Scientists shine a light on the detection of bacterial infection

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Researchers at the University of Sheffield have developed polymers that fluoresce in the presence of bacteria, paving the way for the rapid detection and assessment of wound infection using ultra-violet light.

When contained in a gel and applied to a wound, the level of fluorescence detected will alert clinicians to the severity of infection. The polymers are irreversibly attached to fragments of antibiotics, which bind to either gram negative or gram positive bacteria – both of which cause very serious infections – informing clinicians as to whether to use antibiotics or not, and the most appropriate type of antibiotic treatment to prescribe. The team also found that they could use the same gels to remove the bacteria from infected wounds in tissue engineered human skin.

Speaking at the British Science Festival today (15 September), Professor Sheila MacNeil, an expert in tissue engineering and wound healing, explains: "The polymers incorporate a fluorescent dye and are engineered to recognise and attach to bacteria, collapsing around them as they do so. This change in polymer shape generates a fluorescent signal that we've been able to detect using a hand-held UV lamp."

"The availability of these gels would help clinicians and wound care nurses to make rapid, informed decisions about wound management, and help reduce the overuse of antibiotics," says project lead Dr Steve Rimmer.

Currently, determining significant levels of bacterial infection involves swabbing the wound and culturing the swabs in a specialist bacteriology laboratory with results taking several days to be available. The team is confident that its technology can ultimately reduce the detection of bacterial infection to within a few hours, or even less.

The research has already demonstrated that the polymer (PNIPAM), modified with an antibiotic (vancomycin) and containing a fluorescent dye (ethidium bromide), shows a clear fluorescent signal when it encounters gram negative bacteria. Other polymers have been shown to respond to *S. aureus*, a gram positive bacteria. These advances mean that a hand-held sensor device can now be developed to be used in a clinical setting.

The research is the result of a 3-year project which started in 2006, part-funded by the Engineering and Physical Sciences Research Council (EPSRC) and the Defence Science and Technology Laboratory (Dstl) – an agency of the Ministry of Defence, interested in the medical application of the research in battlefield conditions, and a subsequent EPSRC funded PhD studentship.

The team is also investigating whether using a sophisticated technique called 'fluorescence non radiative energy transfer (NRET)' to generate the light signal could enable a highly refined sensor technology that could have applications in other areas.

"For example, we think that NRET could be very useful in an anti-terrorist and public health capacity, detecting pathogen release or bacterial contamination, whether accidental or deliberate," says Dr Rimmer. "NRET also allows us to learn more about how the polymers collapse around the bacteria, which is important in developing our understanding of how bacteria interact with these novel responsive polymers."

The team is interested in talking to potential partners to take this technology forward.

Provided by University of Sheffield