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Effect of hydrogel and olive mill wastewater on germination and seedling growth of cress as bioindicator

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Abstract

Olive oil-producing countries are facing challenges with their wastewater management. Several studies have highlighted the potential phytotoxicity of olive mill wastewater (OMW), despite its frequent use for agriculture. As a potential solution, hydrogels, synthetic polymers capable of absorbing big quantities of water and releasing it back, have been applied as a soil amendment to increase the soil’s water holding capacity. This study investigates the interaction between hydrogel, as an amendment for growing medium, and diluted OMW, as a moistening solution, as well as their combined effect on germination and seedling growth of cress (*Lepidium sativum*), commonly used as bioindicator. Two biodegradable Polyaspartic acid-based hydrogels, cLPASP-HMD (H9) and cLPASP-OH-HMD (V26), differing in their synthesis pathway and chemical structure, were developed and used in this study. Each hydrogel was blended with soil at a ratio of 0.2 % (w/w), and the blends were used as the growing media. Polyphenol-rich OMW from Spain was used as the moistening solution in concentrations of 0, 10, 25 and 40 % (v/v). The diluted OMW solutions and the hydrogel-containing growing media were tested on a germination test with cress seeds according to DIN EN 16086–2. After 72 h, the germination percentage (GP) and seedlings’ root length (SRL) were recorded. The germination assay showed that GP was not affected by hydrogel addition, independent of the used OMW concentration. Similarly, no phytotoxicity effect was found at any tested OMW concentration within each of the growing media, suggesting that the dilution was efficient to reduce the potential phytotoxicity of OMW. Furthermore, SRL of the samples with hydrogel VH26 at OMW concentrations of 10 and 25 % were significantly lower ($p < 0.05$) than that of the samples with hydrogel H9, highlighting the effect of differing hydrogel properties. By applying hydrogel together with OMW, the properties i.e., swelling capacity, sensitivity towards salt in its environment, or influence on the biodegradability shall be further considered.

Keywords: Hydrogel, olive mill wastewater, phenolic compounds, phytotoxicity, polyphenols