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Performance analysis of decentralized sewage solutions for multifamily residential condominiums in Aracaju

Matheus Carvalho Conceição
Master in Civil Engineering, UFS, Brazil
matheusconceicao76@gmail.com

Luciana Coêlho Mendonça
Ph.D. Lecturer, UFS, Brazil
lumendon@gmail.com

Tatiana Máximo Almeida Albuquerque
Ph. D. Lecturer, IFS, Brazil
tatianamaximoalmeida@gmail.com

SUMMARY

The adoption of decentralized sewage treatment systems appears as an alternative for regions lacking sanitary infrastructure. Regarding Brazilian municipalities, they presented, in 2020, a sewage collection service rate for the urban population equal to 63.2%. Also, according to data from the National Sanitation Information System, in the municipality of Aracaju, capital of the state of Sergipe, the rate of collection of generated sewage is only 53.5%. Due this reality, investment in individual effluent treatment systems becomes a valuable alternative for areas that lack of sanitary infrastructure. In this work, the performance of domestic sewage treatment systems, used as individual treatment solutions in two multifamily condominiums in the capital of Sergipe, was evaluated. Physical-chemical monitoring of the individual sewage treatment systems was carried out, and the results indicated negative efficiencies in most of the analyzed parameters. As for the requirements of the current environmental legislation for the release of effluents, there was non-compliance with the legislation in almost all the time of observation. The lack of systems operation supervision by public agencies leads to failures that cause degradation of groundwater and surface water. Moreover, there is a lack of commitment to inspections and maintenance of the systems by those responsible for the condominiums. According to the types of solutions adopted, treated sewage with higher quality should be achieved and, thus, effluents with high loads of pollutants would not be released into water bodies.
KEYWORDS: Sewage treatment. Performance. Individual solutions.

INTRODUCTION

Decentralized wastewater treatment systems are those whose collection, treatment and disposal steps are carried out close to the generating source (LIBRALATO et al., 2012). When well designed, built and operated, they are alternatives for ensuring public health and maintaining environmental integrity (CAPODAGLIO et al., 2017).

The adoption of decentralized wastewater treatment systems, notably in developing countries (SINGH et al., 2009), emerges as an alternative for regions lacking sanitary infrastructure, whose consequences are, among others: high levels of pollution of water bodies, eutrophication processes and the emergence of waterborne illness (SINGH et al., 2017; AHMED et al., 2016).

In relation to Brazil, the country's municipalities presented, in 2020, an index of sewage collection services for the urban population equal to 63.2%. Also, according to data from the National Sanitation Information System (SNIS), the percentage referring to the existence of a sewage collection network in the Northeast region was 39.3% (SNIS, 2022).

Regarding the wastewater collection service by the public system, Aracaju has a sewage collection rate of 53.5%, higher than the average for the state of Sergipe (32.5%) and close to the national average, which has a rate of 63.2% (SNIS, 2022).

According to data from the National Water Agency (ANA, 2017), a low rate of sewage collected in the state of Sergipe was also verified, with a value of 32.5%, of which 33.2% do not undergo any type of treatment. Regarding the use of individual sewage solutions, through septic tanks followed by post-treatment, the ANA survey pointed to an index of 11.5% for the state of Sergipe and 15.6% for Aracaju city.

In Sergipe’s capital, all collected sewage undergoes treatment at the operating units of Sergipe Sanitation Company (DESO), which return the treated effluent to the receiving water bodies. Despite the high rate of treatment of collected sewage, almost half of the population of Aracaju still lacks a collection and treatment network. The lack of regular investment of financial resources in the sector, the fiscal crisis, and the drop in the availability of public resources, corroborates to this reality (BRASIL, 2019).

That said, buildings located in regions not served by sewage infrastructure, when they do not discharge their effluents *in natura* indiscriminately into the soil and water bodies, they use decentralized sewage treatment solutions.

In view of this scenario, the adoption of decentralized solutions, also called *in situ* sewage treatment solutions, becomes a valuable alternative for serving areas located far from sewage infrastructure (BRASIL, 2019).

Such systems, when well managed, promote an increase in the quality of wastewater and consequent protection of ecosystems, by avoiding the negative effects of pollutants discharged in excess into the environment, in addition to protecting and promoting human health, by breaking the cycle of diseases. (CAPODAGLIO et al., 2017).

However, since the operation and maintenance of individual sewage solutions are under the responsibility of the owners, failures in the systems occur in many cases, due to inadequate management (MESQUITA et al., 2021).

Among the methods of individual treatment of wastewater, the association of the septic tank with the anaerobic filter (MASSOUD et al., 2009; ABNT, 1993) and the compact treatment stations, equipped with anaerobic and aerobic chambers arise as alternatives. It happens due to their functional simplicity, low requirement for mechanization, ease of construction and operation of systems and low energy consumption of compact stations (RIBEIRO and SILVA, 2018; ABNT, 1997).

OBJECTIVES

In this work, it is proposed to evaluate the treatment systems performance, used as decentralized solutions in the treatment of domestic sewage in two multifamily condominiums, located in the municipality of Aracaju, capital of the state of Sergipe, comparing their removal efficiencies among themselves. In addition, the compliance to the Resolution 430 from CONAMA (BRASIL, 2011), which provides for the release of treated effluents into receiving bodies of water, is observed.

METHODOLOGY

The research was carried out in two multifamily condominiums located in regions that still lack of a sewage system, in the municipality of Aracaju, Sergipe state.

The condominiums in question were chosen because of the possibility of accessing the inspection boxes for collecting wastewater samples. Besides that, one condominium makes use of an anaerobic process for sewage treatment, while the other uses a combined process of anaerobic and aerobic technology, when treating its effluents.

Condominium A, whose occupation took place three years ago, is located in the *Japãozinho* neighborhood, in the North zone of Aracaju, already in the bordering area with the municipality of *Nossa Senhora do Socorro*.

Regarding the project, it is a vertical condominium with 216 apartments distributed in 10 towers with four floors each. Of the total apartments, 209 units have 2 bedrooms, and the remaining 7 units, 1 bedroom. The useful areas of the apartments range from 35 to 45 m², thus classifying the building as a *popular* one, aimed at the low-income population, whose family income ranges from 0 to 3 minimum wages.

The sewage treatment system of condominium A is composed of a cylindrical module made of compact fiberglass, consisting of two consecutive anaerobic chambers with ascending flow, followed by an aerobic chamber, corresponding to a submerged aerated biofilter (SAB), connected to a secondary settling chamber. The last compartment of the system is the disinfection chamber, in which the action of pathogens is attenuated through the use of sodium hypochlorite tablets. After treatment, the effluent is released into the public rainwater network. The main advantages of the compact system are low cost of construction, operation and maintenance, low energy consumption, simplicity of operation and low impact on the environment to be inserted (CHUNG et al., 2016).

Initially, the raw sewage from condominium A is subjected to preliminary treatment, through grating, installed at the entrance of the system, to remove coarse solids (METCALF and EDDY, 2016).

After going through the solids retention stage, the sewage goes to the primary chamber of the Upflow Anaerobic Sludge Blanket reactor (UASB), where mainly the hydrolysis and acidogenesis processes predominate, in which bacterial activity promotes hydrolysis and acid fermentation, transforming complex organic compounds into simpler ones (CHERNICHARO, 1997).

For the secondary chamber of the UASB, the effluent from the primary chamber is directed through the pipe existing in the dividing wall of the two compartments of the reactor. The sewage is conducted to the bottom of the secondary chamber, so that the upward flow occurs. In this stage, the reactions of acetogenesis and methanogenesis complement the anaerobic process of the system (CASSINI et al., 2003; CHERNICHARO, 1997). The gases generated in the two anaerobic chambers are drained through a 75 mm diameter pipe to the point of dispersion.

In the aerobic treatment stage, the effluent is submitted to a submerged aerated biofilter, whose upward flow causes its contact with the support medium (splits from a polyvinyl chloride [PVC] corrugated pipe) in suspension and, therefore, the biofilm formed promotes the degradation of the remaining organic matter of the anaerobic process (ABNT, 1997).

A *Spider Jet* submersible aerator type is used to guarantee the aeration process in this phase.

After passing through the filter, the effluent goes to the decantation chamber, in which the remaining sludge from the previous stage tends to move to the bottom of the compartment. In case of detection of excessive loss of solids in this chamber, a sludge disposal maneuver is carried out, by activating the recirculation system, which represses this sludge, through a self-suction pump, model SCHNEIDER BCA 2 - 2.0 hp - three-phase, for the primary chamber of the anaerobic reactor.

In the last stage of the compact treatment system, the effluent is disinfected through a chlorination process, promoted by the contact of the sewage with sodium hypochlorite tablets in the disinfection chamber.

After all the treatment stages of the condominium A system, the effluent is directed to the condominium rainwater system, which flows into the public drainage network.

With regard to condominium B, it was occupied approximately twenty-two years ago and is located in the Jardins district, in the southern part of Aracaju. The development comprises 2 residential buildings with 12 standard floors for each tower, 4 apartments with 3 social rooms per floor, for a total of 96 apartments. The units have a usable area of 110 m^2 and the building can be considered aimed at a portion of the population located in the upper middle class.

Condominium B's treatment system consists of 2 single-chamber rectangular prismatic septic tanks, 2 ascending anaerobic filters and 2 chlorination units. In an isolated way, each residential building has 1 septic tank associated with 1 anaerobic filter. The last stage of treatment consists of a chlorination unit, which receives the effluent from the filter before releasing the treated sewage into the rainwater drainage channel.

Initially, raw sewage is collected through the sanitary facilities of the building's residential units and conducted through downfall pipes and passage boxes to the septic tank, where the suspended solids settle, and the organic matter undergoes anaerobic decomposition. The less dense part floats and gas bubbles encourage the rise of some solid particles, forming scum on the surface of the liquid (ANDRADE NETO et al., 1999).

For the anaerobic filter, only the liquid fraction of the sewage follows, since the solids and scum are retained by the existing screens at the entrance and exit of the tank (ABNT, 1993). The entry of the liquid effluent from the septic tank occurs at the bottom, through a false bottom, and flows through the gravel layer No. 04 (half support), 1.20 m high, in which there is the stabilization of the resulting organic matter from the action of microorganisms retained in the interstices or adhered to the filling material. At the top of the filter, after passing through the gravel layer, the waste flows through a rectangular reinforced concrete gutter until it is led to a passage box, to then pass through the chlorination unit, in which bacterial contamination is reduced by the addition of sodium hypochlorite, before releasing the effluent into the rainwater drainage network (ABNT, 1997).

Eleven sewage samples were collected from the individual treatment solutions, in the inlet and outlet boxes of each system, from November 2018 to March 2019.

At the inlets and outlets of each individual system, some readings were performed with a Horiba U-52G multiparameter probe, in which both temperature and pH were verified. Data from these readings were stored in the equipment's memory in the control unit and, later, downloaded through the *Data Collection U-50PC* software.

Regarding the collected samples, the COD, ammoniacal nitrogen and solids (total, fixed, volatile and settleable) indexes were analyzed, according to the procedures described in the Standard Methods for Examination of Water and Wastewater (APHA, 2012).

Due to the impossibility of carrying out tests to obtain BOD values, and due to its importance in determining the level of water pollution, in addition to being a quality parameter contained in Resolution 430 of CONAMA (BRASIL, 2011), a relationship was used between COD and BOD to obtain the biological oxygen demand.

According to Von Sperling (2014), the COD/BOD ratio for raw domestic sewage ranges from around 1.7 to 2.4 and reaches values greater than 2.5 in the final effluent of biological treatment.

In this work, the COD/BOD ratio equal to 2 in the raw sewage and 3 for the final effluent of the individual solutions was adopted.

After analyzing and obtaining the values referring to the physical-chemical parameters of the individual sewage treatment systems evaluated, these were compared with each other, and with the limits established by Resolution 430 of CONAMA (BRASIL, 2011).

Table 1 shows the required parameters and their limits established by CONAMA Resolution 430 (BRASIL, 2011) for conditions and standards for effluents from sewage treatment systems.

Table 1: Conditions and standards for effluents from sewage treatment systems – Resolution 430

pH	Temperature	Settleable Materials	BOD	Oil and Grease	Floating Materials
Between 5 and 9	< 40 °C	≤ 1 mL/L	≤ 120 mg/L*	≤ 100 mg/L	Absent

*: Permissible concentration above 120 mg/L provided that the removal efficiency is at least 60%.
Source: Adapted from CONAMA, 2011.

Data were organized in the *Microsoft Office Excel* (2016 version) and analyzed using the R software (*Project for Statistical Computing*) version 3.5.0. With the known input and output parameters concentrations, efficiency calculations were performed, through which the pollutant removal capacity of the individual treatment systems was obtained. Data normality was tested by applying the Shapiro-Wilk test (RAZALE and WAH, 2011). The confidence level was 95%.

After applying the normality test, the influence of existing non-standard data on the determination of results was verified. In view of this, it was necessary to verify the influence of points that differ from the data set of the samples (outliers).

This analysis was performed using the outlier identification method using Thompson's Modified Tau Test (CIMBALA, 2011).

The significance level adopted was 5%. After removing the outliers, it was obtained removal means closer to reality, without the influence of outliers.

In addition to obtaining the data, information for the research was collected by carrying out technical visits in which the state of conservation of the treatment units and equipment in the individual solutions of condominium sewage was observed, as well as the control form of the sewers' treatment processes.

RESULTS AND DISCUSSIONS

Regarding the analyzes of the individual sewage solutions of multifamily residential condominiums A and B, the average efficiency values are shown in Table 2.

Table 2: Average removal efficiency in condominiums

Parameters	**Individual Sewage Solutions**	
	Condominium A	**Condominium B**
COD (%)	20,2	13,0
BOD (%)	42,9	40,3
Ammonia Nitrogen (%)	- 27,8	- 413,0
Settleable Solids (%)	- 7.953,8	- 397,0
Total solids (%)	- 42,6	- 6,0
Total Fixed Solids (%)	- 32,6	4,0
Total Volatile Solids (%)	- 148,0	- 24,0

Source: Prepared by the authors, 2022.

According to Table 2, the removal efficiencies, except for COD and BOD in the two condominiums studied and total fixed solids in condominium B, present negative values. It means that the systems, instead of treating the sewers with the reduction of their polluting loads, potentiate the environmental impacts when these effluents are released into the receiving water bodies.

The results, in general, show poor performance of the sewage treatment devices of condominiums A and B. It is worth mentioning the lack of regulation in Brazil, which defines responsibility for the maintenance and operation of decentralized systems. There are only regulations defining responsibility for the management of decentralized sewage systems, in the states of *Maranhão* and *Santa Catarina* (MESQUITA et al., 2021).

In the two systems evaluated, the compact treatment station, referring to condominium A, presented a COD removal of 20.2%, while in condominium B, equipped with an associated set of septic tank followed by an anaerobic filter with ascending flow, it was verified an efficiency of removing COD equals to 13%. For both treatments, the performance values are well below the rates observed in the literature.

A compact sewage treatment system, similar to that used by condominium A, when treating effluents from approximately 1,700 inhabitants in the municipality of *Uru*, state of *São Paulo*, obtained an average value of 85% in COD removal (RIBEIRO and SILVA, 2018).

A better performance in degrading organic matter in the condominium A system could be achieved with the installation of deflectors in the two anaerobic chambers of the system, as an alternative to turn the solid-liquid separation of the influent more efficient. In this way, the loss of biomass would be reduced and there would not be an overload of solids in the submerged aerated biofilter and in the decanter.

The efficiency verified in the condominium B system in removing COD was 13%, slightly lower than that of condominium A. The values obtained differ from the ones obtained by Arrubla et al. (2016), whose COD removal efficiency was 56.8%, in a system also equipped with an anaerobic filter preceded by a septic tank. This result is still considered low for this type of treatment, since when operating in good conditions, it reaches around 80% of efficiency (JORDÃO and ALEM SOBRINHO, 2009).

The probable accumulation of sludge in the septic tank, caused by the lack of periodic maintenance of the system, compromises its primary treatment capacity and also implies the insignificant retention of settleable solids. The passage of sewage with a higher concentration of solids to the anaerobic filter implies the possibility of greater accumulation of these particles in the interstices of the gravel layer. As the voids in the support layer become smaller, there is a tendency to increase the ascent velocity of liquid sewage, along with greater drag and loss of these solids in the effluent, causing negative impacts in relation to COD removal.

In four of the eleven analyses, the effluent had a higher COD concentration than the influent.

Low BOD removals were verified in condominiums A and B, equal to 42.9% and 40.3%, respectively. Even so, only condominium B did not comply with CONAMA Resolution 430 (BRASIL, 2011) during the monitored period, in one of the eleven analyzes carried out. In the sample collected on November 19th, 2018, the BOD concentration in the treated sewage was 149.3 mg/L, higher than the 120 mg/L limit of the legislation, and efficiency of 5.8%, which is less than 60%. Condominium A complied with the legislation regarding BOD in all analyzes carried out.

The absence of a schedule for the disposal of spare sludge and its recirculation to the anaerobic chambers of the treatment unit in condominium A contributed to its low efficiency. Likewise, the lack of cleaning of the submerged aerated biofilter during the entire three-year period of operation resulted in a performance below expectations.

The lack and/or inefficient programming of sludge management in UASB reactors compromises the efficiency of the treatment system, whose main consequence is the excessive loss of solids. Because that, there is a negative impact in both the quality of the effluent and in the physical efficiency of particulate matter removal, resulting from the depletion of the sludge storage capacity inside the reactor. Consequently, there is an overload in the post-treatment units, such as the clogging of the biological filter support medium (LOBATO et al., 2018).

Condominium B presented, for the type of treatment adopted, BOD removal efficiency below the value found in studies in which similar individual solutions were evaluated.

Arrubla et al. (2016), when monitoring a system located in a rural area of Colombia and similar to condominium B, obtained a BOD removal efficiency of 50.1%. It was proposed by the authors to increase the TDH in the treatment units and better environmental conditions for the biological processes occurring inside the reactors as a way of increasing their performance.

Despite the systems of the two condominiums complying with the legislation, in relation to the BOD parameter, in almost the entire period studied, there is a possibility of them achieving better efficiencies through programmed maintenance measures, adaptations and monitoring of their treatment devices.

In the condominium sewage treatment systems evaluated, negative efficiencies were verified regarding the removal of ammoniacal nitrogen. In both systems, the concentrations values in the effluents were higher than the concentrations in the affluents in almost all the analyzes carried out.

In practice, raw sewage from condominiums, when passing through the treatment devices, increases its concentration of ammoniacal nitrogen and when release, the pollutant loads related to this parameter are increased in the drainage infrastructure, which is connected to a water body. As a consequence, there is more contamination and greater chances of eutrophication in this aquatic environment.

In only four of the eleven samples collected in condominium A, there was a positive performance of the treatment system.

A system similar to that of condominium A, analyzed by Abou-Elela et al. (2016), treated sewage through a set composed of a UASB reactor followed by an aerated biofilter and, finally, a decanter equipped with inclined deflectors. The aim was retaining biomass and improving the quality of the treated effluent, designed on a pilot scale in the city of Cairo, Egypt. The system was operated for almost two years, at ambient temperature varying between 10 °C and 40 °C. The UASB reactor performance was verified regarding the removal of ammoniacal nitrogen, and a negative efficiency equals to -10.9% was obtained.

A possible ineffective aeration, in this case, can strongly affect the nitrification process in the sewage. Another hypothesis would be the considerable presence of organic matter in the filter, due to the inefficiency of the anaerobic reactors, and the consequent inhibition of the nitrification process due to the competition for organic matter.

In condominium B, the removal of ammoniacal nitrogen was even worse. There was no removal of the analyzed parameter and all output samples had higher concentrations than the input. Even when using an anaerobic form of treatment, such as the conventional septic tank used in condominium B, Nasr and Mikhaeil (2015) managed to remove ammoniacal nitrogen between 17.7% and 26.8%.

In relation to settleable solids, initially, the treatment system of condominium A proved to be efficient. In the analysis of the first five collections, there was good removal performance. However, in the analysis of the remaining collections, there was a significant increase in the inefficiency of the system and disobedience to the aforementioned resolution. Incorrect maintenance of the anaerobic chambers may have been the cause of the increased presence of settleable solids from the sixth collection. With the intention of removing the excess of sludge, good part of the biomass was just turned over, and when it remained inside the system and detached from the mantle, it was carried to the final effluent.

Ribeiro and Silva (2018) reported the importance of the correct sludge disposal and return operation in contributing to the improvement of a compact treatment system similar to that of condominium A.

In condominium B, the set composed by the combination of septic tank and anaerobic filter did not remove settleable solids. Due to the fact that the system is composed of a septic tank, whose retention of settleable solids is one of its main functions, it is assumed that the non-periodic removal of the sludge from the septic tank, turns it into a passage box in which the liquid effluent carries particles and microorganisms to the physical environment (PEREIRA et al., 2009).

As a consequence, the interstices of the stone bed in the anaerobic filter become blocked by solids not retained in the septic tank, and the set loses functionality, corroborated by the lack of backwashing of the filter support layer and the removal of aged sludge from its false bottom.

As for the fraction of solids, in condominium A, there was no removal of total solids. It was noted that, after treatment by the compact system, there was a considerable increase in the concentration of total solids, different from the performance obtained by Ribeiro and Silva (2018), equal to 54%, when analyzing the efficiency of the association of submerged aerated filter preceded by UASB reactor.

In condominium B, there was also no removal of total solids. Unlike Colares and Sandri (2013), who, when measuring the performance of a three compartmentalized septic tanks set, arranged in series, and followed by three cultivated beds, when treating sewage, achieved an efficiency in the set of tanks equals to only 37.56% regarding the removal of total solids.

With regard to fixed solids, indicators of the amount of inorganic matter present in wastewater, corresponding to the fraction of solids remaining after the calcination process at 550 °C and volatilization of organic matter, condominium A presented a higher value in the average concentration in the effluent compared to the affluent. Due to the fact that these solids were not removed, it is possible that mineralized substances are carried from the biofilter into the treated sewage.

Likewise, the average concentration of volatile solids was higher at the system exit compared to the entry. The greater presence of volatile solids in the treated sewage confirms the low removal of BOD and COD and the inefficiency of the system in degrading organic matter in the anaerobic chambers, as well as the poor performance of the sedimentation process that occurred in the decanter.

Inefficient management of excess sludge in anaerobic reactors can also lead to excessive loss of solids in the final effluent of the system.

Large accumulations of sludge inside the reactor cause high losses of solids in the treated effluent, since the biomass is retained in the decanter, due to the high load of solids, part of these do not settle and, consequently, there is degradation of the quality of the treated sewage, caused by the loss of efficiency of the treatment system in removing organic matter and retaining solids (FLORIPES; CHERNICHARO; MOTA FILHO, 2018).

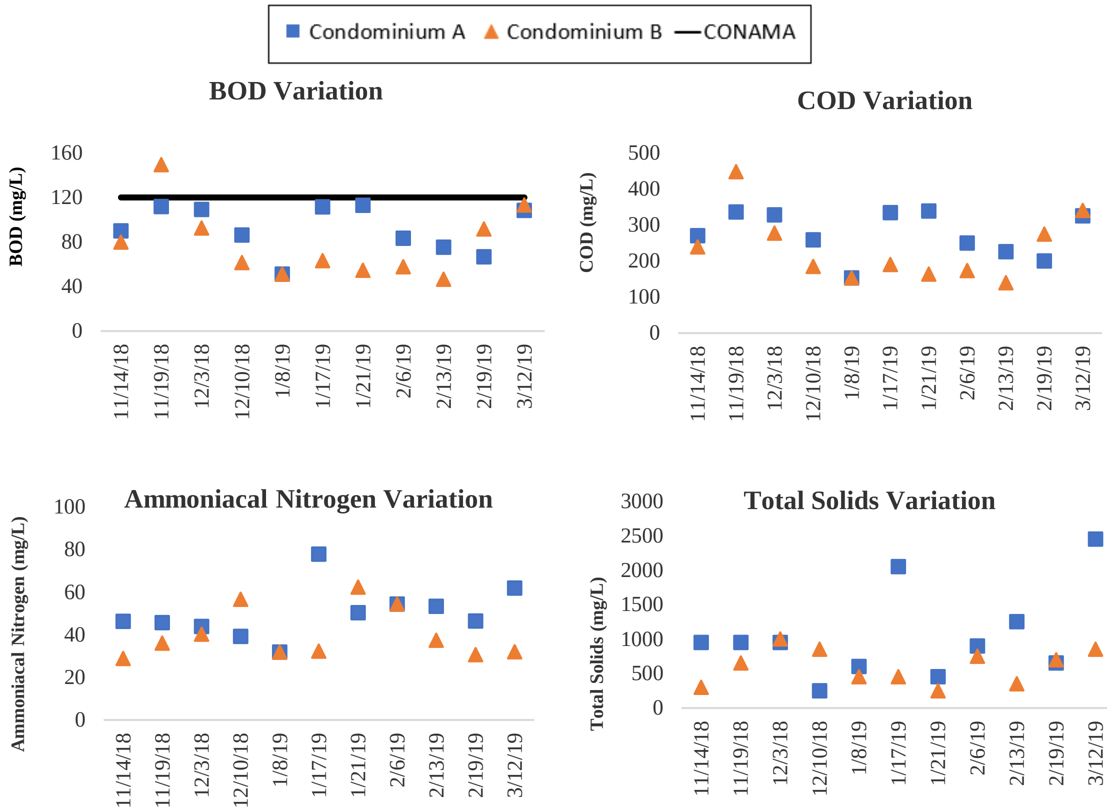
The efficiency in the removal of fixed solids referring to condominium B reached only 4%. There was also a high concentration of volatile solids in the effluent, proving the low retention of organic matter in the condominium B system, corroborated by the low BOD and COD efficiencies obtained in the analyses.

As for the pH, the two condominiums presented in their treatment systems, values close to neutrality, favorable to the existence of most aquatic life, and the growth of bacteria, as it is in the ideal pH range, between 6.5 and 7, 5 (METCALF and EDDY, 2016). The pH of the treated sewage related to condominium A varied between 5.7 and 7.2 after the biological treatment. It was in accordance with the release limits established by Resolution 430 of CONAMA (BRASIL, 2011), whose pH range varies from 5 to 9.

Concerning condominium B, the pH values of the final effluent were in a range between 5.6 and 7.3, similar to those obtained by Daija et al. (2016), Merino-Solís et al. (2015) and Colares and Sandri (2013), when researching efficiencies of septic tanks and anaerobic filters.

Figure 1 shows the variation of parameters (BOD, COD, ammoniacal nitrogen and total solids) analyzed in the effluent of the individual solutions of the condominiums.

Figure 1: Parameters analyzed in the effluent of individual condominium solutions



Source: Prepared by the authors, 2022.

In the case of temperature, both condominiums met the legislation. The average temperatures in the affluent and effluent of condominium A were 30.6 °C and 31.3 °C, respectively. Thus, they were within the optimum temperature range for biological activity, between 25 °C and 35 °C. Santos et al. (2018), through an experiment with UASB reactors, established in addition to the age of the sludge, temperature as the main operational variable that affects the efficiency of the anaerobic treatment. In condominium B, the average values in raw and treated sewage were 30.8 °C and 31 °C, respectively.

CONCLUSION

In light of the results obtained, the efficiencies in the removal of pollutants from individual condominium treatments, it was observed that these presented values much lower than expected, due to the type of treatment used. The BOD and COD removal efficiencies of condominiums A and B, together with the fixed solids removal efficiency of condominium B were the only positive efficiency values, whilst the others showed negative results.

In relation to the individual solutions of condominiums A and B, regarding compliance with Resolution 430 of CONAMA (BRASIL, 2011), from the parameters analyzed, there was compliance with the parameters BOD, pH, and temperature. For settleable solids, legislation index was accomplished in the middle of the analyzed period. The average efficiency in removing ammoniacal nitrogen, total solids and volatile solids was negative in both condominiums.

Because they are buried, there is no commitment to inspections and maintenance of the systems by those responsible for the condominiums, despite the fact that the operation is simple and low cost. Measures are only taken when the systems present serious problems, such as sewage rising on the ground surface, through the inspection boxes.

The lack of supervision of the condominium sewage treatment systems by public agencies leads to failures, causing degradation of surface water. There is no commitment to inspections and maintenance of the systems by those responsible for the condominiums, although the operation is simple and inexpensive.

In order to guarantee a minimum performance of these specific solutions, it is necessary to adopt legal provisions, such as a construction and operation license, in which the inspection and regulatory authorities, representatives of the public power, guarantee the proper functioning of the systems in accordance with what was designed, checking periodically through visual inspections and through physical, chemical, and bacteriological tests.

In practice, the operating license is only charged when the system starts operating. Without the requirement of periodic renewal, the systems are inspected and operated by employees of the condominiums, who do not have any technical quality for this purpose. In the case of effectiveness by the public authority for renewal of the license, maintenance would be carried out by professionals in the sanitation area and analyzes would also be carried out to prove the proper functioning of the individual sewage solutions.

Due to the types of solutions adopted, treated sewage of higher quality should be achieved and, thus, effluents with high loads of pollutants would not be released into water bodies.

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