Shedding light on decontamination using bacterial bioluminescence

Bioluminescent bacteria emit light when metabolically active. We have harnessed this phenomenon to let us directly visualise decontamination in real-time. We visualised the inhibition of the food poisoning bacterium *Salmonella enterica* sv *Typhimurium* on an antimicrobial flooring surface. This research could lead to improved design of a more hygienic environment.

Bacteria are all around us, and for the most part share our environment without doing harm. Some bacteria however, are capable of causing disease (pathogens) and it is important to reduce our exposure to pathogens in our environment. This becomes more important in key areas like hospitals, clean-rooms and food preparation areas. Testing flooring using traditional microbiology methods can be time consuming and you have to remove the surface to test it effectively. The aim of the project was to determine whether the effect of an antimicrobial flooring surface could be visualised in real time, in situ, using bioluminescent *Salmonella typhimurium*.

Genes from naturally bioluminescent environmental bacteria *Photorhabdus luminescens* were inserted into *Salmonella typhimurium*. These genes made the Salmonella glow and this can be seen in a dark room with the naked eye (like the hands of a watch). We used very sensitive low-light cameras to detect the bioluminescent Salmonella on the surface of three types of flooring.

Time-lapse photography monitored the glowing Salmonella which we added to the surface of the flooring. The image shows four shots taken over a few hours. In each shot there are three types of flooring. At the top of each shot are three pieces of antibacterial flooring (dark blue/black). Below these are three pieces each of two types of standard flooring.

At the start of the experiment, there is a lot of light being emitted from the bacteria on all types of flooring. Soon it becomes clear that on the antibacterial flooring, the light from the bacteria is getting dimmer and dimmer until eventually it goes out completely. There is still plenty of light being emitted from the Salmonella on the other two types of flooring.

What this tells us is that on the antibacterial flooring, the bacteria find it more difficult to survive. Research like this allows us to identify surfaces that bacteria might find it difficult or even impossible to survive on. Using bioluminescence we can monitor their survival in real time, directly on the surface. This can allow us to choose better materials to make a safer, healthier environment.

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