Sustainable Agricultural Irrigation Using Hydrogel

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The main two challenges facing agriculture are water scarcity and poor soil quality. Various methods are used to solve these problems, such as drip irrigation and mulching. A promising emergent approach is the use of hydrogel in improving the water retention properties of soil. Therefore, This study aims to develop an efficient water management system to decrease water scarcity in agriculture, by imbibing the exact amount of water in the hydrogel that the plant needs without losing this amount of water, and reclaiming desert lands. The proposed starch-based hydrogel is more eco-friendly and cost-efficient compared to other hydrogels exploited in different irrigation methods. The hydrogel is primarily composed of crosslinked starch and polyacrylic backbone rendering the hydrogel non-toxic, biodegradable, and biocompatible. The hydrogel achieved a swelling ratio of 3200%, suggesting its potential for agricultural applications. Such swelling ratio was reached by using a 1:1 weight-to-weight ratio of acrylic acid and starch, respectively, and by adjusting the quantity of the crosslinker (N,N'methylene bisacrylamide). We planted basil plants in sandy soil (poor soil), using hydrogel as the medium of water and nutrients in the soil. The nutrients were put in powder form with tailored quantities for the basil plant. Compared to the normal cultivation of basil plants, the hydrogel increases the soil's water retention and saves about 50% of the water compared to the normal cultivation of basil plants.

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