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WASTEWATER TREATMENT WITH BIOGEDRADABLE DETERGENT BY AN UNI-RESIDENTIAL SYSTEM SUBMITTED TO FLOW OSCILLATIONS

Kaio Gustavo Gomes (PROVIC), Maria Magdalena Ribas Döll (Advisor), kaio-gu@hotmail.com; mmrdoll@uepg.br.

UEPG/Department of Civil Engineer.

Sanitary Engineering: Basic Sanitation.

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Abstract

The Evapotranspiration Tank (TEvap) is an ecological and complete sewage treatment system, as it can be designed to serve a single residence or a residential community. The present work aimed to evaluate the efficiency of a bench-scale TEvap system fed with gray wastewater from washing dishes using biodegradable detergent. The TEvap on a pilot scale presented values that confirm the efficiency of the system during its monitoring, such as an efficiency of 89.2% in removing Chemical Oxygen Demand (COD), approximately 87.0% in reducing turbidity and effluent with a neutralized pH (7.85).

Introduction

The Evapotranspiration Tank is a more ecological system. This unit has a depth of between 1.0 and 1.5 m, with upflow of sewage through an anaerobic chamber, followed by a stones layer such as basaltic gravel, construction debris and other stones. Subsequently, the sewage rises to a layer of sand and a layer of soil, where plants with high evapotranspiration capacity are grown, so that the effluent is eliminated by the evapotranspiration plants (GABIALTI, 2009), however some studies have shown that the system may leak in some special cases. Rocha (2020) highlights that the treatment steps in each layer of the TEVap should be evaluated since its startup and the influence of temperature on its efficiency.

Materials and Methods

In this work, a bench-scale TEvap was developed, where the system was evaluated for the treatment of gray wastewater, coming from washing dishes, using biodegradable detergent. During the experimental period that lasted 322 days, during which time 5 phases were analyzed, with different states, and an intermittent period, where the system was not powered for days, the experimental conditions are shown in Table 1.

Table 1 – Experimental conditions

Phase	Flow rate (mL/day)	HDT (day)	Operated days
1	210	50,62	46
2	280	37,96	92
3	560	19,98	57
Period with no operation			55
4	560	19,98	23
5	1120	9,49	46

*HDT – hydraulic detention time

Results and Discussion

During the monitoring of the gray water input and output of the TEvap, it was possible to observe that the system showed good behavior and a good response to variations in organic load. The output pH increased during the operational stages, with an average value of 6.72 at the beginning and 7.85 in stage 5. Electrical conductivity also showed the same increase, however with a greater variation, with an average value of 8.84 µS/cm in phase 1 and 610.38 µS/cm in phase 5. This fact can show the mineralization of organic matter inside the system.

Turbidity was another prominent factor, presenting an elimination of 87.0%, likewise the COD showed considerable removal in phase 5 of 89.2%. The system also showed an average removal of 96.4% of inorganic phosphorus and 93.6% of total phosphorus, while the ammoniacal nitrogen in phase 5 had reduced 89.2%, while the nitrite in the worst scenario had a removal efficiency of 79.7% and nitrate had achieved 100% of elimination.

The efficiency of eliminating Escherichia coli and fecal Coliforms in the system was not as satisfactory, but this result was already expected considering that it is an anaerobic treatment system.

Conclusion or Conclusions

It is possible to affirm that the system is efficient and presents good behavior even when subjected to a variation in the organic feed load, thus generating the possibility of an adaptation to the system sizing methodology, where for better applicability to the system, we can adapt its size so that there is a greater inlet flow and consequently a lower demand for surface area.

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