conflicts of interest

Do you have any conflicts of interest to declare?
I have no potential conflict of interest to report