Nature inspires antibacterial steels

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Taking inspiration from nature in order to confer new properties to coatings, such as steel: that is the basic principle of Biocoat project, which has for six years now brought together the University de Liege (Belgium) and ArcelorMittal.

Recently, researchers linked with the project presented their most recent results concerning the possibility of equipping stainless steel surfaces with sustainable and wide spectrum antibacterial properties. That should (re)give a veneer of biosecurity to these surfaces, which are everywhere around us, which we touch on a daily basis and which can be bacteria transmission vectors. The risks of nosocomial infections contracted in hospital environments are known about, and it has been recently once again stressed that restaurants and cafes are also particularly exposed sites...

These new results are inscribed perfectly with the objectives of BIOCOAT, which is looking to develop a new concept of coating stainless steel surfaces through bio-inspired processes which respect the environment and are not costly. 'The eco-conception compatible with industrial wet coating processes (through soaking or spraying) is our Ariane's thread throughout this project in order to render developed systems which can be produced industrially,' specifies Christophe Detrembleur, a Senior FNRS Researcher at the University of Liège's Center for Education and Research on Macromolecules (CERM).

Numerous chemical methods today already enable durable antibacterial properties to be conferred to surfaces but few prove to be transposable

on an industrial scale. That is the challenge the researchers united around the BIOCOAT project set themselves, in wisely combining bio-inspiration with the chemistry of synthetic polymers.

In 2009 they demonstrated the feasibility of a process based on an aqueous solution of a bio-inspired multi-functional polymer. Nevertheless the durability of the antibacterial property was not assured and the process required too many successive deposits of thin layers (some dozens of nanometres) on the steel, which blocked its industrialisation.

"We wanted to simplify this process by using the same basic products but by changing the ways in which they were deposited," points out Christophe Detrembleur. "We pre-assembled the active principles (hydrosoluble polymers bio-inspired for adhesion and nanoparticles of antibacterial silver) in the water in order to have a solution ready for use available, in other words ready to be deposited on the steel by a simple soaking or spraying." This process proved effective, quicker and not very costly.

"Since sending our results for publication in the *Langmuir* journal we have progressed further," adds Christophe Detrembleur. "We have now developed a solution ready for use which enables the functionalisation of substrates by biomolecules (anti-biofilm enzymes, antibacterial peptides, etc.). All that in water and at room temperature."

In addition, if these developments have been mainly carried out on steel substrates, these same products are now being tested on other supports, inorganic (titanium, etc.) or organic (plastics, textiles, etc.). The very innovative results will also be valorised in another entity, Symbiose Biotech, which will serve as a springboard between results which have freshly been produced by university research and the rapid development of various applications with different Walloon manufacturers in

different sectors (health, hygiene, etc.)

More information: 'Antibacterial Polyelectrolyte Micelles for Coating Stainless Steel', *Langmuir*, 2012, 28 (18), pp 7233–7241. DOI: 10.1021/la3003965