2nd Online Symposium on Circular Economy and Sustainability, Online Event, Alexandroupolis, Greece, 14-16 July, 2021

Biotreatment of Fludioxonil Wastewater in a Sequencing Batch Reactor

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In the fruit packing industry, postharvest fungicides are widely used to minimize fruit losses from fungal infections during storage and transportation (Nguyen Van Long et al., 2016). Postharvest fungicides are applied in fruit and vegetables via spraying or dipping practices, producing concurrently important quantities of fungicide-rich wastewaters (Russouw et al., 2020; Campos-Manas et al., 2019). According to Directive 2007/76/EC, these types of wastewaters shall be treated before disposal to the surrounding environment or to a conventional biological system, due to their structure complicity and recalcitrant nature.

The most used postharvest fungicides in the fruit packing industry are ortho-phenylphenol, thiabendazole, imazalil and fludioxonil (D'Aquino et al., 2013). Especially, fludioxonil (4-(2,2-difluoro-1,3-benzodioxol-4-yl)-1H-pyrrole-3-carbonitrile) is a pyrrole-based non-systemic fungicide (Taiwo et al., 2021). It is capable to prevent the decay of a variety of fruits, like apples and citrus, from green and blue molds, such as *Penicillium* and *Botrytis* spp. *(*Khodadadi et al., 2020; Hauschildt et al., 2020). However, it is toxic to certain aquatic organisms, while such molecules can accumulate in the soil (Brock et al., 2020). Physicochemical treatment methods, such as activated carbon adsorption and (photo)catalytic oxidation, have been applied to depurate these wastewaters (Morin-Crini et al., 2018). Apell et al. (2019) have studied the photolytic degradation of fludioxonil. Moreover, Mavriou et al. (2021) reported high fludioxonil removal rates in an aerobic immobilized cell bioreactor. However, biological treatment methods are limited and further research on fludioxonil degradation mechanisms is required.

In this work, a sequencing batch reactor (SBR) was employed to depurate a fludioxonil wastewater containing 200 mg/L under a hydraulic retention time of 10 days. Regarding removal process, the SBR system was able to depurate this fungicide-rich wastewater, resulting in fludioxonil removal efficiencies greater than 95%. COD removal efficiency was also high and estimated to be equal to 73%. Moreover, the pH in the influent and the effluent were stable, whereas the electrical conductivity in the effluent was gradually increased, as a consequence of fludioxonil breakdown. In addition, total Kjedahl nitrogen concentration in the effluent was decreased, indicating fludioxonil assimilation. Thus, SBR technology can be a biological solution for the depuration of fludioxonil-rich wastewater.

Keywords: fludioxonil wastewater; sequencing batch reactor; fungicide treatment; bioreactor technology.

Acknowledgements
This research, carried out within the frame of the research project entitled "Development and implementation of novel biobased methods for the treatment of pesticide-contaminated wastewaters from agro-industries, MIS 5030360", has been co-financed by the European Regional Development Fund of the European Union and Greek national funds through the Operational Program Competitiveness, Entrepreneurship and Innovation, under the call RESEARCH –CREATE – INNOVATE (project code: T1EDK-02566).

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