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Genetically modified *Bacillus subtilis* bacterial strain for self-healing and sustainable green bio-concrete material

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Development of smart bio-concrete materials has recently become an emerging area of research for construction purposes. In this exertion, the gene having silica leaching attribute has been transformed to a *Bacillus subtilis* bacterial strain and the transformed bacterial cells are utilized directly for higher strength and more durable green self-healing concrete structures. The silica leaching gene was fished out from the BKH2 bacterium, amplified by the PCR technique and cloned into *Bacillus subtilis* bacteria via a suitable T-vector for developing a novel bio-engineered *Bacillus subtilis* strain. The transformed bacterial cells when incorporated directly into mortar specimens produced high performance bio-composite materials. Improvements of compressive strength, ultrasonic pulse velocity and decrease in water absorption capacity along with increased sulfate resistance are noted in the bacteria amended mortars. It is established that the microbiologically induced new rod-like shaped Gehlenite (Calcium aluminium silicate) phase grow inside the cement-sand mortar/concrete matrices which is responsible for increment of strength and durability. This means in practice that a substantial part of the cement of mortar/concrete mixtures can be left out while still obtaining the necessary final strength. This would substantially improve the ecological footprint as cement causes massive CO_2 emission during its production which affects the global climate negatively. Exploration of lucrative and easy methodologies for the development of bio-concrete materials using the novel bio-engineered *Bacillus subtilis* bacterial strain is therefore highly significant for commercial purposes which creates new hope for green and self-healing sustainable construction composites in the near future.

Biography

Brajadulal Chattopadhyay is currently working in the Department of Physics, Jadavpur University, India. He has completed his Master (1987) and PhD (1994) degrees from the University of Calcutta, India and worked at Bose Institute, India and Technical University of Delft, Netherlands as a Post-doctoral Fellow. He has been working in the field of Bioconcrete development by using an anaerobic bacterium to enhance the strength and durability of concrete structures since 2001 and published his work in many internationally reputed journals. He holds one national and two international patents in his research career.

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