'BacillaFilla' for concrete cracks

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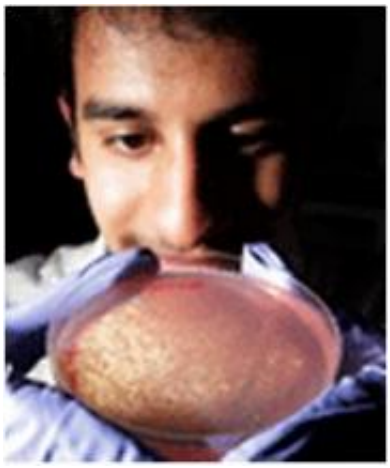

A bacteria that can knit together cracks in concrete structures by producing a special 'glue' has been developed by a team of students at Newcastle University.

The genetically-modified microbe has been programmed to swim down fine cracks in the concrete. Once at the bottom it produces a mixture of calcium carbonate and a bacterial glue which combine with the filamentous bacterial cells to 'knit' the building back together.

Ultimately hardening to the same strength as the surrounding concrete, the 'BacillaFilla' – as it has been aptly named – has been developed to prolong the life of structures which are environmentally costly to build.

Designed as part of a major international science competition in the US, the students have scooped Gold for their research.

Joint project instructor Dr. Jennifer Hallinan explains: “Around five per cent of all man-made carbon dioxide emissions are from the production of concrete, making it a significant contributor to global warming.

“Finding a way of prolonging the lifespan of existing structures means we could reduce this environmental impact and work towards a more sustainable solution.

“This could be particularly useful in earthquake zones where hundreds of buildings have to be flattened because there is currently no easy way of repairing the cracks and making them structurally sound.”

As part of the research, the students have not only considered the advantages of their engineered bacteria, but also the potential risks to the environment.

The BacillaFilla spores only start germinating when they make contact with concrete – triggered by the very specific pH of the material – and they have an in-built self-destruct gene which means they would be unable to survive in the environment.

Once the cells have germinated, they swarm down the fine cracks in the concrete and are able to sense when they reach the bottom because of the clumping of the bacteria.

This clumping activates concrete repair, with the cells differentiating into three types: cells which produce calcium carbonate crystals, cells which become filamentous acting as reinforcing fibres and cells which produce a Levans glue which acts as a binding agent and fills the gap.

The nine students, whose backgrounds range from computer science, civil engineering and bioinformatics to microbiology and biochemistry, took part in the International Genetically Engineered Machines contest (iGEM), is run out of the Massachusetts Institute of Technology (MIT) in Cambridge, Boston.

The aim is to get together a team of students from a variety of backgrounds to design and genetically engineer a bacterium to do something novel and useful.

Over 130 teams took part in this year's event and it is now the third time Newcastle University has won Gold. The team instructors were Professor Neil Wipat and Dr. Jennifer Hallinan, and the advisors were Dr. Wendy Smith, Dr. Matthew Pocock, Dr. Colin Davies, Dr. Jem Stach and Professor Colin Harwood.

Professor Neil Wipat added: "The students have done extremely well – this is a great achievement. Their work will now be used as a basis for research which is being carried out here at the University."

Provided by Newcastle University