Vapour harvesting through nutrients modified superabsorbent polymers: exploiting surface enrichment into an opportunity for the sustainable agriculture

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The global population is projected to reach 9.1 billion by 2050, increasing food consumption and putting pressure on land and water resources[1]. To achieve adequate food production, the use of fertilizers is expected to grow significantly in the coming years[2]. Additionally, climate changes are reducing the availability of water resources, making efforts to improve water use efficiency and control nutrient loss crucial challenges for agriculture worldwide[3].
Although tons of water vapor emitted by industrial chimneys could be used in agriculture every year, they are lost. Meanwhile, food and production wastes continue to accumulate in landfills or are incinerated. These scenarios highlight significant sources of water and nutrients that could be re-entered in the production with a circular economy perspective.
In this context, superabsorbent polymers (SAPs), can absorb and retain large amounts of water without negatively impacting soil microbiology. However, the potential use of SAPs for recovering chimney vapor and developing nutrient-enriched SAPs using waste-derived nutrients has not been explored. This study modifies the SAPs' surface with waste-derived nutrients and investigates their ability to recover water vapor at high temperatures to create a novel fertilizer for sustainable agriculture. In this instance, the release of water and nutrients into the soil was examined, and a preliminary cost evaluation based on pilot-scale production was conducted.

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