Membrane Wastewater Treatment System CASE STUDY ON SEWAGE TREATMENT plant of the University of Sinnar 2019-2022

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ABSTRAC:

The scientific study aims to identify the advanced treatment system of modern sewage plants that treat wastewater with advanced high-efficiency biofilms in wastewater treatment systems. Which is so that the treated water is suitable for safe irrigation purposes and its importance in knowing the quality of the treated water and its properties for reuse in irrigation of gardens in university housing and neighboring sickles and to benefit from the improved organic fertilizer resulting from the treatment for agriculture.Failure to follow up on changing the membranes led to problems in the production of odors and foul gases, and reduced the efficiency of treatment. The research adopted the method of collecting information in field uniforms, taking different pictures showing the stages of treatment, the shape of the incoming and outgoing water, and how the compressors work, and making a questionnaire for the residents of the area about the station, and collecting previous reports and readings of the treated water at the station at the start of its operation and personal interviews, and using the station design plans and analyzing that information analysis program Statistics. The conclusion of the study is that the membrane treatment system is one of the advanced systems with high efficiency in wastewater treatment, and that the plant operates at its beginning according to the specifications and standards of wastewater, but the lack of follow-up in changing the membranes according to the method of operation decreased efficiency.The treated water has become unfit for irrigation purposes, which necessitates changing the compressors in order for the system to return to its previous state

نظام معالجة مياه الصرف الصحى بأغشية الحيوية (الممبرين)
دراسة حالة محطة معالجة مياه المجارى بجامعة سنار
فترة الدارسة (2019-2022)م

أ.عرفة كمال الدين محمد إبراهيم - باحث - جامعة الزعيم الأزهري
د. محمد أحمد آدم خدام - أستاذ مشارك - كلية الهندسة - جامعةالخرطوم

المستخلص

تهدف الدارسة العلمية للتعرف على نظام المعالجة المتقدمة لمحطات الصرف الصحى الحديثة التى تعالج مياه الصرف الصحى بالأغشية الحيوية الممبرين ذو الكفاءة العالية المتقدمة فى انظمة معالجة مياه الصرف الصحى. بحيث تكون المياه المعالجة صالحة للاغراض الرى الآمن و اهميته فى معرفة نوعية المياه المعالجة وخواصها للاعادة استخدامها فى الرى الحدائق بالسكن الجامعى والمناجل المجاورة والاستفادة من السماد العضوى المحسن الناتج من المعالجة للزراعة .عدم المتابعة فى تغيير الممبرين ادى الى مشاكل فى انتاج الروائح واغازات الكريهة وقلل من كفاءة المعالجة . اعتمدالبحث منهج جمع المعلومات بالزيات الميدانية واخذ صور مختلفة توضح مراحل المعالجة وشكل المياه الداخلة والخارجة وكيفية عمل الممبرين , وعمل استبيان لسكان المنطقة حول المحطة ,وجمع التقارير والقراءات السابقة للمياه المعالجة بالمحطة عند بداية تشغيلها والمقابلات الشخصية و الاستعانة بالخرط التصميمية اللمحطة وتحليل تلك المعلومات برنامج التحليل الاحصائى .خلاصةالدراسة على أن نظام المعالجة بالممبرين من الانظمة المتطورة ذات الكفاءة العالية فى معالجة مياه الصرف الصحى وان المحطة تعمل فى بدايتها بحسب المواصفات والمقايس لمياه الصرف الصحى ولكن عدم المتابعة فى تغيير الممبرين بحسب طريقة عملة قلت الكفاءةاصبحت المياه المعالجة غير صالحة للاغراض الرى ممايلزم تغيير الممبرين ليعود النظام لسابقه.

الكلمات المفتاحية : الحمأة المنشطة ، المعالجة ، الأغشية ، الري ، التشغيل ، المحطة ، المجلات ، الصرف الصحي ، النفايات السائلة ، مياه الصرف الصحي ، السعة, الاكسجين الحيوى المستهلك

1/ Introduction]

Sinnar University complete its faculties in various fields and departments. Thus, the National Student Welfare Fund established the university cities of the martyrs and Osama bin Zaid and replaced the septic and well system with the establishment of a sewage plant, which is located in the Bunyan neighborhood north of Sinnar city to treat water and use it to irrigate gardens and sickles, to end of the environmental impacts resulting from sewage. The station was established in January 2008, with a design capacity of 500 m3/day, the cost of the project is two billion nine hundred,

the owner of the project, the National Student Welfare Fund, a biological treatment system with active sludge (advanced biofilm treatment (membrane strips))It is the last stage of biological treatment (advanced treatment), in which pollutants, toxic substances and any abnormally high levels of suspended organic matter are removed. Such treatments are used in the case of recycling sewage water for agricultural use, charging groundwater reserves, and using the resulting water in cooling and industry. It also performs the final sedimentation tank and filtration at the same time, which distinguishes it from other advanced treatment systems. When it reaches the water, by any method, it treats it, and this has an effect on the membranes, which reduces their lifespan, and the water has reached a lower degree of purity, which is better than being turbid. As shown in the picture below. The membrane does not need final sedimentation tanks, and it performs all the roles and tasks of the sedimentation tanks, and drains the treated water to the irrigation tank and returns the sediment (sludge) to the tanks.A rectangular tank detailed into three slices of biofilms, each slice treats 5 m3 in the cycle, and it is connected to iron pipes that raise the water from the aeration tank to the reactor, and pipes that supply air to the slides tanks in a direction opposite to the direction of water withdrawal in order to prevent sticking of suspended materials to the wall of the membrane reactor, and that Air ensures that bacteria interact with suspended organic matter. The slides are made of very fine materials that can be materials (cellulose tonsils, polymers, plastics, and others). In this tank, there is a sensitive device for measuring total solids, connected to a coil that works automatically, and when its reading exceeds 10 mg, the coil is opened and the total suspended materials are returned to the collection tank. Thus, we can call the plant with a combined system between treatment with active sludge and membranes (bio-membrane reactor). Then the treated water is withdrawn to the last part of the membrane reactor equipped with a weighted chlorine injection belt through a sensitive device at a ratio of (5-10) mg in the tube connected to the

filter and then cleared to the irrigation tank.

by P. Quevauviller, O. Thomas and A. van der Beken, *Wastewater Quality Monitoring and Treatment* EditedC _2006 John Wiley & Sons, Ltd. ISBN: 0-471-49929-3,

2/ GENRAL Objectives

To study the performance of a wastewater treatment and to suggest improvements for preventing adverse effects of treatment Plant, on the surrounding environment.

3 / Specific Objectives:-

- To assess the current status of a wastewater treatment plant (quality and quantity)
- To assess the quality of treatment wastewater and its use in irrigation
- To Improve the current situation and future expansion of the station to keep pace with the number of users
- Sludge treatment of the current sludge treatment processes
- Environmental effects of the station treatment plant on the surrounding environment.

4/ RESEARCH PROBLEM: -

- Wastewater treatment plant for the student hostels of sinnar University was over loaded and treated effluent is not computable with the Standard specification for treatment of irrigation of farm.
- The sewage system of the station works with a tertiary treatment system with a rectangular bio membrane filter of plastic material. It is necessary to regularly change it at least every five years, therefore, this is one of it is biggest problems.
- The membrane reactor works on the biological treatment system of wastewater through the active sludge with compressed air, this process requires operating skills by engineers and technicians of different levels.
- Lack of periodic maintenance of the station with the qualified personnel

5.Material and Method

1. General information was collected from the station from the project management, including the core capacity of the station and the map of the station, in addition to the basic information.
2. Doing a number of field visits to the station and its annexes, taking different pictures at different times and comparing them to find out the causes of malfunctions and change the quality of the treated water in the station to study its current status.
3. Taking the operational data of the station, which includes the amount of treated water entering and leaving the station at the start of operation and before stopping, as well as taking a reading ((BOD, COD, TSS,PH)
4. A questionnaire was made for the station and included the residents of the neighborhood about the station and government and private facilities, and accordingly the questionnaire was analyzed by SPSS programs
5. Studying of environmental impact by interviews through questionnaire.

The location of the SINNAR University station for advanced treatment (membrane), taken on 10/29/2022

موقع محطة جامعة سنار للمعالجة المتقدمة (الممبرين) لخذة الصورة ٢٠٢٢/١٠/٢٩م

٢/ MBR sewage water treatment machine :-

(1) **(2)**

The location of the SINNAR University station for advanced treatment (membrane), taken on 10/29/2022

موقع محطة جامعة سنار للمعالجة المتقدمة (الممبرين) اخذة الصورة 2022/10/29م

2/ MBR sewage water treatment machine :-

2)(1()

Figure (1) A picture of a slice of membrane taken on 6/11/2019.

The adjacent picture is three slices of membrane taken in January 2013 from the sewage treatment plant at Sennar University.

الشكل (1) صورة لشرائحة الممبرين مأخوذة 2019/11/6م الصورة المجاورة ثلاثة شرائح ممبرين مأخوذة يناير/2013 من محطة معالجة مياه الصرف الصحى بجامعة سنار

FIGURE (1) Membrane Bioreactor (MBR) treatment wastewater advanced technology (Filtration)

Membrane Bioreactor (MBR) is a advanced technology developed since the end of 20th century which realized the efficient combination of membrane separation technology with biological technology. The membrane separation technology replaces the traditional active sludge method and the normal filter unit, its strong separation ability can make the SS turbidity near to be zero, therefore greatly expands the scope of application of waste water recycling.

:Quantity	1
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- **Brand:BETTER**
- **Code:8421299090**
- **Product Description**

Product Description

MBR

t Description

Membrane Bioreactor (MBR) is a kind of advanced technology developed sin

cethe end of 20th century which realized the efficient combinatio n of membrane separation technology with biological technology the membrane separation technology
replaces the traditional active sludge method and the normal filter unit, its strong separation ability can make the SS turbidiS ty near to be zero. Hydraulic retention time (HRT) sludge age (S RT) is completely separated, the outlet water is good and stabl e in quality, it can be reused without the third level treatment. Du e to the high security and economic and effective water, it greatly expands the scope of application of waste water recycling.

l Technological Process:
Sewage → Grille → Regulating pond → MBR Bioreactor → Discharge (reuse)
1. Temperature: 5℃~45℃, average membrane aperture 0.10 μm.
2. PH: 2~12, membrane thickness: 40μm.
3. Outlet water turbidity : ＜1 NTU , outlet water SS ＜1mg/L.
4. Membrane area: 8m^2, advised gas-water ratio: 25:1~30:1.
5. Operating pressure: -0.01 ～ -0.03Mpa

1. Pendashteh A.R., Fakhru'l-Razi A., Madaeni S.S., Abdullah L.C., Abidin Z.Z., Biak D.R.A. Membrane foulants characterization in a membrane bioreactor (MBR) treating hypersaline oily wastewater. Chem. Eng. J. 2011;168:140–150. doi: 10.1016/j.cej.2010.12.053. - DOI

Membrane standard specifications table taken from the website
info@sigmadafclarifiers.com
+34 972 22 34 81Request for quotation·Customer accessen
Table(1) Information technical

Modelo	Hab/equi.	Capacidad (m^3/día)	Membrana (m^2)	Nº módulos	Potencia (kwh)	Dimensiones (mts)
SMBR40-1	Hasta 130	20	40	1	10	9 x 2.3 x 2.3
SMBR60-1	Hasta 200	30	60	1	12	9 x 2.3 x 2.3
SMBR40-2	Hasta 260	40	80	2	14	9 x 2.3 x 2.3
SMBR60-2	Hasta 400	60	120	2	16	11 x 2.3 x 2.3
SMBR80-2 (*)	Hasta 550	80	160	2	20	11 x 2.3 x 2.3
SMBR100-2 (*)	Hasta 700	100	200	2	30	11 x 2.3 x 2.3

Ratios diseño: 20 lts/m^2/h
150 lts/hab

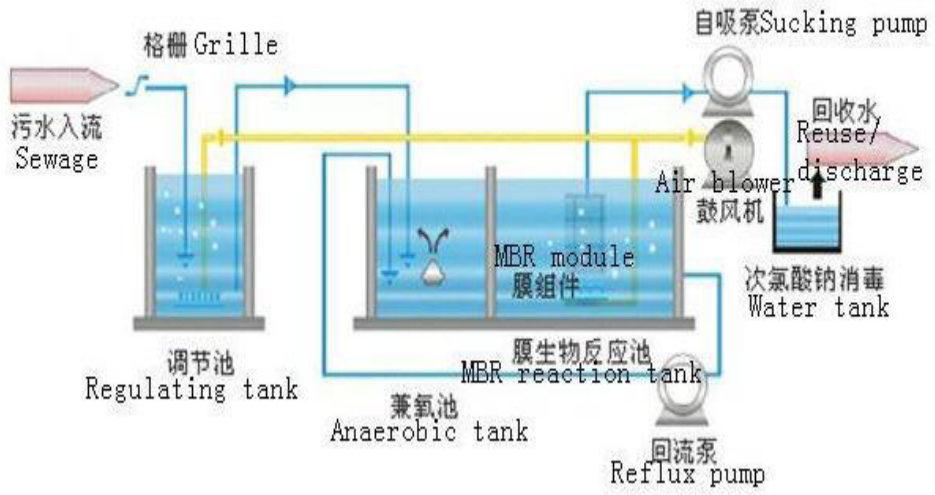
(*) No incluyen homogeneizador

5/Fetures

1. Because of the high-efficiency solid-liquid separation, it can efficiently remove the SS, colloidal material and dead microbe in the

sewage, no need sedimentation tank, or filter device, nor other solid-liquid separation device. 2. The MBR can make the biomass in biological treatment unit maintain high concentration, thus highly improve the volume loading. Meanwhile, the high efficient membrane separation can shorten the HRT. The device is with a compact structure and small space occupation. 3. MBR can filter out bacteria, part of the harmful material such as virus, it can obviously save dosing disinfection dosage, greatly improve the quality of the output water and reduce the operating cost and widen the scope of application of water. 4. Due to the strong interception function of MBR, it can keep the microbe in the reactor to avoid the loss of all kinds of microbe groups, which is good for the growth of the bacteria (such as the nitrifying bacteria), at the same time, it can lengthen the residence time of diffi-

cult
degradablemacromolecule organics to improve the decomposition so as to make the metabolic system process smoothly. The system has a strong impact resistance and wide suitability. 5. It can realize the completely separation of HRT and SRT. By the extended aeration, it can consume the organics, it can theoretically achieve the effect of no excess sludge emissions, thus reduce the surplus sludge treatmentcosts significantly. 6.The unique mode of operation makes the membrane surface no blocking, and the cleaning interval time is long. The way to clean the membrane is eay, since the membrane module can be separately cleaned, thus, the maintenance is convenience and simple. 7. The module design make the machine flexible, it is easy to expand the volume.



FIGURE(2) MBR sewage water treatment machine

operation cost. Previous: Dissolved Air Floatation Machine (DAF)Next: Packaged Sewage Treatment PlantTop of Form

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6/MBR is a kind of new technology for waste water treatment by combining membrane separation technique with activated sludge method. It can be used for municipal sewage and industrial waste water treatment and substitute for secondary sedimentation tank in removing suspended particles, so as to increase nitrogen removal rate and organics degradation rate.

As a waste water treatment system features simple operation, high automation and modular design, it also has below advantages:

※ Save 50% occupying area compared with traditional system.
※ Relative high MLSS value (＜15g/
Land long residuetime for sludge(＜60days).
※ Stable producing water quality for different inlet water.
※ Less sludge residue reduces cost for sludge treatment.
※ Low energy consumption, simple cleaning and low operation
(**Shandong Better Environmental Protection Technology Co.,**

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3/results of the research paper

Al-Shahdeen and Osama bin Zaid station was designed with a maximum number of 4,000 students, with a water treatment capacity of 500 m3/day, and bio-oxygen consumed before treatment 500 mg/liter and after treatment (5-10) mg/liter and bio-oxygen consumed before treatment 1000 mg/liter after treatment.(50-80), total solids (1-9) mg/L and pH (5.5-7.5)a biological treatment system with active sludge (advanced biofilm treatment (membrane strips)).

1/This include **the previous monitoring of waste water quality during 2013m**

1/ BOD5 consumed before treatment(450)mg/l and after treatment (5)mg/l , and COD consumed before treatment (800)mg/l after treatment (50)mg/l, total solids(1)mg/l, and PH(5.5).
2/ the treatment efficiency of the plant is (98%).

2/this is the data obtained during the study period of the research in 2019m

1/ BOD5 consumed before treatment **(500)mg**/l and after treatment (155)mg/l **, and** COD consumed before treatment (1000) mg/l ,after treatment (350)mg/l, total solid (10)mg/l, and PH (8.5).
the treatment efficiency of the plant is (69%).

3/Operation building The parts of the operating station building are divided according to the treatment stages as follows:

1/ Pretreatment of wastewater (physical treatment), including:
1/ Lifting Station

(1)- (2)

الصورة (1)مأخوذة من حوض التجميع لمحطة جامعة سنار فى 6/11/2019م والصورة (2) مأخوذة لنفس الحوض فى 2022/10/19مPhoto (1) taken from the collection basin of Sennar University station on 11/6/2019 AD and photo (2) taken for the same basin on 10/19/2022 AD

FIGURE (3) Primary Settling(lift tank and pump)after and before station stops

It is a square tank with dimensions (3.4 x 3.4 x 4) m equipped with an electric drum to operate submersible pumps, connected with a control room to operate the electricity of the station.the station has completely stopped working, and all departments have been removed from the various faculties of the university.

1-2/ Screen's

1-3/ Sand and gravel stone basins

1-4 / Oil and fat storage tanks

2/ Primary treatment

2-1/ Primary sedimentation (Buffer tank)

2-2/ Anoxic tank

2)(1()

الصـورة (1) مأخـوذة مـن محطـة جامعـة سـنار لحـوض الخلـط 2019م الصـورة (2)مأخـوذة لنفـس الحـوض 19/10/2022م بعـد توقـف المحطـة

Photo (1) taken from the Sennar University station for the mixing

basin 2019 AD Photo (2) taken for the same basin 19/10/2022 AD after the station stopped

FIGURE(4) Oxygen Uptake (Aeration tank of activated sludge sewage treatment plant)**(after and before station stops)**

It is a rectangular tanks of dimensions (4.55 x 9.8 m), a depth of 4 m, with a network of perforated square-shaped plastic pipes connected to the pipelines of the oxygen line generated by air pumping motors.Failure of submersible pumps that raise sewage water inside the tank, Sedimentation of an amount of agglomerated sludge at the bottom of the tank , Water arrives from the lifting station with an external connector cartridge that tilts all parts of the station to reduce the amount of excess flow from the lifting station.

3/ Secondary treatment (biological)

3-1/ Aeration tank

MBRANE PROCESSES FOR WASTEWATER TREAT-

MENT

(1). (2)

الصورة (1) لحوض التهوية ماخوذة 2022/19/10م من محطة جامعة سنار بعد توقف المحطة والصورة (2) ماخوذة 2019م اثناء عمل المحطة

Photo (1) of the ventilation basin taken on 19/10/2022 AD from the Sennar University station after the station stopped, and Photo (2) taken on 2019 AD during the station's operation

FIGURE(5)Aeration tanksDisable the waste water pumps that lift to the ducts and pumps(after and before station stops)

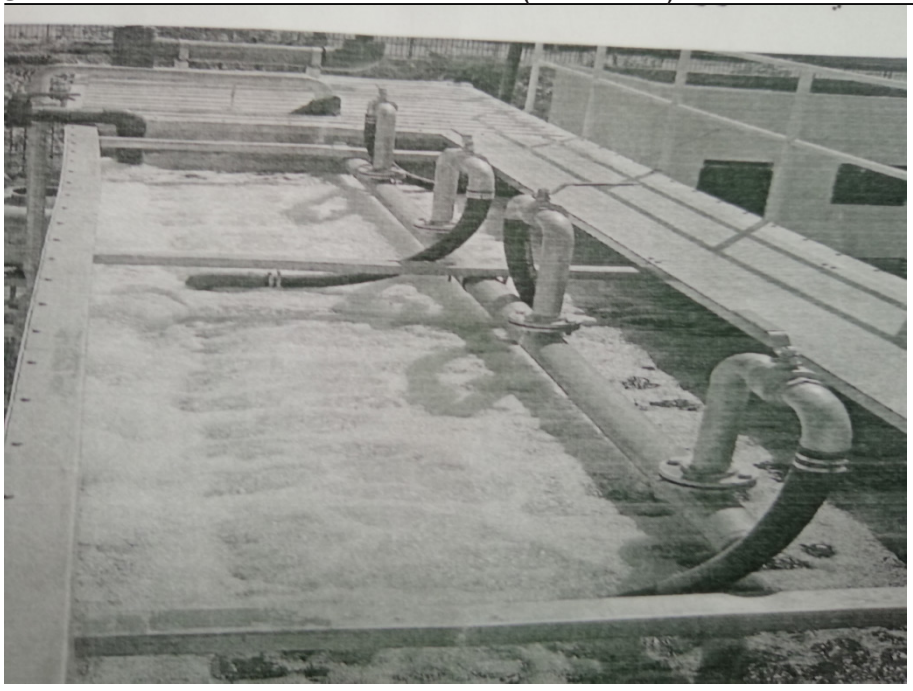
It is a rectangular tank of dimensions (4.55 x 9.8 m), a depth of 4 m, with a network of perforated square-shaped plastic pipes connected to the pipelines of the oxygen line generated by air pumping motors.

Blockage of the perforated pipe network with sludge that transfers air to the

parts of the tank as a result of the increase in sludge in the tank

and the inability to drain it due to the breakage of the conveyor line.^ *Khopkar, S.M. (2004). Environmental Pollution Monitoring And Control. New Delhi: New Age International. p. 299. ISBN 978-81-224-1507-0*

3-2/ The treated membrane tank (filtration) advanced treatment



خـزان الممبريـن لمعالجـة ميـاة الصـرف التـى تعمـل بـه محطـة جامعـة سـنار اخـذة الصـورة 2013م

Membrane tank for wastewater treatment in which the Sennar University station operates, photo taken in 2013

FIGURE(6) membrane Aeration tank of activated sludge sewage treatment plant

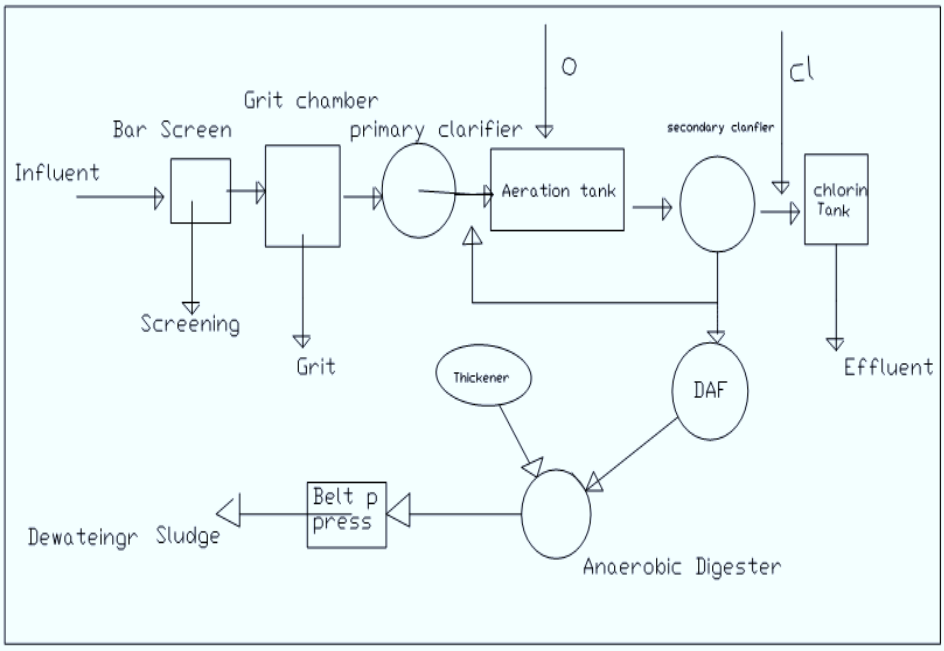
Algae growth in membranes biofilms , The presence of a quantity of water inside covered by the sewage , Blockage of pipes carrying water from the ventilation basin to the membranes

3-3/ Chlorine disinfection tank Chemical treatment

3-4/ irrigation tank

3-5/ Discharged sludge tank

4/ control room
5/ Oxygen generating room
6/ Electricity generator room
7/ room for station wors



Wastewater Plant Included physical And Biological Processes

FIGURE(7) secondary treatment plan (wastewater plant included physical and
biological processes ^ *Tchobanoglous, George; Burton, Franklin L.; Stensel, H. David; Metcalf & Eddy, Inc. (2003). Wastewater Engineering: Treatment and Reuse (4th ed.). McGraw-Hill. ISBN 978-0-07-112250-4*

/questionnaire4

تحليل الاستبيان ببرنامج التحليل الاحصائى الخاص بسكان الحى المجاور لمحطة الصرف الصحى جامعة سنارAnalysis of the questionnaire using the statistical analysis program for the residents of the neighborhood adjacent to the sewage station, Sennar University

A Table (1-4) showing the population harm from the presence of the station

1/ Does the presence of a sewage plant near your residence affect your health in terms of odor

Cumulative Percent	Valid Percent	Percent	Frequency		
50.6	50.6	50.0	40	اوافقبشدة	Valid
65.8	15.2	15.0	12	اوافق	
74.7	8.9	8.8	7	لااوافقبشدة	
82.3	7.6	7.5	6	محايد	
100.0	17.7	17.5	14	لااوافق	
	100.0	98.8	79	Total	
		1.3	1	System	Missing
		100.0	80		Total

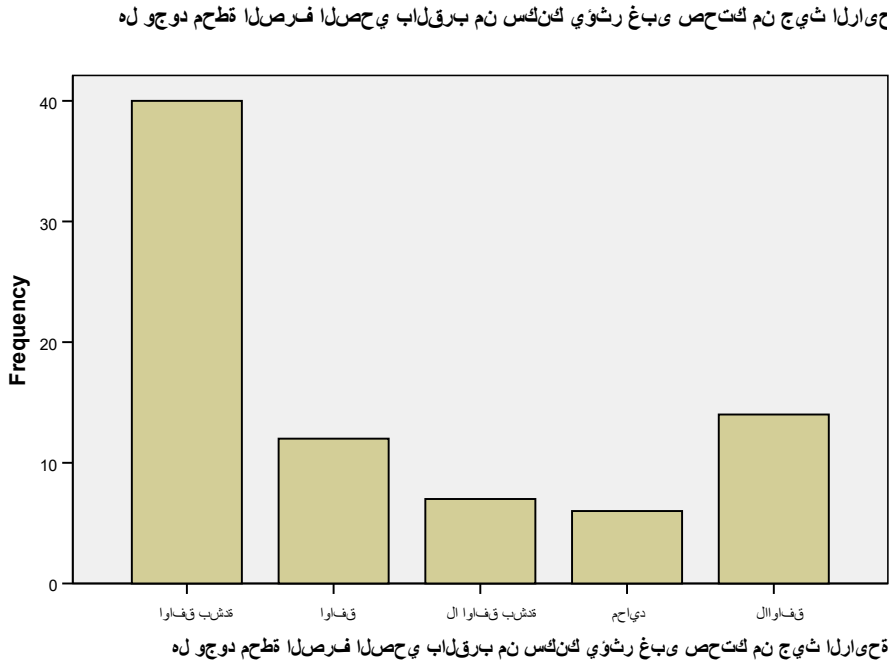


Figure (1-4)

Percentage of population damage from the smell of the station

The above table and chart demonstrates the participants point of view who takes part in the questionnaire about the Item "do you suffer from the unpleasant odor that comes from the sewage station nearby ": 50.0% say strongly agree, 15% say agree, 8.8 say strongly disagree, 7.5 % say neutral and say 17.5% disagree.

Table (4-2) shows the benefit from the station for residents of the surrounding area

Do you agree if there is an opportunity to connect the bathrooms of your home or interest to the station?

Cumulative Percent	Valid Percent	Percent	Frequency	

Valid	اوافقبشدة	22	27.5	28.2	28.2
	اوافق	24	30.0	30.8	59.0
	لااوافقبشدة	14	17.5	17.9	76.9
	محايد	7	8.8	9.0	85.9
	لااوافق	10	12.5	12.8	98.7
		Total	78	97.5	100.0
	Missing	System	2	2.5	
	Total		80	100.0	

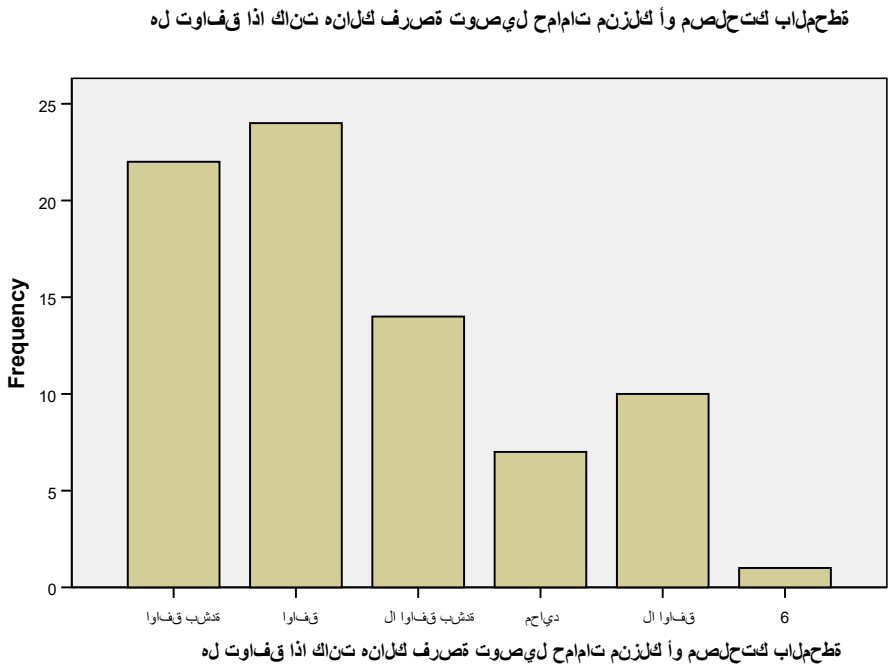


Figure (2-4) Percentage of individuals wishing to have their bathrooms connected to the station

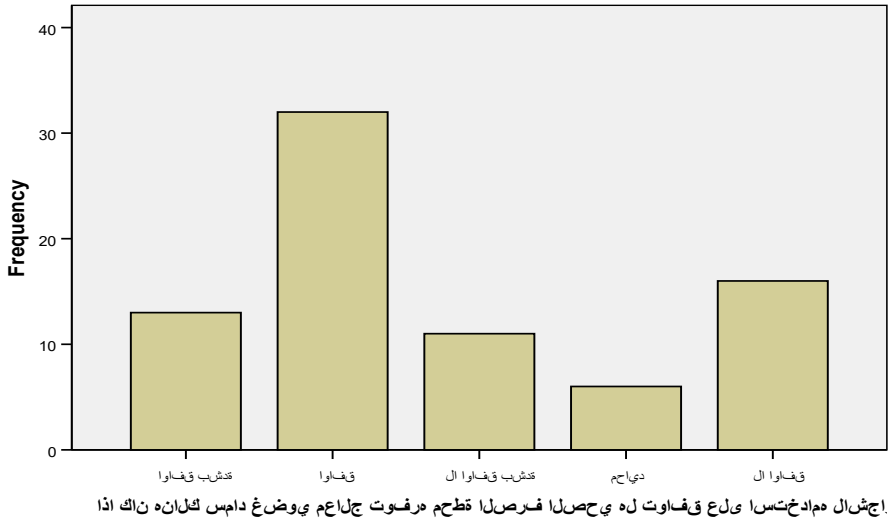
The above table and chart demonstrates the participants' point of view who takes part in the questionnaire about the Item "if you get chance to connect your bath and toilet to the sewage station pipes do you agree?"17.5% say strongly agree, 30.0% say agree, 8.8%

say strongly disagree, 8.8% say neutral and say 12.5% disagree.
Table (2-4) shows the number of individuals who wish to use organic fertilizers

If there is a processed organic fertilizer provided by the sewage station, would you agree to use it for your garden trees?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	اوافقبشدة	13	16.3	16.7	16.7
	اوافق	32	40.0	41.0	57.7
	لااوافقبشدة	11	13.8	14.1	71.8
	محايد	6	7.5	7.7	79.5
	لااوافق	16	20.0	20.5	100.0
	Total	78	97.5	100.0	
Missing	System	2	2.5		
Total		80	100.0		

اذا كان هنالك سماد عضوي معالج توفره محطة الصرف الصحي هل توافق على استخدامه لاشج



اذا كان هنالك سماد عضوي معالج توفره محطة الصرف الصحي هل توافق على استخدامه لاشجا

Figure - (3-4) Percentage of individuals who agree to use organic

fertilizer

The above table and chart demonstrates the participants' point of view who takes part in the questionnaire about the Item "if you get chance to connect your bath and toilet to the sewage station pipes do you agree? "16.3% say strongly agree, 40.0% say agree, 13.8% say strongly disagree, 7.5% say neutral and say 20.0% disagree.
Table (2-4) shows the number of individuals who wish to irrigate trees with sewage water
If there is a garden in front of your house, do we agree to see its Lord from the station?

Cumulative Percent	Valid Percent	Percent	Frequency		
19.0	19.0	18.8	15	اوافقبشدة	Valid
57.0	38.0	37.5	30	اوافق	
68.4	11.4	11.3	9	لااوافقبشدة	
73.4	5.1	5.0	4	محايد	
100.0	26.6	26.3	21	لااوافق	
	100.0	98.8	79	Total	
		1.3	1	System	Missing
		100.0	80		Total

Figure (3-4) Percentage of individuals agreeing to irrigate trees from the treated water

Figure (3-4) Percentage of individuals agreeing to irrigate trees from the treated water

The above table and chart demonstrates the participants' point of view who takes part in the questionnaire about the Item " if there is a garden in front of your house do you agree to be watered from the sewage station?"18.8% say strongly agree, 37.5% say agree, 11.3% say strongly disagree, 5.0% say neutral and say 26.3% disagree.

4/ RESULTS AND DISCUSSION

3.0.1 /National students welfare fund station with a wastewater treatment capacity 500m3/day.

1/Data Collection

4.1.2/This include **the previous monitoring of waste water**

quality during 2013m

1/ BOD5 consumed before treatment(450)mg/l and after treatment (5)mg/l , and COD consumed before treatment (800)mg/l after treatment (50)mg/l, total solids(1)mg/l, and PH(5.5).

2/ the treatment efficiency of the plant is (98%).

3.0.2 **/this is the data obtained during the study period of the research in 2019m**

1/ BOD5 consumed before treatment **(500)mg**/l and after treatment (155)mg/l **, and** COD consumed before treatment (1000) mg/l ,after treatment (350)mg/l, total solid (10)mg/l, and PH (8.5).

2/ the treatment efficiency of the plant is (69%).

Table (4.1) date comparison of waste water quality during (2013-2019)m.

parameter	UNIT	In/2013m	Out/2013m	In/2019m	Out/2019m
BOD5	mg/l	450	5	500	155
COD	mg/l	800	50	1000	350
T.SS	mg/l	-	1	-	10
PH		-	5.5	-	8.5

BOD5=Biological Oxygen Demand, COD = *Chemical oxygen demand* T.SS = Total Suspended Solids ,PH = Hydrogen ion concentration

- the treatment efficiency of the plant is (98%). Of the station during 2013m and BOD5 = 5mg/l is suitable for migration pups.
- the treatment efficiency of the plant is (69%),of the station before it stops and BOD5 the effluent was 155mg/l which is of out and the range for imagining green areas.

2/questionnaire

- There are foul odors coming out of the station, which transmitted to the residents of the area and are affected by asthma and allergy sufferers.
- IF there is an opportunity to connect the neighborhoods

bathrooms to sewage station, they don't mind.

- Some people are using organic compost from plants, trees, and home gardens

5/ Conclusion

5.1.1/ The original plant capacity was 500m3/d .The plant was over loaded due to the expansion of hostel (up to 750m3/d) .

5.1.2 / The quality of the effluent for irrigation during the start of operation of the plant was (BOD5) = (5)mg/l and later after over loading was (BOD5) = (155)mg/l

5.1.3 /The units of the plant that need rehabilitation :- lifting pump , membrane , sludge spare parts should be made available in order to have sustainable operation of the plant. .

5.1.5 / No skill technicians or engineering are available for operation and maintenance of the plant in operated and maintained by causal laborers .

5.1.6 / The questionnaire questions reveal that some adverse effect on the environment of the residents surrounding the treatment plant. But odors, insets are some of the adverse effect

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ANNEX

Sennar University operational plan