SWELLING PROPERTIES AND BIODEGRADABILITY OF A NEW AGRO-HYDROGEL BASED ON RENEWABLE MATERIALS FOR AGRICULTURAL USE

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Purpose

- Maintenance of a soil quality for providing of a sustainable arable farming
- Increasing the quality of soil and conserve water resources

- Utilization of dairy industry by-product – acid whey to reduce associated environmental pollution

Objective

- Development of a novel biopolymer hydrogel based on acid whey and cellulose derivatives (carboxymethylcellulose and hydroxyethylcellulose) cross-linked with citric acid for application in agriculture as a soil conditioner

Experiments

Hydrogel preparation

Liquid acid whey + CMC/HEC 3:1

Stirring 22-24°C, 4 h → + citric acid → Drying 60 °C, 24h → Xerogel

Hydrogel after swelling

Characterization

- Swelling and re-swelling properties
- Water retention in soil
- Biodegradability –Soil burial test, Gas chromatography
- Structural characterization of degraded hydrogel samples (Scanning electron microscopy , Fourier transform infrared spectroscopy)
- Effect of hydrogel biodegradation products on soil fertility and plant growth

Results

Fig. 1. Swelling and res-swelling properties of whey-CMC/HEC based hydrogel crosslinked with 5% and 10% citric acid (H5 and H10 resp.).

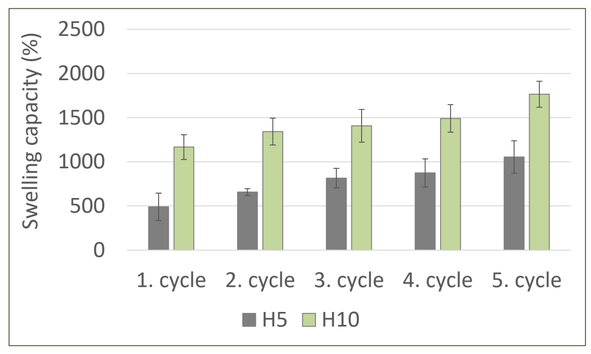
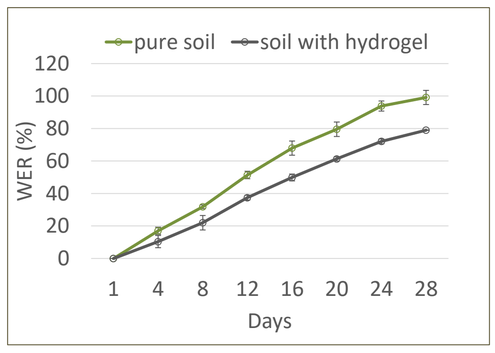


Fig. 2. Water evaporation ratio (WER %) and water retention ability of whey-CMC/HEC based hydrogel in soil.



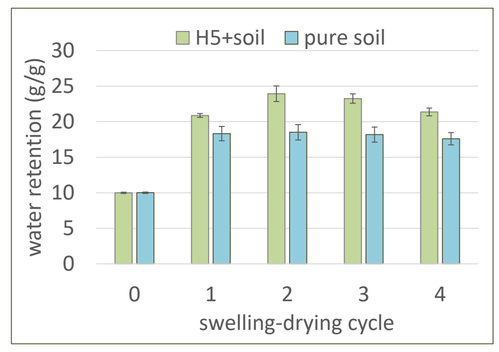
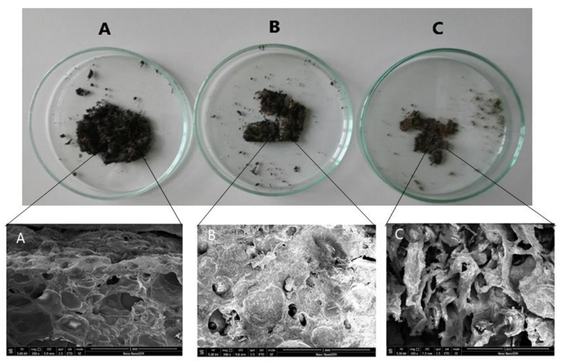


Fig. 3 Hydrogel biodegradability in soil: A) after 5 days; B) 10 days; C) 15 days and effect of degraded hydrogels on plant growth (*Lepidium sativum*): D) control- soil without hydrogel, E) soil with 1% of hydrogel, F) soil with 2% of hydrogel



Conclusions

- Acid whey can be successfully employed for hydrogel synthesis as a valuable source of nutrients to increase nutrition use efficiency and availability for plants
- The novel agro-hydrogel represents a promising material to improve water retention capacity of the soil and for controlled release of nutrients.

Polymers are close to our hearts

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