Egypt. J. Agric. Res., 81 (4), 2003.

USE OF FOAM MEDIA FOR FILTERING HEAVY SEDIMENTS WATER

EL-BERRY A. M., M. T. EL-TANTAWY, A. I. GHAZY AND E. WASIF

Agric. Eng. Res. Inst., Agric. Res. Centre, Dokki, Giza, Egypt.

(Manuscript received 15 September 2003)

Abstract

The experimental work was carried out at Ismalia wastewater treatment plant in "Serapeum". For the last 35 years in the field of wastewater filtration, many new models of filters were used. Some types use upward flow filters such as filters with floating granular media from expended polystyrene. They have many advantages over other types that have high holding capacity. The applied filters contain floating media for physically and biologically treating municipal wastewater of Ismalia City for reuse in agriculture.

The experiment was set for the comparison between the granular and crushed foam with effective diameter 1.6 – 2 mm and 2 – 3 mm respectively. The data showed that the granular foam media was more efficient in the removal efficiency measured as TSS mg/L, VSS mg/L, BOD_5 mg/L, F. Coliform N/100 ml and Chlor (A) which increased by percentages of 16.2, 20.8,2.7, 18.5, and 6.1, respectively than those of the crushed one, at head losses of 0.3 bar. All hydraulic parameters (flow rate reduction as percentage, time consumed for filtering in cubic meters, mean flow rate and filtration cycle time) related to removal efficiency were in general better in granular media under different inlet pressures (2.0 bar and 1.0 bar) and those under 2.0 bar inlet operating pressure were better than those under 1.0 bar. The filtration cost of granular media was 0.0024LE under inlet operating pressure of 2.0 bar.

Kay words: Floating media, removal efficiency, wastewater treatment.

INTRODUCTION

The discharge of wastewater from Ismalia treatment plant is about 80000 m^3/ day as treated drainage water to Timsah Lake, which is considered an important natural source for fishing and tourism. The type of treatment in this plant station depends on aeration lagoon to obtain a secondary treatment. The mechanical filter ,as floating media under study, is used as tertiary treatment. This requires an advanced treatment process to produce wastewater to have best quality used in agriculture with irrigation systems. One of the most important problems facing trickle irrigation is the clogging of the fine diameter of emitter. Filtration remains of basic importance among others using chemicals or design modifications of the network components. However, the conventional granular filtration , successfully used in water and tertiary wastewater treatment, suffers from many disadvantages, such as limited retention capacity and high-energy requirement for the back wash operation.

Nago and Vigneswaren (1995) pointed out that use of floating filter medium overcomes shortcomings, especially when direct filters are used in the treatment plants. A laboratory–scale study indicated that the floating medium filter with a down flow direct filtration arrangement was a good pretreatment unit to reduce the pollution load in rapid filters used as polishing filter units. Due to its ability to form uniform micro-flocs of the order of 26-40 micron throughout the filter run. the floating medium filter can serve as an excellent static flocculator. Ngo and Vigneswaren (1996) mentioned that the applicability and the advantages of the down flow-floating medium filter (DFF) in wastewater treatment were examined. The experimental results indicated that the DFF with inline flocculation is a good pretreatment to reduce phosphorous load (up to 80-89 % removal). The DFF also resulted in uniform filterable flocs of 32-42 micron throughout the filter run. Thus it can also successfully be used as a flocculator. The back washing of the floating medium filter was achieved with a small quantity of water and velocity. The introduction of floating medium filter in the top coarse sand filter (CSF) increased the filter run time and removal efficiency (more than 87 and 94 % of NH3 – N and T-P removal, respectively), particularly at a low filtration capacity (5 $m^3/m^2.h$).

Nago and Vigneswaren (1998) mentioned that the experimental results indicated that frequent (once every 90-120 minutes) but short duration of backwash (not more than 60 seconds) was found to be suitable. During the backwash, the water and air were sent for 30 seconds in upward direction and then followed with up – flow of water for another 30 seconds. Backwash water amount comprised only 1.2-1.8% of the filtered water production.

El-Etriby and Menlibai (1997) reported that Floating media filters differ from the conventional sand filters in many ways. Because the density of media grains is less than 0.1-gm/cm^3 (0.01- 0.1 gm/cm^3) retaining grating is placed at the top of the filter in order to maintain the media inside the filter under submerged conditions. Floating media filters are washed with down flow of water, therefore the granular media expand downward in these filters . Media are sorted downward for size, so that direction of downward washing simply coincide with the direction of decreased size of media grains. El-Tantawy (1997) reported that, the most efficient thickness of filtration sand media is around 70% of the total length of the filter. Ghazy (1999) concluded that the most efficient thickness of filtration floating media would be around 80 cm.

MATERIALS AND METHODS

The effluent of wastewater treatment plant is used in filtration with floating filter. The average analysis of effluent wastewater treatment is shown in table (1).

Table 1. Some average parameters of effluent wastewater treatment plant.

TSS. mg/L	VSS mg/L	BOD_5 mg/L	F.Coliform N/100 ml	Chlor.(A) mg/L
25.5	20.7	6.75	60758	0.17

Parameters were determined in Wastewater Treatment Plant Laboratory in Sarapeum and Soil & Water Research Institute for inlet and outlet of the floating filter. The two different shapes of floating media (crushed and granular) were used to evaluate the performance of the filtration unit. The two types of media selected depend on some hydraulic parameters such as: pressure loss through media filters, filter run, flow rate reduction percentage (%), time consumed in filtering per cubic meter (min/m.^{3}), mean flow rate (m.^{3}/h), filtration capacity (m.^{3}/h m.^{2}), and removal efficiency (%). These experiments were done in Ismailia wastewater treatment plant to test the selected best one of floating media. The irrigation water was taken from the network of the irrigation system. The analysis and measurements were determined in Wastewater Treatment Plant Laboratory in Serapeum - Ismalia Governerate and Soils & Water Research Institute, as *BOD_5, TSS, VSS, Fecal* Coliform, Chlor. (A). bulk density, particle density, porosity, and permeability. These parameters and measurements are considered as good indicator for selecting the best media types according to Carig (1993) and were determined as the following:

A. Bulk density "P" = M/ V

B. Particle density "GS" = M / Vs

C. Porosity "n" = Vv / V

where:

M = is the total mass of the samples.

V = is the total volume of the particles.

Vv = is the volume of voids.

Vs = is the volume of solids.

Smith (1985) reported that the permeability (Pr) of porous material can be calculated using Darcy"s flow equation as follows:

Pr = Q/At

Where:

Q = quantity of water flow (cm.^{3}).

t = time for quantity of water flow (sec).

A = area of cross - section through which the water flows (cm.^{2}).

Table (2) shows the specification of the filtration unit. Two operating pressures at the inlet were used 1.0 and 2.0 bar in both types of floating media at start of filtration process. The volume of filtered wastewater (m.^{3}) was measured with flow meter. Filtration cycle time (h) and mean flow rate (m.^{3} /h) were measured and estimated time consumed to increase at each successive step of pressure loss by 0.1 bar . Two liters water samples were collected before and after media filter at each 0.1 bar pressure loss to estimate the sediments concentration in (mg/L) in the two media cases for calculating the filtration efficiency (%) (E_f).

The back washing occurs when the pressure differences between inlet and outlet media filters reached 0.5 bar. The following equation was used for estimating (E_f).

Removal efficiency (%) (E_f)

$(E_f) = (Ss - Si / Ss) * 100$

where

Ss = The sediments concentration in the entrance of water (mg./l.).

Si = The sediments concentration in the filtered water (mg./l.).

The back washing process was carriedout when the pressure difference reached 0.5 bar for each sample. This process continues from 5 to 7 min for each case.

A group of indicators were taken to indicate the field evaluation of each selected floating media. These indicators were presented with the following equations:

(P) Pressure loss (bar)

$P = Pi - Po$

where

Pi = average pressure before media filters (bar).

Po = average pressure after media filters (bar).

(q) Flow rate ($m.^3$ /h)

$q = V_f / t$

where

V_f = volume of water passing through media filter during one filtration cycle. ($m.^3$)

t = filtration cycle time (h.).

(Fc) Filtration capacity ($m.^3$ /h .$m.^2$)

$Fc = q / A$

where

Q = Flow rate passed through filters ($m.^3$ /h).

A = Filtration bed area ($m.^2$).

(t) Time consumed for each cubic meter filterate (min./ $m.^3$)

$t = (1 / q) * 60$

Table 2. Specification of the filtration unit.

- Floating filters	
- Number of filters	2.0
- Recommended maximum flow rate ($m.^3$/h).	40
- Maximum operating pressure (bar).	10
- Filtration capacity ($m.^3/m.^2$ h).	70.8
- Inlet and outlet diameters (inch).	1.5
- Length (mm).	1200
- Tank diameter (mm).	600
- Wall Thickness (mm).	5
- Thickness of media layers (mm).	700
- Back washing diameter (inch).	1.5
- Up drain types.	cylindrical
- Up drain diameter (inch).	2.0
Floating media	
- Bed area ($m.^2$)	0.565
- Effective diameter of granular media (mm).	1.6 - 2.0
- Effective diameter of crushed media (mm).	2.0 - 3.0

*Filtration cycle time (h)

The time consumed between two successive back washing process (h).

* Filtration period (h)

The time consumed each of 0.1 bar head loss.

Filtration treatment costs (LE / $m.^3$)

(Price of floating media) / ((Mean flow rate ($m.^3$/day) X (number of operating days))

(Qr) Flow rate reduction %

$Qr = (Qs - Qi) / Qs * 100$

where

Qs = Flow rate at the start ($m.^3$ /h).

Qi = Flow rate at any time ($m.^3$ /h).

RESULTS AND DISCUSSION

The results of lab tests for the two different types of the floating filtration media were following the standard levels according to the international levels given by Carig (1993) which were taken as basis for the lab evaluation of the tested samples. The main objectives of the field hydraulic tests are for measuring and evaluating the performance of the selected two floating filtration media. The standard levels given by Ravina *et al.* (1993) were taken as a reference level for the field evaluation of the tested samples. Water flow through the filtration process was from bottom to top (up flow). The pressure loss at the start of the filtration process through the filtration unit was 0.2 bar in granular and 0.1 bar in crushed media. When the pressure loss increased to 0.5 bar, it was an indication that the filtration unit needs cleaning, then reversing the direction of water flow through the filters from top to bottom to have the back washing process (down flow).

The main properties of the two types of the floating media (granular and crushed) are bulk density (g/cm^3), particle density (g/cm^3), porosity (%) and permeability (cm/sec) at different inlet pressures 1.0 and 2.0 bar. These properties were measured and are manifested in table (3).

Table 3. Physical properties of different shapes of floating media.

Samples	Bulk density (g/cm^3)	Particle density (gm/cm^3)	Porosity (%)	Permeability (cm/sec)
Granular	0.0132	0.053	25.1	1.82
Crushed	0.0182	0.062	29.2	1.97

Table (4) shows the average efficiency for some parameters of effluent wastewater treatment plant. The measurement of F. coliform was (60758 N/100 ml) before filtration. At pressure head loss of 0.3 bar for two types of floating media (granular and crushed) under two different operating pressures (1.0 and 2.0 bar). The removal efficiencies were 20% , and 19% at inlet pressure of 1.0 bar, while they were 50.0 % and 31.5 % at inlet pressure 2.0 bar for the floating media of the granular and crushed types, respectively.

The data in table (4) depended on the measurement before and after filtration. Before filtration, the measurement of Chlor (A) was (0.17mg/ml) and was considered as an indicator for the presence of algae in the water. However, The operating pressure of 2.0 bar gave better results than those of 1.0 bar operating pressure specially in the crushed type due to cached the fine tissue of algae. By increasing pressure head loss from 0.3 bar to 0.5 bar the removal efficiency decreased sharply.

Table 4. The removal efficiency (%) of the floating media for Fecal Coliform and Chlorophyll (A) at different head losses through the filter.

Parameters	Fecal Coliform (%)				Chlor. (A) (%)			
Grain shape	Crushed		Granular		Crushed		Granular	
Inlet pr.	2 bar	1 bar	2 bar	1 bar	2 bar	1 bar	2 bar	1 bar
H. L (bar)								
0.2	35.0	23.0	55.0	25.0	63.2	43.1	59.2	38.2
0.3	31.5	19.0	50.0	20.0	61.2	38.5	55.1	35.1
0.4	28.5	17.8	46.0	17.0	55.4	35.7	41.9	33.2
0.5	26.0	13.3	45.C	15.0	52.6	28.3	40.7	25.4

Table (5) shows the average of the measurement VSS % and BOD_5. The measurement of volatile suspended solids VSS was (20.7 mg/L) before filtration. At pressure head losses 0.3 bar, the values of removal efficiency were 10.0% and 7.7% at inlet pressure 1.0 bar and 2.0 bar, respectively. They were 51.0 % and 30.2 % for granular and crushed types, respectively. So, the granular type of floating media at inlet operating pressure of 2.0 bar was better than the other treatments due to increased number of mesh per linear inch of granular media.

The measurement of biological oxygen demand (BOD_5) was (6.75 mg/L) before filtration. At pressure head loss of 0.3 bar the removal efficiencies were 24.6% and 15.8% at inlet pressure of 1.0 bar, while at inlet pressure of 2.0 bar they were 15.0 % and 12.3 % for granular and crushed types respectively. By increasing pressure head loss to 0.5 bar the removal efficiency decreased sharply. However the granular type of floating media at inlet operating pressure of 1.0 bar was better than the other treatments due to turbulent movement of media and the water, the biological oxygen demand increased 1.0 bar inlet pressure.

Table 5. The removal efficiency (%) of the floating media for the volatile suspended solids (VSS) and the biological oxygen demand (BOD_5) at different head losses through the filter.

Parameters	VSS (%)				BOD_5 (%)			
Grain shape	Crushed		Granular		Crushed		Granular	
Inlet pres.	2 bar	1 bar	2 bar	1 bar	2 bar	1 bar	2 bar	1 bar
H. L(bar)								
0.2	31.3	8.5	53.0	10.5	13.0	16.2	16.1	26.6
0.3	30.2	7.7	51.0	10.0	12.3	15.8	15.0	24.6
0.4	27.5	6.8	45.8	9.5	10.0	13.0	13.3	17.8
0.5	26.1	6.4	44.0	9.1	9.0	11.6	11.0	4.3

With respect to chlorophyll A, as an indicator for algae presence, the data showed that the crushed floating media appeared more efficient in removing of algae than the granular media. This may be due to the particle shape, which is different. On contrary, the granular floating media was more efficient in retention time of Fecal Coliform than crushed one. This is presumably interpreted by the better aerated condition in case of granular media than that of the crushed media. Concerning the VSS and BOD_5, their values are greatly affected by the particle size of media and pressure. Values of VSS percentage were increased in case of granular media at 1 bar inlet pressure than the crushed one. On the other hand, BOD percentage values are more in case of granular media. This may be due to the presence of better aerated condition, which led to more oxidation of VSS and also to diminish the BOD as resulted from decreasing Fecal Coliform and algae.

The media used after depletion in filter may cause environment pollution. These materials are polymers (polystyrene), exposed to relative decomposition during filtration process and also born with organic substances. Thus, this study suggests using of these media for composting with sludge to eliminate the pollution expected after finishing filtration process.

The effect of different shapes of media on filtration parameters under different inlet pressures of 1.0 bar and 2.0 bar

Data in fig. (1) show that the flow rate reduction percentage generally increased in case of granular shape at inlet pressures 2.0 and 1.0 bar than the crushed one through the filtration cycle up to pressure head losses 0.5 bar. At pressure head loss 0.5 bar, the flow rate reduction percentages were 15.0% and 13.5 %, while at inlet pressure 0.1 bar reached 25.0% and 20.7% in granular and crushed foam media respectively. Consequently, in granular shape, the higher flow rate reduction percentage and longer filtration cycle of the media lead to shorter back washing intervals and lower energy loss for each process.

Data in fig. (2) show that the filtration period at each 0.1 bar head loss decreased in case of granular media at inlet pressures 2.0 and 1.0 bar compared with that of the crushed one through the filtration cycle time up to pressure head-loss 0.5 bar. That means that in granular shape, the lower filtration cycle of the media requires shorter back washing intervals and lower energy loss in the back wash for each process.

Data in fig. (3) show that the mean flow rate at each 0.1 bar head loss decreased in case of granular medium at inlet pressures 2.0 and 1.0 bar than in the crushed one through the filtration cycle up to pressure head losses 0.5 bar. Under inlet pressure 2.0 bar and pressure head loss from 0.2 bar to 0.5 bar in granular shape, the lower mean flow rate under two different inlet pressure heads of the media are the shorter back washing intervals and lower energy loss for each process.

Data in fig. (4) show that the time consumed for filtering one cubic meter increased in case of granular medium at inlet pressure 2.0 and 1.0 bar than that of the crushed one through the filtration cycle up to pressure head losses 0.5 bar. Under inlet pressure 2.0 bar at pressure head loss from 0.2 bar to 0.5 bar, the time consumed for filtering one cubic meter in granular media increased from 1.62 min /m.^{3} to 1.88 min / m.^{3} , while in crushed one it increased from 1.5 min /m.^{3} to 1.76 min /m.^{3}. Under inlet pressure 1.0 bar at pressure head loss from 0.2 bar to 0.5 bar the time consumed for filtering one cubic meter in granular media increased from 2.07 min /m.^{3} to 2.61 min / m.^{3} , while in crushed one it was 1.88 min /m.^{3} to 2.50 min /m.^{3}. That means, for granular shape, the higher time consumed for filtering one cubic meter under two different inlet pressure heads of the media is for the shorter back washing intervals, lower energy loss in the backwash process and higher removal efficiency.

Data in fig. (5) show that the removal efficiency increased in case of granular medium at inlet pressures 2.0 and 1.0 bar than that of the crushed one through the filtration cycle up to pressure head loss of 0.5 bar. Under inlet pressure 2.0 bar at pressure head loss from 0.2 bar to 0.5 bar, the removal efficiency in granular media decreased from 60.0 % to 46.2 %, while in crushed one it decreased from 39.9 % to 31.0 %. Under inlet pressure 1.0 bar at pressure head loss from 0.2 bar to 0.5 bar, the removal efficiency in granular media decreased form 16.5 % to 3.8 %, while in crushed one it decreased from 12.70 % to 3.30 %. By increasing pressure head loss to 0.5 bar, the removal efficiency will decrease sharply. So the granular floating media at inlet operating pressure 2.0 bar is better than the other treatment due to increasing compact ratio of granular media at 2.0 inlet pressure. That means, in granular shape, the higher time consumed for filtering one cubic meter under two different inlet pressure heads of the media are the shorter back washing intervals, lower energy loss in the backwash for each process and higher removal efficiency. So, the recommended pressure head loss is under the pervious parameters at 0.3 bar with removal efficiency 54.9 % under inlet pressure 2.0 bar in granular floating media.

Filtration cost

Filtration cost of the floating media in granular media at inlet pressure 2.0 bar with assumed 8.0 h / day (mean flow rate 35.0 m.^{3}/h and 150 day operating age) equal 42000 m^3 for one time changing of media. The cost of changing media is 100.0 LE. So The filtration cost was about 0.0024 LE/m.^{3}

SUMMARY AND CONCLUSION

The Floating media filters differ from the conventional sand filters in many ways. Because the density of media grains is less than 0.1 g/cm^3 (0.01- 0.1 g/cm^3) retaining grating is placed at the top of the filter in order to maintain the media inside the filter under submerged conditions. Floating media filters are washed with down flow of water, therefore the granular media expand downward in these filter media which are sorted downward for size. so that direction of downward washing simply coincides with the direction of decreased size of media grains. In cases of Fecal Coliform, VSS, and TSS were 50.0 %, 51.0%, 54.9 % respectively while in case of Chlor (A). The crushed shape was better than the granular one with 61.2 %. In case of BOD_5 the removal efficiency of granular floating media is better than the crushed one at inlet pressure 1.0 bar under pressure head loss 0.3 bar was 24.6 % due to uncompressed media and turbulent movement of media and the water. So, the biological oxygen demand increases. The removal efficiency of granular floating media is better than the crushed one at inlet pressure 2.0 bar, under pressure head loss 0.3 bar. Filtration cycle, mean flow rate, and time consumed for filter in cubic meter were 7.05%, 21 h, 35 $m.^3$/h and 1.71 min /$m.^3$ respectively. The filtration cost of cubic meter was 0.0024 LE/ m^3. Thus; this study suggested using these media for composting with sludge to eliminate the pollution expected after finishing filtration process.

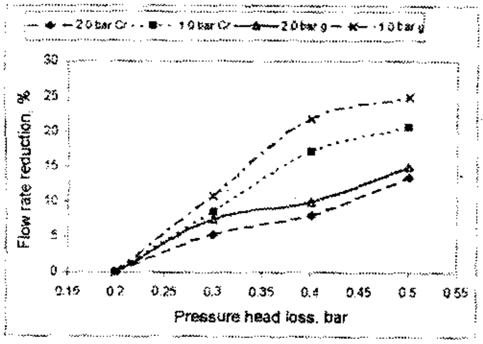

Fig. 1. The relationship between pressure head loss and flow rate reduction percentage.

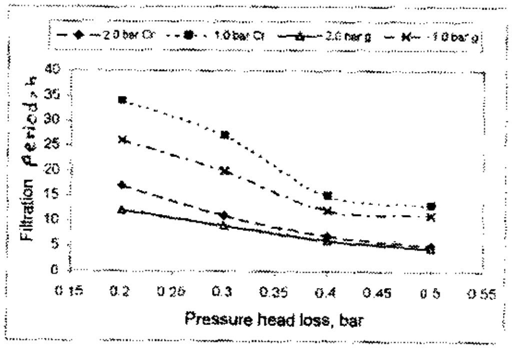

Fig. 2. The relationship between pressure head loss and filtration cycle.

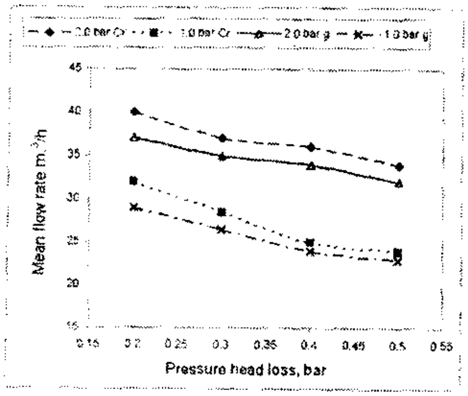

Fig. 3. The relationship between pressure head loss and mean flow rate.

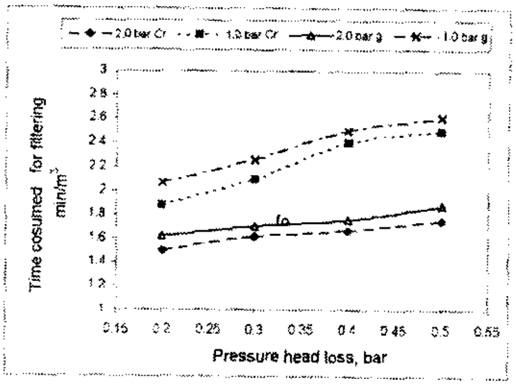

Fig. 4. The relationship between pressure head loss and time consumed for filtering.

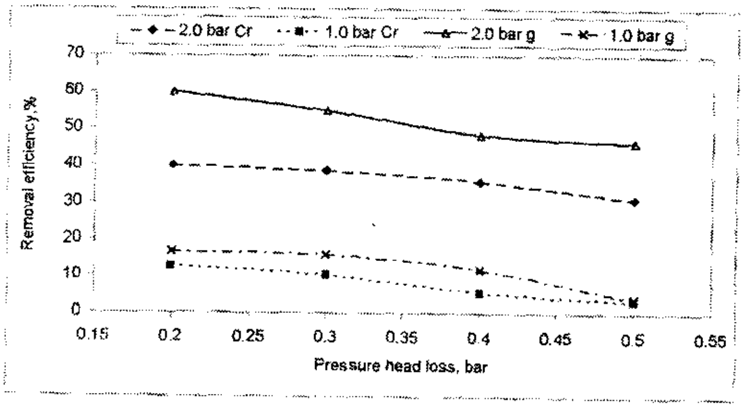

Fig. 5. The relationship between pressure head loss and removal efficiency.

REFERENCES

1. Carig. R.F. 1993. Soil mechanics, 5th Edition Chapman - Hill London - Glasgow - New-york - Tokoyo - Melborne, p: 5-7.

2. Ghazy A.I.I. 1999. Study of wastewater effect on irrigation system elements and the environment. Ph. D Thesis, Dept. of Agric. Eng. Fac. of Agric. Zagazig Univ.

3. Nago. H.H. and Vignswaran S. 1995 . Application of floating medium filter in water and wastewater treatment with contact – Flocculation Filtration Water Res. Vol. 29, No. 9. pp. 2211 – 2213, 1995.

4. Nago. H.H. and Vignswaran S. 1996 . Application of down flow floating medium Flocculator/ prefilter (DFF) – Coarse sand filter (CSF) in Nutient Removal. Water Sci. Tech. Vol. 32, No. 8. pp. 63 – 70, 1996.

5. Nago. H.H. and Vignswaran S. 1998. Process optimization of a combined system of floating medium and sand filter in prawn farm effluent treatment, Water Sci. Tech., Vol. 38, No. 4-5. pp. 87 – 93, 1998.

6. Ravina, I., G. Sagi, A., Shischa, Z., Yechiely, A. Marco, Z. Safer and Y. Lev, 1993. Filter performance and emitter clogging in conditions of effluent reservoir water, 6th Int. Conf. On Irr. Proc., May 3-4 1993.

7. Smith, M.J. 1985. Soil mechanics 4th Ed English language book Society ELBS / George Godown. P21-47.

8. El-Tantawy, M.T 1997. Technical studies on using local filtration media in drip irrigation system. Ph D. Thesis, Dept. of Agric., Eng., Fac. of Agric. Cairo Univ.

9. El-Etriby H.K. and Menlibai M. 1997. Sewage tertiary treatment using floating media filters. Second International water technology conference. Fac. of Eng. Alexandria Univ.

أستخدام أوساط ترشيح عائمة لترشيح مياة ذات شوائب كثيفة

عزمي محمود البري ، مجدي توفيق الطنطاوي ،
عادل أبراهيم غازي ، عصام واصف

معهد بحوث الهندسة الزراعية - مركز البحوث الزراعية - وزارة الزراعة.

تم أجراء التجربة في محطة معالجة مياه الصرف الصحي بمنطقة سرابيوم - محافظة الأسماعيلية. ومنذ حوالي ٣٥ سنة تستخدم طرق عديدة لتنقية مياه الصرف الصحي . واهتمت الدراسة باستخدام المرشحات ذات أوساط ترشيح عائمة في تنقية مثل هذه النوعية من المياه لاستخدامها في شبكات الري الضغطي. وتم إجراء تحليلات معملية للمياه (بيولوجية - وكيمائية - وفيزيائية) قبل وبعد المرشحات بغرض أعاده استخدامها في الزراعة. وتمت التجربة [اختبار شكلين مختلفين من أوساط الترشيح العائمة كروي ومجروش بمتوسط أقطار فعالة من ١,٦-٢مم، ٢,٠٠-٣,٠٠ مم علي الترتيب و ضغط التشغيل قبل المرشح ٢,٠٠ بار ، ١,٠٠ بار . أوضحت الدراسة النتائج التالية:

١- في حالة الاختبارات البيولوجية والفيزيائية والكيمائية

زادت كفاءة أوساط الترشيح الكروية عن النوع المجروش في ترشيح المواد الصلبة الكلية ، والمواد الصلبة المتطايرة، والأكسجين الحيوي المدمص ، والبكتريا القولونية، والكلورفيل بنسب ١٦,٢٪، ٢,٨٪، ١٨,٥٪، ٦,١ علي الترتيب عند فاقد في الضغط خلال المرشح ٠,٢ بار .

٢- في حالة الاختبارات الهيدروليكية

في جميع المعاملات الهيدروليكية تحت ضغط تشغيل ٢,٠٠بار قبل المرشح في حالة أوساط الترشيح الكروية زادت النسبة المئوية للفقد في التصرف والزمن اللازم لترشيح متر مكعب من المياه ، وكفاءة الترشيح ، وقل متوسط التصرف المار وزمن دورة الترشيح وذلك خلال عملية الترشيح .

٣- تكلفة ترشيح المتر مكعب من المياه

تكلفة ترشيح المتر مكعب من المياه لوسط الترشيح الكروي ٠,٠٠٠٢٤ جنية تحت ضغط تشغيل قبل المرشح ٢,٠٠ ض ج مع مراعاة انه يمكن أستخدام أوساط الترشيح العائمة كسماد عضوي بعد أضافة المحسنات لها .