Efficacy of Chitosan Hydrogel for a Variety of Agricultural Applications

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The hydrogel has gained attention as a delivery mechanism to reduce nutrient runoff and improve delivery of fertilizers. Hydrogels are crosslinked polymers that expand to hold liquid when submerged. This study focuses on comparing the capability of a chitosan-gelatin hydrogel to diffuse a colloidal silver antibiotic solution, to chelate Rhodamine B from deionized water, and to increase plant yield. The gelatin-chitosan hydrogel was chemically crosslinked with acetic acid for all studied applications. To determine the gel's ability to deliver silver nanoparticles, the hydrogels absorbed colloidal silver, were placed on petri-dishes streaked with S. marcescens, and zones of inhibition (ZOI) were recorded over time. The ZOI created by hydrogel silver diffusion expanded over time, and were significantly larger than ZOI created by the disk diffusion of silver. To test chelation ability, microplate spectrophotometer absorbance measurements were analyzed. Gelatin-chitosan hydrogels were crosslinked with dialdehyde carboxymethyl cellulose, then placed in well plates filled with textile dye Rhodamine B. Every 24hrs, optical density readings of the Rhodamine B solution were recorded. The dialdehyde carboxymethyl cellulose hydrogels only selectively held Rhodamine B temporarily. To compare the effects of fertilizer delivery by a hydrogel to traditional fertilizer application, germination rates and leaf yield of L. sativa were recorded across both treatment mechanisms. Hydrogel fertilizer delivery significantly increased plant yield and doubled germination rates as compared to traditional fertilizer delivery. The absorption capacity of hydrogels provides unique utility for a variety of agricultural applications.

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