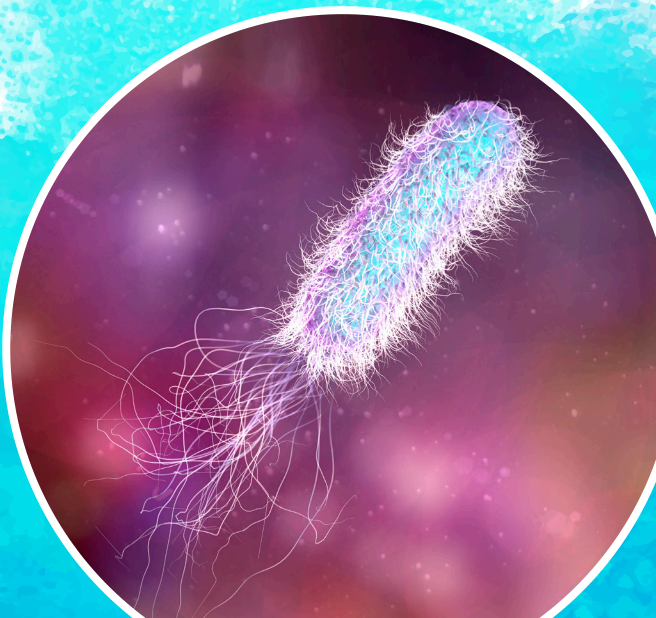
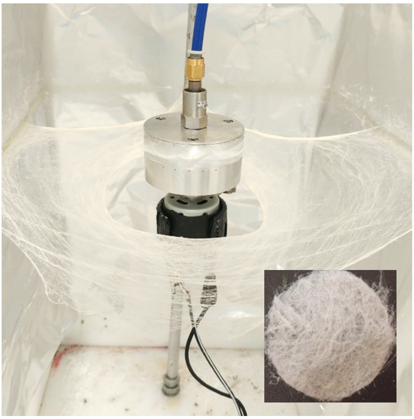
Antimicrobial filters for air and water

Novel filters for water and air with embedded antimicrobial intermetallic nanoparticles which kill over 90% of tested microorganisms in seconds.



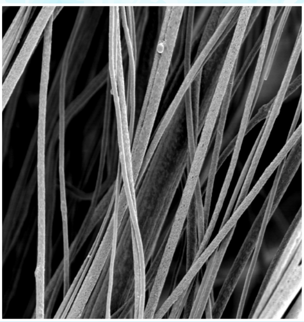
How it works

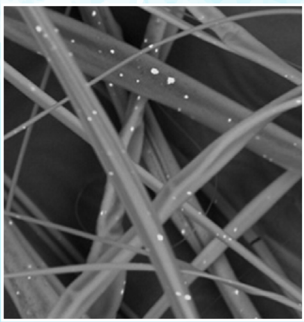
At the University of Hertfordshire, preparations of antimicrobial nanoparticles were manufactured and selected according to their performance in antimicrobial assays. The nanoparticles that had the best antimicrobial activity consisted of a combination of intermetallic nanoparticles with multi-elemental compositions including silver, copper and zinc. It was found that combining a number of metals in nanoparticles significantly increased the antimicrobial effect.



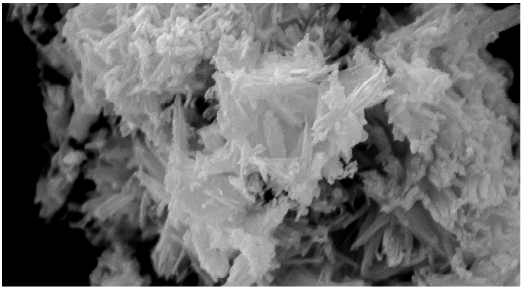
Fibres formed using pressurised gyration, inset: typical filter manufactured

The nanoparticles were then embedded into polymer fibres by using a pressurised gyration technique pioneered at UCL Mechanical Engineering. This novel fabrication process is a hybrid technique that combines centrifugal spinning and solution blow spinning. It uses speed and pressure to transform polymer solutions into uniform ultrafine fibres, resulting in a filter-like mesh. Each filter can be made in 180 seconds.





Scanning electron micrographs of the filter fibres with and without nanoparticles. The nanoparticles can be seen as bright spots on the fibres.



Scanning electron micrograph of the antimicrobial nanoparticles.

The novel antimicrobial filters were then tested for activity against the bacteria *Pseudomonas aeruginosa* and *Staphylococcus aureus*, well known human pathogens, to assess their effectiveness. Flow cytometry was used to enumerate live and dead cells before and after filtration.

Our results show that the filters are able to kill more than 90 % of these two pathogens after a few seconds of filtration.

Staphylococcus aureus

Pseudomonas aeruginosa

We are now in the process of testing the filters' effectiveness against two common viral pathogens, influenza A and adenovirus, during air filtration.

The team

The project is coordinated by **Dr Lena Ciric** at the University College London Department of Civil, Environmental and Geomatic Engineering.

The antimicrobial testing was carried out by Dr Ciric's team in collaboration with **Dr Elaine Cloutman-Green** from Great Ormond Street Hospital for Children.

The nanoparticle analysis and preparation were carried out at the University of Hertfordshire Centre for Engineering Research by **Dr G Ren**'s antimicrobial nanoparticle team.

The manufacture of the filter fibres was carried out at the University College London Department of Mechanical Engineering, led by **Professor Mohan Edirisinghe FREng.**

The researchers on the project are **Dr Claire Bankier**, **Dr Yuen Ki Cheong**, **Dr Suntharavathanan Mahalingam** and **Miss Rupy Kaur Matharu.**

The team was supported by an expert panel from industry and the NHS.

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