Scholar Publishing Group
Water Pollution Prevention and Control Project
https://doi.org/10.38007/WPPCP.2022.030205
ISSN 2790-2730 Vol. 3, Issue 2: 41-49

Construction of Sewage Treatment System Integrating Boosting and Bagging Algorithms and Artificial Intelligence

Mankee Jeon*

Vytautas Magnus University, Lithuania

**corresponding author*

Keywords: Fusion Algorithm, Bagging Algorithm, Boosting Algorithm, Sewage Disposal

Abstract: The sewage produced by human beings would cause great harm to human health. Therefore, it is necessary to treat all kinds of waste water and discharge it after reaching relevant standards. This paper discussed and analyzed the current situation, existing problems, optimization strategies and technologies of wastewater treatment in environmental protection projects, thus hoping to provide some useful reference and reference for practical work and lay a good foundation for future development. In this paper, through experimental analysis, the concentration of various water quality indicators in sewage was analyzed and compared by fusing Boosting and Bagging algorithms. It was found that the range of chemical oxygen demand of sewage samples was 396g/ml-456g/ml. The average chemical oxygen demand was 416g/ml, and the ammonia content was 36g/ml-63g/ml. Finally, the removal rate of pollutants in the artificial intelligent sewage treatment system by using Boosting and Bagging fusion algorithm and traditional algorithm was analyzed and compared. It was found that the removal rate of pollutants by using the fusion algorithm was 23.01% higher than that of the traditional algorithm.

1. Introduction

With the continuous development of society, people's lives have also changed. However, this has also triggered a chain effect, with problems in all aspects, especially ecological problems. Relevant experts made a comprehensive analysis and discussion on the application and development of intelligent technology in wastewater treatment, which played a certain role in the sustainable development of wastewater treatment.

Construction of sewage treatment system integrating Boosting and Bagging algorithms and artificial intelligence

Relevant scholars have made relevant discussions on the treatment of water pollution. Zhai Junhai adopted the basic classifier based on fuzzy synthesis for sewage treatment and carried out the basic classifier model based on fuzzy synthesis. He compared it with the latest low sample and integration technology [1]. By analyzing the current situation of water pollution, Bai Jie studied the prevention and control of water pollution by using image fusion classification method based on image, and proposed a fusion algorithm, which had practical significance for water pollution monitoring [2]. Tian Sheng used machine learning algorithm to model the sewage treatment system and enhance the expansion performance and stability of the model. The test results showed that the machine learning fusion algorithm had the best prediction effect on the detection set, which was better than other algorithms [3]. Sun Bin proposed a method based on data mining. That is to say, on the basis of machine learning and in-depth research, the water pollution data was targeted. This method adopted a general statistical method, so it could also be applied to other aspects [4]. Weiqi Kong used intelligent technology to predict and count the sewage treatment system, and analyzed the change trend of sewage treatment indicators, the relationship between the change rate and the change value. This technology could be used to analyze the pollution degree of sewage [5]. With the continuous promotion and development of intelligent technology, the treatment of wastewater would become better and better.

The treatment of water pollution can be carried out through modern science and technology. Li Rui adopted a fusion algorithm, which was used to obtain water pollution treatment information beyond the scope and integrate it into machine learning training [6]. Viet Nguyen Duc summarized the possibility of applying artificial intelligence technology model to the field of water pollution at present, and pointed out their advantages and disadvantages. He discussed the concept and category of the latest intelligent model, and discussed its advantages over conventional models [7]. Jude A Belin analyzed that quality was crucial in the design and development of intelligent garbage disposal system. However, according to these characteristics, the prediction of water pollution generation was a very difficult working characteristic and change. A structure based on convolution neural network was adopted to estimate the source of pollution [8]. XuZuxin reduced pollution, and eliminates dumping. He also reduced the discharge of harmful substances and half of untreated sewage, and used it in a large number of recycling and safe ways around the world, thus improving water quality [9]. By taking the surface water, spring water, Quaternary phreatic water and soil rocks in the central area of the Yellow River basin as the representative, He Xiaodong analyzed the pollution of surface water and the main influencing factors, especially the production and possible sources of chromium, and conducted a comprehensive study on the relationship between the pollution and the health risks of surface water [10]. Lee Chang-Gu studied that the removal and inhibition of organic substances in sewage were reduced due to the removal and oxidation of synergic organic substances, and the power of each reaction sequence required to eliminate this hormone disturbance [11]. In order to solve the problem of urban sewage discharge, the discharge of wastewater was minimized by effectively improving the efficiency of water resources utilization.

The above studies only studied the fusion algorithm and the artificial intelligence sewage treatment system separately, without combining the two. Although these studies had some reference, they were more or less insufficient to prove the conclusion, and had some room for improvement. In order to study the construction of the sewage treatment system integrating Boosting and Bagging algorithms and artificial intelligence, this paper proposed to use the fusion algorithm to solve the construction problem of the artificial intelligence sewage treatment system by analyzing the current situation of sewage treatment and the difficulties it faced. Through the analysis of experimental data, and by comparing the effects of traditional algorithms and fusion algorithms, it had reference significance for the future research of algorithms in other fields.

2. Construction Evaluation of Artificial Intelligence Sewage Treatment System

2.1. Investigation Status of Sewage Treatment

From the actual situation, the sewage treatment work still faces many problems, which leads to the unsatisfactory treatment effect, thus seriously affecting the reuse of water resources and increasing the water price. From the perspective of wastewater treatment of environmental protection projects, the wastewater treatment plant is facing the following problems: First, the population is increasing rapidly, and the demand for water is large. The wastewater treatment plant and wastewater treatment technology are relatively backward, and all wastewater cannot be effectively treated, thus resulting in a large amount of wastewater spreading to the surrounding areas and causing serious environmental problems. Second, the improvement of wastewater treatment technology requires a lot of investment, but the government grants very little funds. There is not enough funds to solve the current wastewater treatment problem, and there is no new technology, so the efficiency of wastewater treatment is still very low. Third, according to the types of various pollutants, corresponding processes should be adopted to achieve the best results. Otherwise, it would not only waste money, but also reduce the efficiency of processing. The application of high technology in wastewater treatment is imperative. Its transformation requires not only the transformation of existing facilities, but also the adoption of new technologies. In production practice, equipment maintenance is not in place. Wear is a very important problem in the use process. If there is a fault, special technology is needed to repair it. However, the actual situation is that the treatment capacity of wastewater is greatly limited due to the lack of specialized technology and maintenance technology. Without sufficient technical support, it would hinder the smooth progress of this work.

At present, there is a lack of a standardized process for urban living sewage treatment. The root cause is that the selected working method is not reasonable. Many places have adopted the same treatment method. According to different regions, it should be solved according to local specific conditions. However, in practice, many places simply copy the processing methods of other regions, and do not choose the appropriate processing methods according to the local actual situation, thus resulting in huge losses in human, material, capital and other aspects.

Today, human living conditions are getting better and better. In the process of using water resources, a large amount of water is polluted by the environment, and the volume of waste water is getting larger and larger. Wastewater treatment cannot be carried out only by manpower, but must be carried out with the help of effective external equipment. Therefore, to ensure wastewater treatment, corresponding supporting facilities must be provided. In actual operation, due to the lack of basic equipment and external assistance, wastewater treatment workers would have psychological resistance in work, thus reducing the quality of work. The principle of sewage treatment is shown in Figure 1.

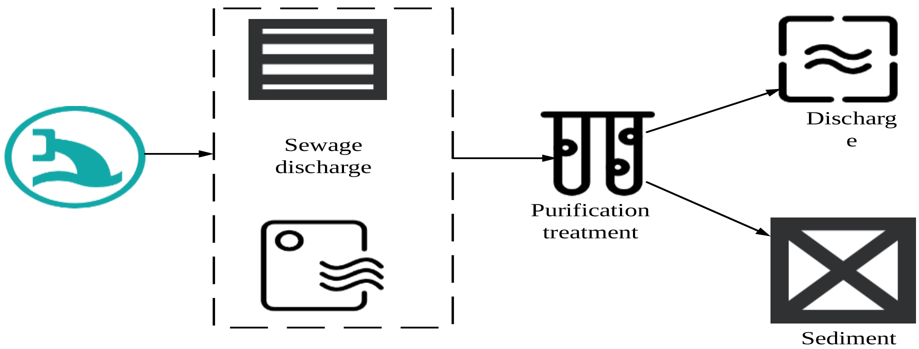


Figure 1. Sewage treatment principle

2.2. Evaluation of Sewage Treatment Process

With the development of society, science and technology have entered a period of rapid development, and the corresponding external equipment for wastewater should be guaranteed enough. Therefore, the government should increase investment and use modern technology to degrade wastewater. At the same time, the government should also pay attention to the location of the wastewater treatment plant, and make full use of the local living environment, so as to ensure that the wastewater treatment would not cause any harm to the nearby residents, and meet the environmental requirements. At the same time, it is necessary to ensure that the urban drainage system is in good operation.

In operation, financial support should be paid attention to. A sewage treatment plant should be built to meet the needs, and a professional enterprise should be responsible for the independent operation, so that the country can be more enthusiastic about sewage treatment, and various sewage facilities and engineering construction systems can be used to promote the development of the city.

In the treatment of wastewater, proper treatment methods should be selected correctly. Activated sludge technology is one of the most commonly used wastewater treatment technologies. Through certain technological means, suspended solids in wastewater can be effectively recycled. This method has been widely used in wastewater treatment, and some research results have been obtained. Its working mechanism is that the filter material contains some microorganism and generates a biological film in the water. When it comes into contact with the wastewater, this film can decompose the organic matter in the wastewater and generate corresponding cells to purify the wastewater. The wastewater treatment process is shown in Figure 2.

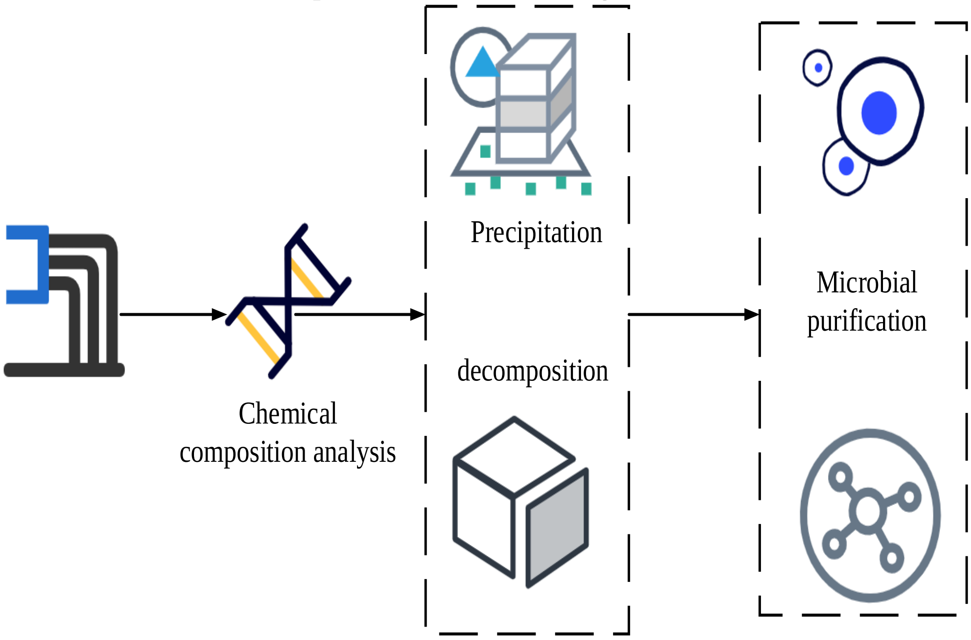


Figure 2. Sewage treatment process

2.3. Evaluation of Artificial Intelligence Sewage Treatment System

The control technology of anaerobic oxidation in wastewater treatment is a very key link, which needs to be comprehensively studied. The artificial intelligent sewage treatment system uses advanced detection technology to accurately measure the impurities in the wastewater, and automatically allocate the pH of the wastewater, so as to effectively monitor the load in the anaerobic machine to ensure the stability of the whole system.

The key to the application of professional intelligent technology in wastewater treatment is to simulate and infer the intelligent control technology, so as to organically integrate the expert knowledge and control system. In terms of the current application of expert technology in wastewater treatment, the ideas of relevant professionals and advanced scientific and technological ideas have been organically combined and achieved good results. The wastewater monitoring and monitoring system has a high comprehensive technology. As a major branch of intelligent technology, this technology can construct different models according to different needs. Aiming at different wastewater treatment problems, the unstable factors of various sensors are properly treated and adjusted to achieve the organic unity of theory and practice.

In order to assist in formulating water pollution prevention measures to prevent and control the rapid development of African countries, relevant personnel found that it was necessary to adopt an economic and feasible measure to monitor the surface water quality as early as possible [12]. Many new technologies have been adopted by relevant scholars in controlling water quality. This is especially true of hybrid nanostructures, especially in the application of magnetic plasma nanostructures in water [13]. Based on the combination of membrane technology with other kinds of water treatment technologies, such as adsorption, advanced oxidation process and biological activated sludge, many experts discussed the current research progress of membrane technology for sewage and wastewater [14]. Professionals have explored urban sewage treatment, industrial wastewater purification, and renewable utilization of rainwater pipes. Through adsorption, precipitation, surface oxidation reduction and catalytic decomposition, the key pollutants in the pollution of industrial sewage can be better solved [15].

The artificial intelligence sewage treatment system selects the most reasonable sewage treatment method by combining the latest technology with the specific conditions on site. The analysis of artificial intelligence sewage treatment system is shown in Figure 3.

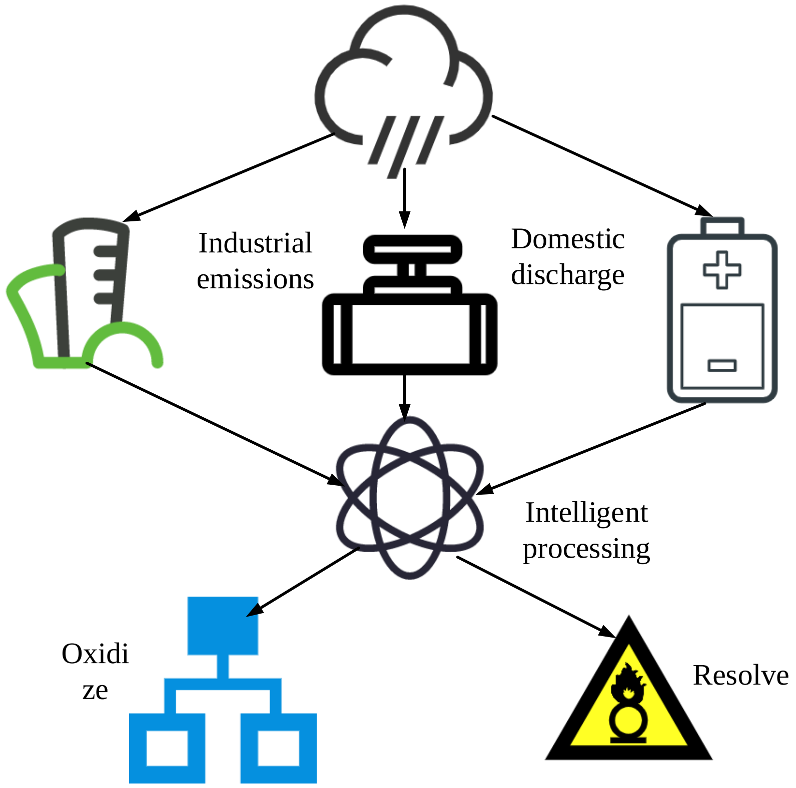


Figure 3. Analysis of sewage treatment system based on artificial intelligence

3. Boosting and Bagging Fusion Algorithm

In the fusion algorithm, bagging and boosting algorithms have the same characteristics, but their learning processes are different. Generally, bagging is conducive to reducing variance, while boosting focuses on deviation and variation. However, boosting often over-matches the data set, which leads to higher variation.

Bagging is the abbreviation of bootstrap aggregation operation. The following equation shows its basic principle: A large number of weak learners are bootstrapped, averaged and output.

$$f(x) = \frac{1}{A}\sum_{a=1}^{A} f_a(x) \tag{1}$$

Boosting is a weighted average method of a weak learning program. In this method, a new weight value is calculated after the previous error is introduced.

$$f(x) = \sum_{i} w_i h_i(x) \tag{2}$$

Boosting and Bagging fusion algorithm is a way to establish an infinite integration composed of boosting processes.

$$F(x) = \frac{\sum_{j=1}^{m} w_j F(x_i)}{\sum_{j=1}^{m} w_j} \tag{3}$$

Boosting and bagging fusion algorithm solves the shortcomings of bagging and boosting, and slightly improves the performance. Its biggest feature is adaptability. It extends all independent processing methods of bagging and boosting, so more programs can benefit from bagging and boosting.

4. Experimental Evaluation of Artificial Intelligence Sewage Treatment System

4.1. Experimental Method

By selecting sewage samples from five cities, the Boosting and Bagging fusion algorithm was used to analyze various indicators of sewage treatment in these five cities. The data results were compared and recorded, thus providing experience for improving the sewage intelligent treatment system in the future.

4.2. Data Evaluation

4.2.1. Evaluation of Various Indicators of Sewage Treatment

Five sewage samples were selected and analyzed using Boosting and Bagging fusion algorithm to compare the concentration of various water quality indicators. The analysis of various indicators of sewage treatment was shown in Table 1.

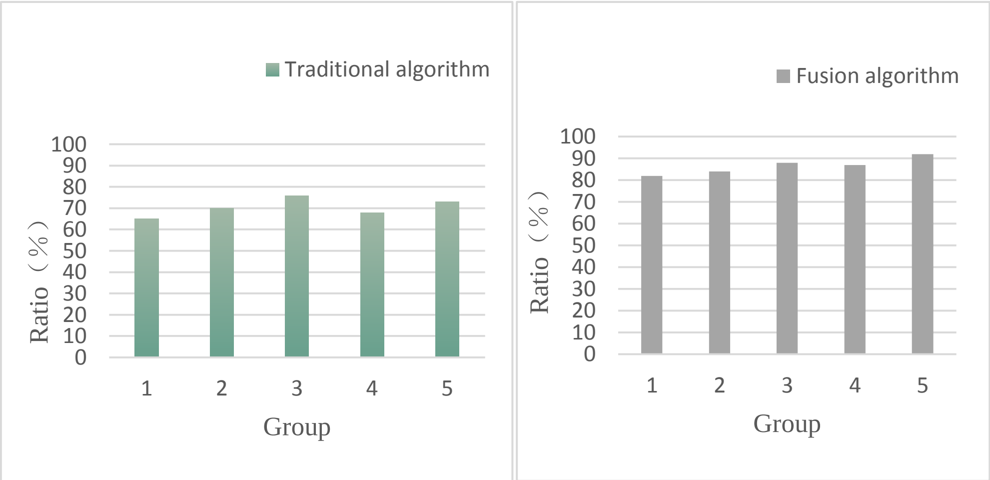
It could be seen from Table 1 that the pH values of the five groups of data were in the range of 7.5-7.9. The minimum value was 7.5 and the maximum value was 7.9. The overall sewage was alkaline. The concentration of impurities in the water was 25.8-29.4, which was at a high level. The range of chemical oxygen demand of five groups of sewage samples was 396g/ml-456g/ml. The average chemical oxygen demand was 416g/ml, and the ammonia content was 36g/ml-63g/ml. It could be seen that the sewage needed to be purified.

Table 1. Analysis of various indicators of sewage treatment

Item	Potency				
	1	2	3	4	5
Potential of hydrogen	7.5	7.7	7.6	7.8	7.9
Turbidity	25.8	26.2	27.4	28.8	29.4
Chemical oxygen demand	396g/ml	402g/ml	410g/ml	416g/ml	456g/ml
Ammonia content	36g/ml	48g/ml	52g/ml	55g/ml	63g/ml

4.2.2. Pollutant Removal Rate

Boosting and Bagging fusion algorithm and traditional algorithm were used to analyze five artificial intelligent sewage treatment systems. The higher the score, the better the pollutant removal rate and the better the algorithm. The comparative analysis of pollutant removal rate was shown in Figure 4.



(a) Traditional algorithm *(b) Fusion algorithm*

Figure 4. Comparative analysis of pollutant removal rate

It could be seen from Figure 4 that Figure a showed the removal rate of water pollution indicators by traditional algorithms. Among them, the third group of artificial intelligence sewage treatment system had the highest removal rate, with a score of 76%. The fourth group of artificial intelligence sewage treatment system had the lowest removal rate, with a score of 68%. The average score of these five groups of systems was 70.4%. From the overall data, the data fluctuated greatly, and the range and variance were large. Therefore, the efficiency of using traditional algorithms was low. Figure b showed the removal rate of the fusion algorithm for water pollution indicators. On the whole, the overall score was high and the fluctuation was small. The range and variance were small. The highest and lowest removal rate of artificial intelligence sewage using fusion algorithm was 92%

and 82% respectively. The average value was 86.6%. It could be seen that the removal rate of the fusion algorithm was 23.01% higher than that of the traditional algorithm.

5. Conclusion

By analyzing the current situation of sewage treatment system and the process of artificial intelligence system treating sewage, this paper revealed the bottleneck of sewage treatment at present, and proposed a method to solve the construction of artificial intelligence sewage treatment system by fusing Boosting and Bagging algorithm. Through the analysis of experimental data, it was found that the fusion algorithm could better reflect the specific conditions of various indicators in water pollution samples when solving the treatment of sewage samples. By analyzing the pH value, turbidity degree, ammonia content, chemical average oxygen content of the sewage, and the treatment and removal rate of the sewage systems of the traditional algorithm and the fusion algorithm, it was found that the efficiency of the fusion algorithm was 23.01% higher than that of the traditional algorithm. The fusion algorithm proposed in this paper had practical significance for the construction of sewage treatment system, and also had significant influence and reference significance for the prevention and prediction of water pollution in other fields.

Funding

This article is not supported by any foundation.

Data Availability

Data sharing is not applicable to this article as no new data were created or analysed in this study.

Conflict of Interest

The author states that this article has no conflict of interest.

References

[1] Junhai Zhai, Mohan Wang, Sufang Zhang. Binary imbalanced big data classification based on fuzzy data reduction and classifier fusion. Soft Computing. (2022) 26(6): 2781-2792. https://doi.org/10.1007/s00500-021-06654-9

[2] Jie Bai. Recognition of bovine milk somatic cells based on multi-feature extraction and a GBDT-AdaBoost fusion model. Mathematical Biosciences and Engineering. (2022) 19(6): 5850-5866. https://doi.org/10.3934/mbe.2022274

[3] Sheng Tian. Method for predicting the remaining mileage of electric vehicles based on dimension expansion and model fusion. IET Intelligent Transport Systems. (2022) 16(8): 1074-1091. https://doi.org/10.1049/itr2.12196

[4] Bin Sun. Securing 6G-enabled IoT/IoV networks by machine learning and data fusion. EURASIP Journal on Wireless Communications and Networking. (2022) 2022(1): 1-17. https://doi.org/10.1186/s13638-022-02193-5

[5] Weiqi Kong, Weisong Wang, Zheng Maoxing. Integrated Learning Algorithms with Bayesian Optimization for Mild Steel Mechanical Properties Prediction. Knowledge-Based Engineering and Sciences. (2022) 3(3): 101-112.

[6] Rui Li. Geometrical defect detection on additive manufacturing parts with curvature feature and machine learning. The International Journal of Advanced Manufacturing Technology. (2022) 120(5-6): 3719-3729. https://doi.org/10.1007/s00170-022-08973-z

[7] Viet Nguyen Duc. Enhancement of membrane system performance using artificial intelligence technologies for sustainable water and wastewater treatment: A critical review. Critical Reviews in Environmental Science and Technology. (2022) 52(20): 3689-3719. https://doi.org/10.1080/10643389.2021.1940031

[8] Jude A. Belin. Retracted Article: An Artificial Intelligence Based Predictive Approach for Smart Waste Management. Wireless Personal Communications. (2022) 127(Suppl 1): 15-16. https://doi.org/10.1007/s11277-021-08803-7

[9] Zuxin Xu. Urban river pollution control in developing countries. Nature Sustainability. (2019) 2(3): 158-160. https://doi.org/10.1038/s41893-019-0249-7

[10] Xiaodong He, Peiyue Li. Surface water pollution in the middle Chinese Loess Plateau with special focus on hexavalent chromium (Cr6+): occurrence, sources and health risks. Exposure and Health. (2020) 12(3): 385-401. https://doi.org/10.1007/s12403-020-00344-x

[11] Lee Changgu. Porous electrospun fibers embedding TiO2 for adsorption and photocatalytic degradation of water pollutants. Environmental science & technology. (2018) 52(7): 4285-4293. https://doi.org/10.1021/acs.est.7b06508

[12] Chen Sophia Shuang. Assessment of urban river water pollution with urbanization in East Africa. Environmental Science and Pollution Research. (2022) 29(27): 40812-40825. https://doi.org/10.1007/s11356-021-18082-1

[13] Pinheiro Paula C. Functionalized inorganic nanoparticles for magnetic separation and SERS detection of water pollutants. European Journal of Inorganic Chemistry. (2018) 2018(30): 3443-3461. https://doi.org/10.1002/ejic.201800132

[14] Martini Sri. Membrane technology for water pollution control: a review of recent hybrid mechanism. Jurnal Rekayasa Kimia & Lingkungan. (2022) 17(1): 83-96. https://doi.org/10.23955/rkl.v17i1.23610

[15] Mingjing He. Waste-derived biochar for water pollution control and sustainable development. Nature Reviews Earth & Environment. (2022) 3(7): 444-460. https://doi.org/10.1038/s43017-022-00306-8