Patent applications

COMPOSITIONS AND METHOD FOR TREATING MATERIALS FOR THE DEVELOPMENT OF (MEDICAL) PROTECTIVE DEVICES WITH ANTIVIRAL AND ANTIMICROBIAL ROLE

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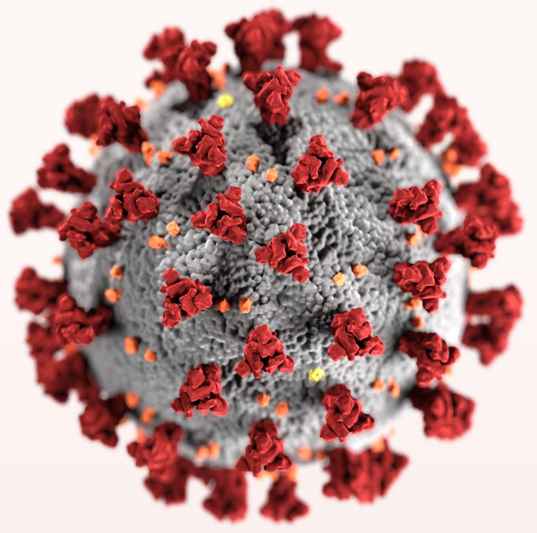
Abstract

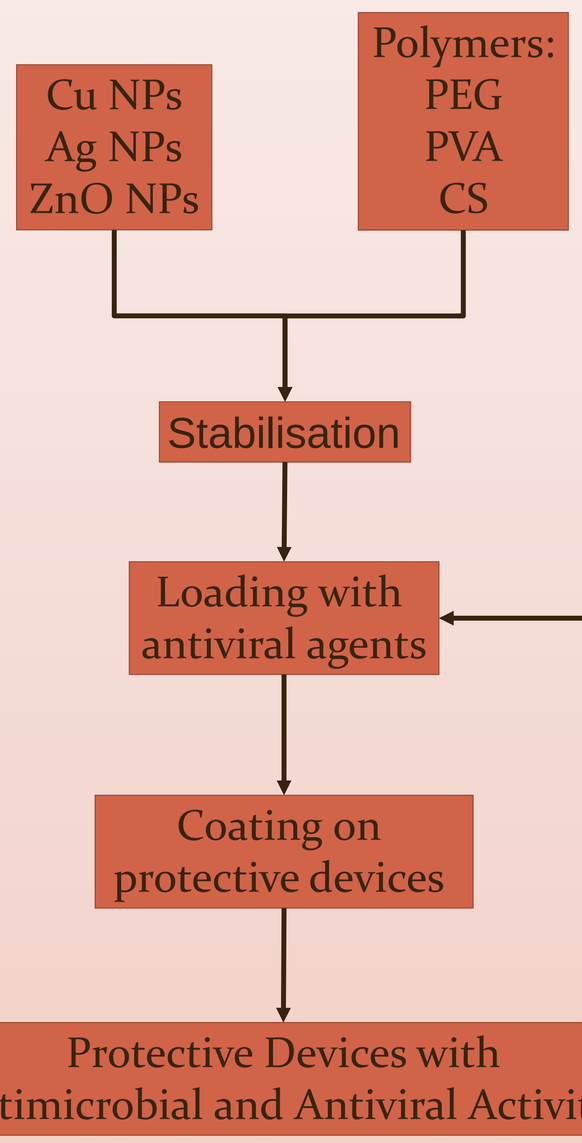
The present invention provides the technology for modifying protective devices (masks, overalls, gowns, gloves, visors) by applying a polymeric layer loaded with Ag nanoparticles (of various shapes and sizes from spherical nanoparticles to triangular, truncated triangular, hexagonal, cubic, cylindrical, etc.), Cu, ZnO, etc. stabilized with suitable agents and loaded with antiviral / antimicrobial substances based on pure components such as eugenol, eugenyl acetate, ..., oils or extracts with low volatility to ensure long-lasting action. In the case of masks, in particular, to avoid inhalation of high amounts of volatile components with irritating / inflammatory effects the volatility and irritability should be considered. In the formulations to be applied on the protection devices, the nanoparticle content can reach 1-2%; antiviral / antimicrobial components also 1-2% while the polymer content varies in the range of 0.1-100% the difference being solvent. The technology can also be applied on the raw material from which the protection devices are obtained, following the thermoforming to be performed with the raw material that already contains the antiviral / antimicrobial components and through this process their embedding in the material takes place.



Context

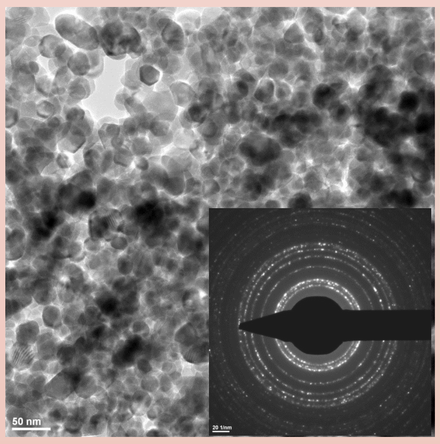
Worldwide, there is an increasing need of manufacturing efficient protective devices, preferable with antimicrobial and antiviral activity! The usual masks are efficient for bacterial penetration, bacterial cells usually having 0.5 – 5μm but limited or no efficiency against viruses which, are usually, from 5 to 300nm in diameter. SARS-Cov-2 is, for instance a small virus of about 125nm which easily pass through the most protective masks. In this context, it is necessary to develop new masks with smaller pores – but inducing problems in breathing or to increase the time needed to pass through these filtrating material (by improving the virus – material interaction) and during this time, to assure the loss of the infectiousness!

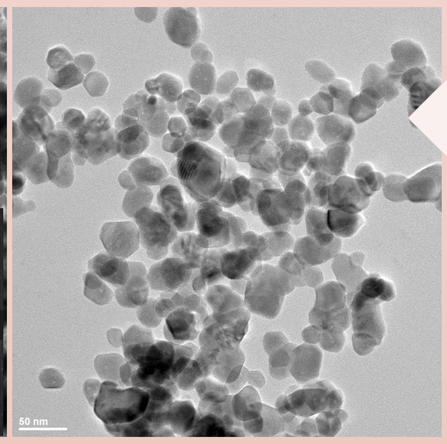
Treating protocol for the development of (medical) protective devices with antiviral and antimicrobial role



Pure compounds: eugenol, eugenyl acetate, terpenes or **natural oils**, in particular thyme, lavender, basil, eucalyptus, bergamot, cloves, rosemary or cinnamon.

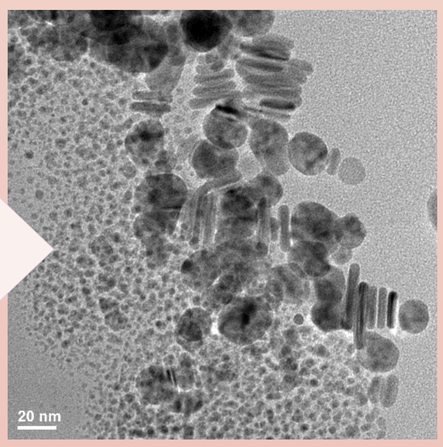
Optical images of the formulations based on AgNPs

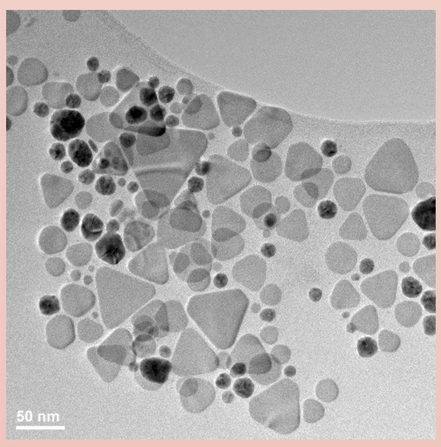


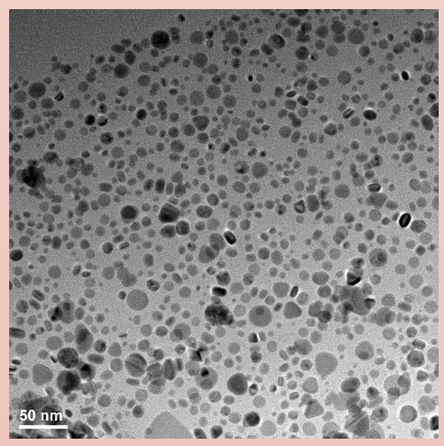


TEM images for ZnO NPs

TEM images for Ag NPs







Quantitative assay of the ZnO antimicrobial activity

Bacterial strain	150 μg/mL	75 μg/mL	37.5 μg/mL	18.75 μg/mL	9.38 μg/mL	4.69 μg/mL	2.35 μg/mL	1.17 μg/mL	0.09 μg/mL
L. monocyt. 318	0.085	0.059	0.067	0.063	0.065	0.062	0.086	0.122	0.336
S. aureus ATCC 25923	0.090	0.083	0.080	0.083	0.086	0.239	0.942	1041	1170
Bacillus cereus	0.071	0.069	0.075	0.070	0.075	0.072	0.084	0.098	0.902
E. coli ATCC 25922	0.066	0.077	0.070	0.077	0.605	0.488	0.579	0.753	0.960
P. aeruginosa ATCC 27853	1146	1276	1295	1252	1327	1235	1255	1382	1301