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Title
Essential oils-loaded nanofibrous mats inhibitory effect against the Escherichia virus MS2, mimic of SARS-CoV-2
Authors
Joana M. Domingues (joana.domingues@2c2t.uminho.pt)
Samira F. da Silva (samifs@gmail.com)
Marta O. Teixeira (pg35037@alunos.uminho.pt)
Marta A. Teixeira (martaalbertinateixeira@gmail.com)
Joana C. Antunes (joana.antunes@2c2t.uminho.pt)
Helena P. Felgueiras (helena.felgueiras@2c2t.uminho.pt) *
[1] Centre for Textile Science and Technology, University of Minho

Abstract
In December 2019, a novel strain of coronavirus, SARS-CoV-2, was identified. Hoping to prevent transmission, many countries adopted a mandatory mask use in closed public spaces. However, most mask options display a passive-like action against COVID-19. To overcome such restrictions, this work proposes the incorporation of anti-viral essential oils (EOs) loaded onto a nanofibrous layer that can be adapted to both community and commercial masks.Twenty EOs selected based on their antimicrobial nature were examined for the first time against the *Escherichia* virus MS2. The most effective were the lemongrass (LO), Niaouli (NO) and eucalyptus (ELO) with a minimum inhibitory concentration (MIC) of 356.0 mg/mL, 365.2 mg/mL and 586.0 mg/mL, respectively. Polycaprolactone (PCL) was prepared at 14 wt% in chloroform/dimethylformamide (DMF) and processed via electrospinning, with processing parameters being optimized to 23 kV, 0.7 mL/h and 26 cm. Uniform, beadless nanofibers were obtained. Mats were characterized as mechanically resilient, to endure movements arising from mask positioning, and hydrophobic in nature, to repel droplets coming from the exterior. Loading of the nanofibrous mats was accomplished via two ways: (1) physisorption and (2) by combining the EOs with the polymer solution. In both cases, EOs were loaded at 10% of MIC concentration (saturation) for 24 h. Presence of the EOs was confirmed along the mats (UV-visible). Antimicrobial testing via halo determination, verified their diffusion abilities. More importantly, time-kill kinetics testing of the loaded mats attested to the EOs capability to fight the virus MS2 even when bonded to the nanofibers at a smaller concentration than MIC. EOs-physisorbed mats were quicker in their action, while those entrapping the EOs in their polymeric matrix retained the antiviral activity of the mat for longer. Data demonstrated the potential of these EOs-loaded PCL nanofibers mats to work as COVID-19 active barriers for individual protection masks.

Keywords
electrospinning; hydrophobic barrier; mechanical resistance; antimicrobial; fighting covid-19 virus