New material in the fight against hospital-acquired infections

January 11 2017

Researchers at the Universitat Jaume I (UJI) in Castellón, Spain, have developed a new light-activated antimicrobial material for use in the fight against the most common hospital infections. Led by professor Francisco Galindo and researcher Alicia Beltrán, the results have been published in the *Journal of Materials Chemistry*.

The new material is a molybdenum complex that has never been used before in antimicrobial photodynamic therapy (PDT). Talking about the study, professor Galindo reports: "We studied the photochemical properties of this complex, observing that it is able to generate singlet oxygen very efficiently. We also conducted preliminary tests on the bacteria Staphylococcus aureus, one of the most common causes of hospital-acquired infections."Galindo adds that "the tests so far have been very promising; it has been able to destroy practically all of the bateria exposed to the new material."

Currently, the field is dominated by the porphyrin and phthalocyanine compounds, which tend to clump together and lose their efficiency. This does not happen with the photosensitiser studied. Another advantage of the molybdenum, bonded to a polystyrene-type polymer, is that it is very photostable, meaning it does not self-destruct upon contact with light, unlike other photosensitisers which tend to break down upon prolonged exposure.

"This demonstration of the antimicrobial properties of molybdenum complexes leaves the field wide open to exploration and testing other

compounds with different microstructures," says Galindo.

Applications of the research

Viruses, bacteria and fungi are responsible for many diseases. PDT is one of the many approaches to combating these microorganisms. It is a form of therapy involving the use of light and a photosensitizing chemical substance – in this case, the molybdenum complex – which reacts to the light and kills off the problem cells: "Upon exposure to a light source, reactive oxygen species (ROS) are produced, which destroy the pathogens," says Galindo. The most frequent ROS is singlet oxygen, which has traditionally been used in PDT as treatment for skin infections and even skin cancer, where instead of destroying the pathogens the PDT kills off cancer cells.

The most immediate applications of the new material developed by UJI will harness its antimicrobial properties. It will be used preventively, incorporating the material into objects that self-sterilise upon exposure to a light source, and therapeutically to develop dermatological treatments for skin disorders, including skin cancer.

Commenting on the study, Galindo says, "Polystyrene-molybdenum is in its chemical and microbiogical lab development phase. We are also studying how other polymers (besides polystyrene-type polymers) might be used as carriers, as well as testing the efficiency and stability of other molybdenum complexes."

The UJI researchers also plan to study the effect of PDT with molybdenum on other pathogens. Application in the medical context is as yet in its initial stages, though the team is already working with medical specialists to evaluate its effectiveness in real-life settings.

More information: Alicia Beltrán et al. A photobleaching resistant

polymer supported hexanuclear molybdenum iodide cluster for photocatalytic oxygenations and photodynamic inactivation of Staphylococcus aureus, *J. Mater. Chem. B* (2016). DOI: 10.1039/C6TB01966H

Provided by Asociacion RUVID