Personal Protective Equipment (Failures)

- How protective is a surgical mask?

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Background

400,000 surgical gowns have recently failed according to the British Standards Institute, but are all surgical masks fit for purpose? There are a variety of surgical face masks available, but they vary considerably in quality. The Health and Safety Executive have tested facemasks and show that viruses can pass through a mask (see Report RR619) but very little research has been done on characterising the pore size of the masks themselves.

Whitehouse Scientific is a world leader in characterising filter media and has used its unique technology to measure the pore sizes in a popular surgical facemask.

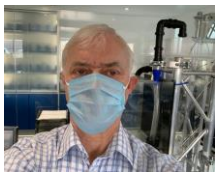

Fig 1. A typical mask

Results

This brief summary reports on the experiments used to analyse the pore sizes in a typical mask. All measurements are traceable to the International Standard metre.

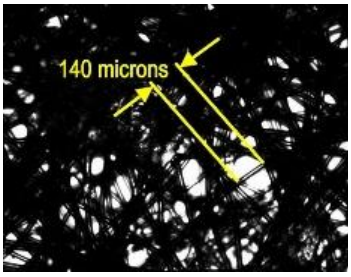

Fig 2. Microscope analysis detects pores of 140 micron

The mask consists of three unbonded sheets of randomly laid down layers of fibres. The pore sizes produced can be as large as 140 micron as shown in the microscope analysis, figure 2.

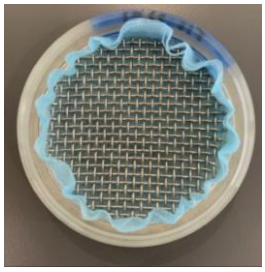

Fig 3. Mask mounted in a holder for testing

However, particles can pass via a tortuous path between the layers, so the size of particle penetration or expulsion could be much greater. The mask was then mounted in a filter holder for a sonic challenge test, figures 3 and 4. Precision glass beads in the size range 100 – 280 microns were used. The beads penetrating the mask were analysed by the microscope and were found to be up to 250 microns in diameter, figure 5.

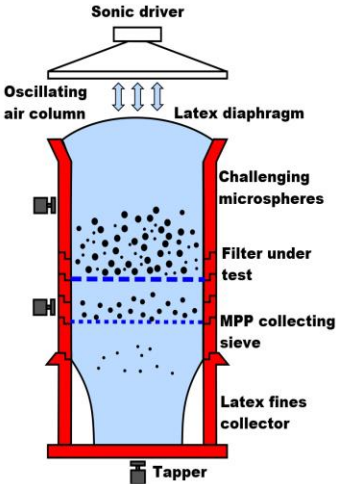

Fig 4. Sonic filter tester action. Collecting the Maximum Penetrating Particles

Conclusion

With pore sizes of up to 250 microns in a surgical mask, we are right to be concerned about the effectiveness of some masks against the Corona virus, which has a size 25,000 times smaller. Sneezing can produce droplets down to 15 microns so they can still penetrate the mask. However, a bigger concern is the consequence of using a poorly fitting mask, where gaps of several millimetres can occur.

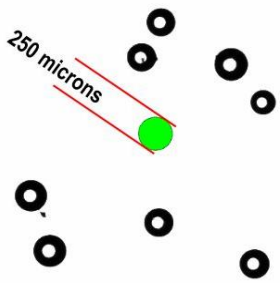

Fig 5. Precision glass beads passing the mask

As we approach the end of lockdown, would you be happy wearing a surgical mask on the London Underground. In a recent survey, 60% of the general public say they would not and, on the basis of this research, I can't blame them. So choose a certified mask (as recommended by the NHS) and make sure it is correctly fitted to minimise the possibility of infection.

Dr Graham Rideal, 7 May 2020