IAAOJ International Anatolia Academic Online Journal

Recycling and Re-Use of Wastewater; Sample of Tekirdağ Province Malkara

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ABSTRACT

The treated wastewater at Malkara Advanced Biological Wastewater Treatment Plant and discharged to the stream is preferred for urban use by taking it from the stream. Irrigation of water from the stream and urban landscape irrigation of green areas in offices, shops and industrial environments, car wash, fire. It can be used for water supply in quenching and dust control, for decorative uses such as waterfall, fountain and pool. When the analysis results made in an accredited laboratory are examined, the total nitrogen removal at the facility is %56, the total phosphorus removal is %92, the BOD expense was %98, the COD expense was %97, the suspended solid matter expense was %97 in 2018.

Keywords: Wastewater, recycling, re-use, Tekirdağ

Atıksuların Geri Dönüşümü ve Yeniden Kullanımı; Tekirdağ İli Malkara Örneği

ÖZET

Malkara İleri Biyolojik Atıksu Arıtma Tesisinde arıtılan ve dereye deşarj edilen arıtılmış atık su, dereden alınarak kentsel kullanım için tercih edilmektedir. Ofislerde, mağazalarda ve endüstriyel ortamlarda yeşil alanların dereden sulanması ve kentsel peyzaj sulanması, oto yıkama, yangın söndürme ve toz kontrolünde su temini için, şelale, çeşme ve havuz gibi dekoratif kullanımlarda kullanılabilir. 2018 yılında akredite bir laboratuvarda iç kontrol ve iç izleme için yapılan analiz sonuçları incelendiğinde tesisteki toplam azot giderimi %56, toplam fosfor giderimi %92, BOİ giderimi %98, KOİ giderimi %97, AKM giderimi ise %97'dir.

Anahtar kelimeler: Atık su, geri dönüşüm, yeniden kullanım, Tekirdağ

INTRODUCTION

The main problem that societies will face in the 21st century is “Water Scarcity”. Increasing population, climate change and acceleration of industrialization cause pollution and depletion of existing resources. The world met with this problem the need for clean water in Africa, the Middle East, and then the developed European countries and the southern states of the USA faced the same threat. (1)

Wastewater pollution is another factor causing environmental pollution. For the purification of water used for industrial and domestic purposes, the treatment process in which many processes are applied together to achieve the discharge criteria given in the Urban Wastewater Treatment Regulation and the Water Pollution Control Regulation (SKKY) is high cost. In order to meet the water need and protect the environment, using water without wasting, developing purification techniques, ensuring that wastewater is treated and reused are of great importance for our future in the days when natural resources are exhausted. (2)

Significant increases in the number of wastewater treatment plants in Turkey and the Environment commissioned the technical and financial support for environmental protection provided by the Urban Development Ministry has occurred. It is important to treat wastewater in order to protect existing resources by using water efficiently. Our country makes big investments in this field. In 1994, 71 municipalities were served with 41 wastewater treatment plants, and as of the end of 2014, 604 wastewater treatment plants and 513 municipalities were served. (3) As of the end of 2015, 653 wastewater treatment plants and 551 municipalities are served. (4) The effluent of wastewater treatment plants operated in our country is recycled and cleaned, irrigation water, etc. Its use in fields is not widespread. Domestic wastewater, which is formed in the showers, sinks and kitchens in homes and called gray water, is also not used for different purposes, it is directly connected to the sewage system. However, it can be used again after purifying gray waters. The use of recycled wastewater as irrigation water is a cheap source of water. In addition, the healthy disposal of the wastewater that needs to be removed and the nutrients present in the wastewater have a fertilizer effect on the plants, providing an advantage in the use of wastewater as irrigation water. In order to use treated wastewater for irrigation, it must meet the legislative values in the Technical Procedures Communiqué of Wastewater Treatment Plants. (5)

In this study, the working principle of the Malkara Advanced Biological Wastewater Treatment Plant operated by TESKİ, which is affiliated with Tekirdağ Metropolitan Municipality, located in the district of Malkara, Tekirdağ, the wastewater treatment process, the reuse of wastewater after treatment has been investigated. It is aimed to raise awareness on the reduction and reuse of wastewater generated.

MATERIALS AND METHODS

This study is a research based on institutional and literature knowledge, results of facility management and laboratory analysis. In the research, the ongoing studies carried out by TESKİ, which is affiliated with Tekirdağ Metropolitan Municipality, which is responsible for the treatment of urban (domestic) wastewater, are examined and evaluated. In the study, the methods used to examine the Malkara Advanced Biological Wastewater Treatment Plant from different angles and to treat domestic wastewater are considered as the method of interpreting the importance and results of the social benefits to be provided for the reuse of wastewater after treatment. In addition, resources, reports, research, projects, articles, books and legislation resources on the subject were used.

Study Area

Malkara is a district center located in the west of Tekirdağ province in South Thrace. Malkara is 56 km from Tekirdağ province. Malko, which is on the E-84 highway, is Uzunköprü and Hayrabolu in the north, the central district of Tekirdağ in the east, Şarköy in the east, Gelibolu in the south, and Keşan in the west. There are no high mountains and valleys in the district. Generally, the land has the appearance of a plateau showing semi-plain features from eroded hills. Tekir Mountains, which is the most important mountain of Tekirdağ province, is 25 km from Malkara. Away. These mountains extend in the southern part of the district, in the direction of Tekirdağ-Gelibolu. The boundaries of the district end near Çimendere village. Mount Ganos is the most important elevation of the Tekir mountain range. The main plains in the district; Evrenbey, Kırıkali, Hacısungur, Gözsız, Karacahalil, Kalaycı, Sağlamtaş and İbribey plains. Although these are not very wide, these plains are important plains of the district. The location of Malkara within the borders of Tekirdağ province is shown Figure 1.

Figure 1. The location of Malkara within the borders of Tekirdağ province

Most of the lands owned by the district are areas suitable for agriculture. The forest cover of the district is mostly located between Sağlamtaş Town, which is located in the south and southwest of the district, and the borders of Gelibolu and Keşan. This area is around 232,380 decares.

The treatment type of the facility is physical and advanced biological treatment. The facility discharge point is Beşyalak Stream. It was commissioned in 2015. The amount of wastewater to come to the facility has been determined as 7.320 m^3 / day by calculating the potable water requirement of the city and the amount of water to be used in the facilities and settlements that produce special flow, and the inflow flow from the groundwater inflow and flue lids. Advanced Biological Wastewater Treatment Plant is shown Figure 2.

Figure 2. Malkara Advanced Biological Wastewater Treatment Plant

The wastewater comes to the facility through a 800 mm diameter HDPE pipeline. The wastewater coming to the facility is taken to the approach channel first and then transmitted to the coarse grids. The administrative building, guard building, wastewater separated in the sand trap and sludge dewatering and filtrate waters are connected to the approach channel. In case of any maintenance at the facility, the 500 mm HDPE bypass line is also connected to the approach channel.

Large pieces such as paper, cloth, plastic in wastewater will be kept in 1cm + 1 spare mechanical cleaning coarse grids with 3cm spacing, rectangular cross-section. Mechanical cleaning Wastewater that passes through the coarse grill is transmitted to the mechanical cleaning fine grill units. Materials that cannot be kept in coarse gratings will be kept between 2 main + 1 spare mechanical cleaning thin grating rods with 1cm spacing and rectangular cross-section. The wastewater that passes from the entrance promotion center is transmitted to the ventilated sand and oil trap units built with two eyes. A 24-hour composite sample is taken with the cooled automatic sampling device in the inlet channel before entering the wastewater aerated sand and oil trap pools. In the sand and oil trap unit; Small solid particles such as sand and gravel, which are transported by the sewage system to the wastewater treatment plant, and swimmer materials such as oil-grease are removed from the wastewater. Due to the air and flow rate given by the diffusers placed along the long edge of the pool, a spiral flow is provided to the water and depending on the spiral flow effect created by the air, materials such as sand and gravel settle to the bottom.

Microorganisms need phosphorus for enzyme and new cell formation. In addition, some microorganisms have phosphorus storage properties and this feature is used for phosphorus removal from wastewater. Since phosphorus causes eutrophication in the receiving environment, it must be removed before discharging. In aerobic conditions, energy is produced by using the carbon storage stored under anaerobic conditions, and thanks to this energy, phosphate is removed from the waste water by removing the phosphate taken from the cell and filling the polyphosphate tanks. As an important issue, oxygen and nitrate should not be present as electron acceptors in order to leave phosphate in anaerobic environment. Bio-p pools are composed of 3 equal volume parallel hoppers built. The wastewaters coming out of the Bio-P pools are taken into the aeration tanks in accordance with the distribution system and then the preferred system. The aim here is the oxidation of organic and inorganics,

which can be decomposed by biological means, with oxygen supplied from the outside. It consists of two stages: nitrification and denitrification.

The final settling distribution structure has been designed to distribute the wastewater coming out of the aeration pool to 2 final settling tanks. Colloidal activated sludge obtained in the final settling tanks and aeration ponds is separated from the water by the effect of gravity. As a sludge dewatering equipment, there are three HAUS brand decanters with a capacity of 80 m3 / h and the mud cake coming out of the decanters will contain an average of 25% solids. In the Malkara Advanced Biological Wastewater Treatment Plant, the wastewater treated for the purpose of reusing wastewater is discharged by UV disinfection and removed from microbiological pollution. Fast Sand Filter unit is provided with downstream speed filters and works with fixed input principle. The water collected in the collectors is taken into the Filter Backwash Water Tank after passing through the UV disinfection unit. Backwashing is done for at least 24 hours.

RESULTS AND DISCUSSION

The discharge water discharged water plants within TESKİ are analyzed regularly every month, as per the legislation, within the scope of the Urban Waste Water Treatment Regulation, and by the Waste Water Laboratory established in 2018 within the body of TESKI. Inlet and outlet water are shown Figure 3 and Table 1 is icluded Legislative Values of waste water.

Figure 3. Inlet and outlet water

Table 1. Legislative Values

Legislative Values					
Parameter	Unit	Urban Wastewater Treatment Regulation	Regulation on Control of Water Pollution (SKKY) (Population 10000-100000)		Ergene Discharge Criteria (Circular 2011/10) (2 hour composite sample)
			2 hour composite sample	24 hour composite sample	
BOD_5	mg/l	25	50	45	
suspended solid matter	mg/l	35	45	30	
COD	mg/l	125	140	100	90
TN	mg/l	15 mg/l N (10000-100000 10 mg/l N (100 000 more than)			
TP	mg/l	2 mg/l P(10000-100000) 1 mg/l P(100 000 more than)			
pH			6-9	6-9	

The results of the analysis of Malkara Advanced Biological Wastewater Treatment Plant, which was commissioned by TESKİ in 2018 in accordance with the legislation, are given below Table 2.

Table 2. Accredited Laboratory Analysis Results for 2018

2018 Malkara Advanced Biological Wastewater Treatment Plant Accredited Laboratory Analysis Results							
Parameter	31.01.2018	14.02.2018	21.03.2018	17.04.2018	16.05.2018	11.06.2018	11.07.2018
COD 125 mg/L	43	41	<40	<40	40	<40	<40
Suspended solid matter *35 mg/L*	<10	<10	<11	<11	<11	<11	<11
BOD 25 mg/L	20	18	<3	<3	16,5	<3	<3
pH 6-9	8,28	7,56	7,95	8,65	8,51	7,86	7,58
TP 2 mg/L	1,71	1,67	0,8	1,9	1,75	1,218	1,5
TN 15 mg/L	11,4	7,5	12	10,9	6,6	10,3	9,48
				INPUT	OUTPUT	INPUT	OUTPUT
Parameter	06.08.2018	05.09.2018	09.10.2018	15.11.2018	15.11.2018	11.12.2018	11.12.2018
COD 125 mg/L	42	<40	45	1336	<40	165	73
Suspended solid matter *35 mg/L*	<11	13	18	443	<11	180	<11
BOD 25 mg/L	16,8	<3	17	535	7	66	24,7
pH 6-9	7,21	8,6	7,21	8,21	8,29	7,58	7,87
TP 2 mg/L	1,6	1,59	0,3	4,5	0,361	9,97	0,61
TN 15 mg/L	7,1	9,3	14,5	22,4	9,67	3,7	5,04

When the analysis results made in TESKİ Wastewater Laboratory for internal control and internal monitoring in 2018 and made in an accredited laboratory are examined, the total nitrogen removal at the facility is %56, the total phosphorus removal is %92, the BOD expense was %98, the COD expense was %97, the suspended solid matter expense was %97. Calculations are made according to the results of seasonal inlet and outlet wastewater samples in the tables.

According to the results of the analysis; The treated wastewater treated at Malkara Advanced Biological Wastewater Treatment Plant and discharged to the stream is preferred for urban use by taking it from the stream. Irrigation of water from the stream and urban landscape (park and garden areas, school gardens and sports areas, highway edges, playgrounds, green areas around public buildings and facilities), irrigation of green areas in offices, shops and industrial environments, car wash, fire It can be used for water supply in quenching and dust control, decorative uses such as waterfall, fountain and pool. In order to use the treated water as cooling water in the industry, the construction of a water tank is needed in the treatment

plant to store the treated water. In addition, the treated water in agriculture; Necessary analyzes will be carried out in the legislation to make use of nutrients and use them as natural fertilizers.

Investments are made with the awareness of increasing demand for TESKİ water resources and using resources efficiently. It is primarily aimed at protecting clean water resources, discharging and reusing wastewater resources without harming nature. The example of Malkara district of Tekirdağ province is an example in Thrace for the reuse of wastewater and creates a source of motivation for other water sewage administrations. Recycling and re-use of wastewater creates significant environmental and economic contributions such as reducing water scarcity, increasing soil quality and saving in production.

CONCLUSIONS

In conclusion, this study has provided some baseline information on Recycling and re-use of wastewater creates significant environmental and economic contributions such as reducing water scarcity, increasing soil quality and saving in production. Since there is no published information about these features of this Malkara Advanced Biological Wastewater Treatment Plant, the results are expected to be useful for future studies.

Acknowledgments: We thank TESKİ for providing measurements and his valuable support.
Disclosure: This study was presented at the "3rd International Water and Health Congress will be held 12th-15th November 2019 in Antalya".

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