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Research Paper

Use of full-scale hybrid horizontal tubular photobioreactors to process agricultural runoff



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Diffuse pollution in rural areas due to agricultural runoff is a widespread and difficult problem to address due to the large areas affected. Drainage channels receive polluted water, but its introduction into conventional treatment network is often unfeasible. Within this context, microalgae-based treatment systems could be used as alternative treatment plants. A new design of semi-closed (hybrid) tubular horizontal photobioreactor (HTH-PBR) with low energy requirements has been evaluated for microalgae cultivation at full-scale (8.5 m³), using agricultural runoff as feedstock. This novel system was tested in batch and continuous mode over 4 and 135 d. Considering a full-scale application in an agricultural context, a batch test was carried out to evaluate the performance of the system. An increase of 22% in the biomass concentration in 4 d was registered, and all nutrients were consumed during the first two days. In the continuous experiment carried out over winter (December–April), productivity was between 2 and 14 g [TSS] m⁻³ d, but values up to 76.4 g [TSS] m⁻³ d were reached at the end of the study in spring, despite the low nutrients concentration in the feedstock. Elimination of emerging contaminants was also evaluated, obtaining the highest removals for the synthetic musk fragrances tonalide and galaxolide (73% and 68%), and the anti-inflammatory drug diclofenac (61%).

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