Magnetic Nanowire-Guided Delivery of BMCs to Prevent Coral Bleaching

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Coral reefs stand as the ocean's last line of defense, a living barrier vital to the marine ecosystem, supporting approximately 25% of its biodiversity, and providing additional benefits to more than one billion people. However, scientists predict that by 2050, most of the world's corals will be destroyed due to coral bleaching. To this date, no reliable treatment exists to prevent coral bleaching. Still, studies on Beneficial Microorganisms for Corals (BMCs) have shown great potential, but no established delivery system exists for them. The purpose of this study is to use magnetic nanowires (NWs) to establish a tracking and delivery system for BMCs. Polydopamine (PDA), a biocompatible coating material, was used to conjugate Fe nanowires with BMCs. The NWs were tested for conjugation via scanning electron microscope (SEM), viability through live/dead assay with optical density measurements, stability in artificial seawater, and applied to corals for interaction analysis. SEM confirmed successful NW-BMC binding, while a live/dead assay demonstrated increasing interaction efficiency over 8 hours. The vibrating sample magnetometer verified the retention of magnetic properties post-conjugation. Stability testing in artificial seawater showed PDA-coated NWs remained intact for 12 hours. Finally, NW-BMCs were applied to corals, with coated BMCs successfully observed within coral tissues. This research shows promise in offering a novel avenue toward developing a precise delivery system for BMCs to enhance their resistance to bleaching events.

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