Optimizing Hydrogel Formulations for Enhanced Algae Bioprinting in Bioremediation Applications

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Abstract:

Algae bioprinting offers an innovative solution for bioremediation by enabling the creation of functional 3D scaffolds. This study investigates the optimization of hydrogel compositions for 3D bioprinting *Chlorella Pyrenoidosa*, focusing on rheological properties such as viscosity to ensure printability and structural integrity [1, 2]. The optimized hydrogel formulation was determined by utilizing alginate (ALG) and carboxymethyl cellulose (CMC) with calcium chloride as a crosslinker. Printed scaffolds were assessed for efficacy in removing Congo red dye and utilized as a model contaminant. The findings indicate that the ideal hydrogel formulation improved structural integrity, nutrient diffusion, and pollutant removal efficacy. By day 7, the bioprinted constructs achieved a dye removal efficiency surpassing 95%, significantly exceeding the performance of free algae systems. This study paves the way for sustainable bioprinting technologies in environmental remediation.

Keywords:

Bioprinting, Bioremediation, Congo Red Removal, Rheology.