

Water Hyacinth from a Circular Economy perspective: A Potential Sustainable Solution for Agriculture?

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Invasive plants are one of the struggles of the decade due to the extensive damage they cause to both the environment (aquatic system degradation) and native biodiversity, as well as infrastructure (like bridges or dams). Because of this, its control is one of the most expensive costs incurred by governments worldwide. Water hyacinth (WH), an invasive aquatic plant, is one of the most worrying, and its controlling costs, just in Europe, have increased to 116 billion euros in the last 60 years. This species thrives quickly at the expense of phosphorus leached from the excessive application of chemical fertilizers to agricultural soils. However, WH has not yet been fully explored as a potential resource for recovering and repurposing phosphorus, along with other essential nutrients, to enhance soil productivity. By doing so, this clear example of a linear economy, currently associated only with costs and losses, can be transformed into a circular economy model that serves as an inspiration for global sustainability efforts. Why does not leverage the rapid spread of invasive species by monetizing and valorizing it within circular agricultural systems as enhancers? To understand WH's potential of WH as a phosphorus-rich agricultural enhancer, its biochemical characteristics must be thoroughly studied and harnessed. A preliminary analysis of WH biomass collected in four distinct agricultural and urban zones showed both spatial and plant-system differential accumulation patterns. The roots accumulated higher levels of As, Fe, Cd, Ni, Mn, and Pb, whereas the aerial components contained higher concentrations of P, Ca, K, Mg, and B. WH elemental analysis was also correlated with the anthropogenic pressure at the sampling location, with WH collected in higher intensity agricultural areas presenting higher P levels but also with potentially toxic elements. Other complementary structural analyses have shown that all WH samples contain significant amounts of aromatic compounds, and high amounts of recalcitrant materials with 48-63% of the biomass corresponding to lignin, hemicelluloses, and cellulose. These results suggest that WH may be a promising resource for agricultural applications; however, baseline studies, such as the one presented herein, are important to ensure its safe use.