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Selection of carrier matrix for bacteria-mediated bioremediation in aquatic environments

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Water pollution and the outbreak of algal blooms are emerging environmental issues in many parts of the world. There is a growing concern on the application of bacteria-mediated bioremediation and bio control strategies to restore water quality and control algal blooms. However, in this context, selecting a suitable carrier matrix for the delivery of selected bacterial inocula is the most important and challenging step. Therefore, this study aimed to find a suitable carrier matrix to deliver bacterial inocula into the natural aquatic environment. Sodium alginate and four locally available low cost materials (sugarcane bagasse, rice husk, rice straw, and corn husk) were selected as potential carriers and treated with an alkaline solution to disintegrate the lignocellulosic cell wall structure. A selected model bacteria, *Escherichia coli* was immobilized into matrices at 1 x 10^8 cells/mL density. Scanning electron microscopic images confirmed enhanced bacterial immobilization in carrier matrices following alkaline pre-treatment. Bacterial growth in nutrient agar medium proved their viability after immobilization. In all carrier matrices bacterial viability remained high (10^7 CFU/g) at the end of seven weeks. The effect of carrier materials on the physicochemical properties of water was monitored in every other week for seven weeks. Dechlorinated tap water was used as the control. The measured water quality parameters; chemical oxygen demand (COD), dissolved oxygen (DO), pH, total dissolved solids (TDS), turbidity, conductivity, salinity and nitrate-N showed time-dependent reduction in water quality in treatments and control. However, Tukey's pairwise comparison revealed absence of a significant difference ($P < 0.05$) in COD, DO, pH, nitrate-N and turbidity in the treatment with sodium alginate compared to the control indicating that there is no negative impact of the application of sodium alginate on the water quality of receiving aquatic environment. Therefore, this research highlights the potential use of sodium alginate as a carrier matrix to deliver bacterial inocula into natural aquatic environments in the application of bacteria-mediated bio control strategies.

Keywords: Bacterial carrier, Bioremediation, Sodium alginate, Water quality

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