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ASSESSMENT OF BIOLOGICAL WASTEWATER TREATMENT SYSTEMS BY PROTOZOA AND METAZOA MONITORING AND CHEMOMETRICS ANALYSIS

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Protozoa and metazoa communities in wastewater treatment plants (WWTP) are known to be dependent of the system itself (conventional activated system – CAS, oxidation ditch – OD, trickling filter – TF, etc.) and of working operational parameters (incoming effluent, dissolved oxygen, nitrification, hydraulic and sludge retention times, transient phenomena, etc.) [1,2]. Thus, for similar systems operating in comparable conditions it is expected to find the same protozoa and metazoa communities whilst differing from dissimilar WWTP. As such, the study of the protozoa and metazoa biota has already been employed for assessing the functioning of AS systems [3].

In the current study the protozoa and metazoa communities of three different types of WWTP, comprising one OD, four TF (TF1 to TF4) and three CAS (CAS1 to CAS3) reactors, were determined for each system characterization. Therefore, the metazoa contents, as well as the main protozoa groups (crawling, free-swimming and sessile ciliates, testate amoeba and flagellates) were determined in terms of contents and relative abundance. The collected data was further processed by principal components analysis (PCA) and the three first principal components (PC1, PC2 and PC3) were subsequently used for the overall characterization.

The obtained PC1 and PC2 results allowed to clearly individualize the related biota groups in different quadrants (testate amoeba and metazoa, linked to nitrification and high sludge retention times – SRT, in the up-left; swimming ciliates and flagellates, linked to transient phenomena, deficient aeration or low SRT, in the up-right; and sessile and crawling ciliates in the down-right quadrant). Furthermore, it could be found a clear division of the OD, CAS1 and CAS3 systems (in the left quadrant) regarding the four TF and CAS2 systems (in the right quadrant). This is in accordance to the fact that the OD is a extended aeration system, CAS1 presented high SRT (around 40 days) and CAS3 high nitrification abilities, thus leading to high contents (and correspondent relative abundance) of testate amoeba and metazoa. Given the high nitrification ability of CAS3, testate amoeba clearly predominated in that system leading to a clear distinction in the PC plot regarding CAS1 and OD. On the other hand, TF and CAS2 systems presented higher contents on flagellates and ciliates species, and were thus allocated towards the right quadrant. Furthermore a clear distinction could also be found between TF (with noticeable contents of flagellates and swimming ciliates) and CAS2 (high sessile and crawling ciliates contents). On the contrary, the four studied TF reactors appeared grouped together due to the fact that all belong to the same WWTP, and presented, to a given extent, similar operational conditions.

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