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ASSESSING THE FILTRATION PROCESS OF MEDIA FILTERS FOR MODERN IRRIGATION SYSTEM USING DIFFERENT MEDIA

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ABSTRACT

The media filter is a fundamental techniques for removing any organic sediments as algae, weeds and bacteria or inorganic sediments as clay, sand and solid chemicals that may be present in the water and could cause nozzles and emitter clogging.

Innovated filter unit with filtration media consists of foam granules and polyethylene granules comparison with sand or gravel media filter.

Worth Mentioning that the foam granules media was resisting of mold, bacteria decomposition and water salinity but unresisting of some acid decomposition. Also, the polyethylene granules media was resisting of mold, bacteria, water salinity and acid decomposition.

Field experiments were carried out, at Al-Mansouria farm-Giza Governorate and Al-Bustan fields Behaira Governorate to evaluate the performance of the designed innovated filters with a foam granules media and polyethylene granules media. The aim of this study was innovated media filter unit consisting to substitute media of sand or gravel media was high sufficiency and lesser coset.

The experiment show that the flow rate is started to decrease and the flow rate reduction percentage is started to increase when the pressure losses increased from 0.6 bar pressure losses until 1.0 bar pressure losses. Also, the results show that the water consumption during the flushing process and the time consumed of filtering volume unite are started to increase when the pressure losses increase from 0.6 bar until 1.0 bar pressure losses. Eventually, the sedimentation concentrate and the filtration efficiency are started to decrease when the pressure loss increase from 0.6 bar until 1.0 bar until 1.0 bar pressure losses. The results show that the use of foam as media filter is recommend because of its high performance regarding increase filtration efficiency at 80.03% with Nile water and 78.69% with waste water and decrease the cost of cubic meter of filtration technically and economically.

Keywords: Innovated, Algae, weeds, nozzles, polyethylene, foam, salinity

INTRODUCTION

The filtration is a fundamental important in modern irrigation system. The purpose of filtration is removing any organic sediments particles that may be present in the irrigation water using in modern irrigation systems.

The media filter is most effective for the water sediments and for organic matter specially. Also, media filter have been for industrial purposes for filtration of many liquids. Media filter consists of gravel course of fin sand placed in cylindrical tank.

Therefore, many researches got interested in styling innovate a new media where substitut of gravel and sand media by foam or polyethylene granules.

Jobling (1974) reported that all steps possible to ensure clean water in a trickle system must be taken. In-take screens or filters are useful as primary filters. But nearly all systems will require same filtration on the delivery of the pump.

Hillel (1982) reported that screen filters made of stainless steel, plastic or system cloth and enclosed in a special housing are the simplest. Aquatic algae in the water tend to cause screen blocking and can reduce the filtering capacity. Most manufacturers recommend 100 or 200 mesh (150 or 75 micron) screen filter. Other filtering must be routinely cleaned and inspected to insure satisfactory operation of any trickle system.

Jensen (1983) reported that mechanical filtration including setting basins, centrifugal sand separators and cartridge and/or sand filters are used to reduce suspended particulate matter. These devices are used singularly or in series. Filtration unit may require the addition of booster pumps for proper backwash and flush operation.

Benami and ofen (1984) stated that to remove coarser material as well as organic matter, micro organisms and colloidal particles from the water, the gravel filter can be used in graded layers of different sizes of gravel. Thus type of filter especially when followed by a screen or "volumetric" filter has often proved successful with irrigation water of poor quality (such as that pumped from reservoirs or ponds).

Dasberg *et al*. (1985) mentioned that the main problem associated with drip irrigation is clogging of the emitter. Emitters usually have passage diameter of only 0.5-1.0mm and are thus vulnerable to clogging by root, sand, rust, micro organisms or others impurities in the irrigation water or by the formation of chemical precipitations. The type of filtration needed depends on water quality and on emitter type.

Adin (1997) compared granular filtration and screen filtration for particulate removal in pilot experiments. The removal rates of particles larger Than 10 microns indirect granular filtration was relatively large while smaller particles showed little removal. Particles in the 10-60 micron size range were removed by 40-50 % in depth by 80% when surface filtration prevailed.

Jusoh *et al*, (1989) studied the effects of effective size of sand media in arapid filteation process and turbidity filter run and flow rate at a water treatment work in Malaysia. No significant difference in the final turbidity was achieved with effective sizes ranging from 0.4-0.9mm. however, the filter runtime increased with affective size. An increase in flow rate from 4.7 to 7.1 m^3/m^2 per hour reduced the filter run by 2 hours for the effective size studied.

Boswell (1990) reported that the lower flow rate and the finer the sand the better the filtration will be, However, a lower flow rate means more filters and higher cost, and a finer sand may result in a greater head loss a cross the filter and more frequent back- washing. Thus, the design of media station must be based up on the required quality.

Keller *et al*, (1990) stated that factors effect filter characteristics and performance are water quality, type and size of sand media, flow rate and pressure drop. The maximum recommended pressure drop across a sand filter is generally about 10 psi (0.7 bar).

Chavez and sammis (1992) reported that sand filters effectively remove both inorganic and organic materials from the source of water. Consequently, selecting a trickle irrigation filter would virtually know the amount of organic solids concentration in the source water. In general, for drip system 20 crushed granite and in micro-jet system 8 crushed granite should be used.

The Study Purpose:

The study aimed to innovated substitute media for a media filters, which using at a modern irrigation system, consisted of foam or Polyethylene granular instead of sand or gravel granular media. Also, the study aimed to evaluated the performance of substitute media comparison with the other media of the media filters (sand and gravel).

MATERIALS AND METHODS

The experiments were conducted at Al- Mansouria farms – Giza – Governorate, For sewage water and Al-Bustan fields – Behaira Governorate for Nile Water at summary of 2011.

The experiment was Conducted as three main treatments of the filters media and two treatments of irrigation water. The filters media treatments contains foam, Polyethylene and gravel or sand media which had a physical analysis at the table (1) And the water as sub (treatment was Fresh or Nile water and waste or sewage water which had a specipication at the table (2).

Table (1) the physical analyses of the filtration media samples

filtration media	Measurements			
	Bulk density Gm/cm3	Particle density	Void ratio %	Porosity %
Basalt	1.89	3.33	76.1	43.2
Polyethyline	0.81	1.46	41.23	23.27
Foam	0.26	0.45	38.13	29.46

Table (2): the specification of Nile water and sewage water

Water Kind	E.C	PH	SS%	Anions				Cations			
				Ca^{+}	K^{++}	Mg^{++}	Na^{++}	So_4^{-}	Cl^{-}	Co_3^{-}	HCO_3^{-}
Waste-Water	3.62	7.86	2.61	2.11	1.43	2.73	8.81	3.01	6.8	0.45	7.1
Nil-water	0.63	7.5	0.71	1.33	0.41	0.81	0.9	1.51	0.46	0.17	1.18

Innovated media as foam or polyethylene was designed to Make substitution sand or gravel Media of Media filter assembly in modern irrigation systems.

Material:

The first Group included media bed consisting of basalt gravel (3.0 mm to 4.5mm) was sitting on the interior bottom of the filter and the second Group included filtration media consisting foam granules Media at one time and polyethylene granular Media (3.0 mm to 4.5 mm) at the second time.

The water which Consisting of the sediments was passing from the inlet holy at the filter top through interior media and the fresh water was discharge from the outlet hole at the bottom of the filter. On the contrary, the inlet and out let was from the bottom to the top on the filter tank for foam polyethylene media. The designed filter was compared with basalt media, polyethylene media and foam media to evaluate their performance. The specifications of different kinds of filters with different media (basalt, Polyethylene and foam) are shown in table (3).

Table (3): The Specification of Filters Units.

Specifications	Media filter		
	basalt	Polyethylene	Foam
Tank diameter (cm)	122	120	120
Filter area (2)	1.17	1.13	1.13
Rate of flow (m^3/h)	70-90	90-100	70-100
Max pressure (bar)	6.5	9	9
Inlet/outlet diameter (mm)	5/4	5/5	5/5
Tank distance (cm)	152	152	152

Methods:

The field experiments were conducted under the condition of 70-100m3/h flow rate and 3.0 bars as Intel pressure through three control heads.

Measures Tested:

Pressure head losses (H):

"H" was measured before intel and after outlet of the filter unit by installation of pressure gauge, and calculated according to following formula:

$H = H_i - H_o$

Where:

H_i : Average pressure before inlet filters, bar.

H_o : Average pressure after outlet filters, bar.

Flow rate (q):

The volume of filterated water (m3) was measured each 0.1 bar pressure head loss increment by digital flow meter to determine the standing time between back wash flashings of filters. It was calculated according to the following formula:

$Q = V_f/T$

Where:

V_f: Volume of water passing through filter unite, m^3.

T : Filtration cycle time, h.

Flow rate reduction (qr%):

"q_r" was calculated according to the following formula.

$q_r = (q_s – q_{i)} / q_s$

Where:

q_s : Flow rate at the start, m^3/h

q_i : Flow rate at anytime, m^3/h.

The water consumption during the back washes process:

The water consumption during the backwash process muste be measured by collect the flashing water at measure tank during the back wash process at pressure losses from 0.1 bar to 1.9 bar through the filter media.

Sediments Concentration:

One liter water sample were collected before and after media filter at each 0.1 bar pressure losses to estimate the sediments concentration in (mg/L). the water sediment was collected by filter paper at the laboratory and drying at 105 ^{o}C for 24 hours at electrical oven and compare the weight of paper at after and before of drying.

Time consumed for filtering of volume unite:

The time consumed for filtering cubic water of water muste be measured by flow meter gaeg at different pressure losses through the filter unit.

Filtration efficiency (E_f):

The filtration efficiency was calculated by compared the sediments concentration which collected in after and before the media filters.

$E_f = [(Ss = S_i)/S_s] \times 100$

Where:

E_f: filtration efficiency %.

S_s : the sediments concentration in the entrance of water, (mg/L).

S_i : the sediments concentration in the filterer water, mg/L.

Cost of filtering cubic meter:

Cost of filtering cubic meter (piaster) = Price of cubic meter of media/total operation time (gr).

RESULTS AND DISCUSSION

The purpose of the field tests were measuring and Evaluating the filters performance under test to select the best from their. The results of field tests are discussed under the following headlines as bellows:

Flow rate under different pressure losses:-

Results in table (4) show that the flow rate, with basalt media, decreased from 90.0m^3/h to 82.6m^3/h when the pressure losses increased from 0.5 bar to 0.6 bar, decreased from 80.17m^3/h to 71.48m^3/h when the pressure losses increased from 0.6 bar to 0.7 bar, decreased from 71.48m^3/h to 59.81m^3/h when the pressure losses increased from 0.7 bar to 0.8 bar, decreased from 59.81m^3/h to 52.68m^3/h when the pressure losses increased form 0.8 bar to 0.9 bar and decreased from 52.68m^3/h to 48.93m^3/h when the pressure losses increased from 0.9 bar to 1.0 bar using Nile water, also, the flow rate decreased from 86.0m^3/h to 79.86m^3/h when the pressure losses increased from 0.5 bar to 0.6 bar, decreased from 79.86m^3/h to 68.51 m^3/h whine the pressure lasses increase bar 0.6 bar 0.7 bar, decreased from 68.51 m^3/h to 55.87m^3/h when the pressure losses increase from 0.7 bar to 0.8 bar, decreased from 55.87 m^3/h to 50.66m^3/h when the pressure losses increased from 0.8 bar to 0.9 bar and decreased from 50.66m^3/h to 45.83m^3/h when the pressure losses increased from 0.9 bar to 1.0 bar using waste water.

By foam media, the flow rate decreased from 90.0m^3/h to 80.17 when the pressure loss increased from 0.5 bar to 0.6 bar, decreased from 81.17m^3/h to 72.0m^3/h when the pressure loss increased from 0.6 bar to 0.7 bar, decrease from 72.0m^3/h to 62.46m^3/h when the pressure loss increased from 0.7 bar to 0.8 bar, decreased from 62.46m^3/h to 57.3m^3/h when the pressure loss increased from 0.8 bar to 0.9 bar and decreased from 57.3m^3/h to 53.87m^3/h when the pressure loss increased from 0.9 bar to 1.0 bar using Nile water, also, the flow rate decreased from 85.0 m^3/h to 78.61 m^3/h when the pressure loss increased from 0.5 bar to 0.6 bar, decreased from 78.61 m^3/h to 67.86m3/h when the pressure loss increased from 0.6 bar to 0.7 bar, decreased from 67.86m^3/h to 54.69m^3/h when the pressure loss increased from 0.7 bar to 0.8 bar decreased from 57.86m^3/h to 57.69m^3/h when the pressure loss increased from 0.8 bar to 0.9 bar and decreased from 54.69m^3/h to 50.46m^3/h when the pressure loss increased from 0.9 bar to 1.0 bar using waste water.

Eventually, by polyethylene media the flow rate decreased from 90.0m^3/h to 82.07 m^3/h when the pressure loss increased from 0.5 bar to 0.6 bar, decreased from 82.07 m^3/h to 73.91m^3/h when the pressure loss increased from 0.6 bar to 0.7 bar, decreased from 73.91m^3/h to 64.33m^3/h when the pressure loss increased from 0.7 bar to 0.8 bar, decreased from 64.33m^3/h to 57.99m^3/h when the pressure loss increased from 0.8 bar to 0.9 bar and decreased from 57.99 m^3/h to 54.09m^3/h when the pressure loss increased from 0.9 bar to 1.0 bar using Nile water, also, the flow rate decreased from 88.0m^3/h to 79.91m^3/h when the pressure loss increased from 0.5bar to 0.6 bar, decreased from 79.91m^3/h to 69.24m^3/h when the pressure loss increased from 0.6 bar to 0.7 bar, increased from69.24m^3/h to 58.91 m^3/h when the pressure loss increased from 0.7 bar to 0.8 bar, decreased from 58.91m^3/h to 53.91m^3/h when the pressure loss increased from 0.8 bar 0.9 bar and decreased from 53.91m^3/h to 48.89m^3/h when the pressure loss increased from 0.9 bar to 1.0 bar using waste-water.

Table (4): The flow rate under different pressure losses

Pressure Losses (bar)	Flow rate (m^3/h)					
	Basalt		Foam		Polyethyline	
	f.w	w.w	f.w	w.w	f.w	w.w
0.5	90.0	86.0	90.0	85.0	90.0	88.0
0.6	80.17	79.86	81.17	78.61	82.7	79.91
0.7	71.48	68.51	72.0	67.86	73.91	69.24
0.8	59.81	55.87	62.46	57.86	64.33	58.91
0.9	52.68	50.66	57.30	54.69	57.99	53.91
1.0	48.93	45.83	53.87	50.46	54.09	51.80

F.W : Fresh water **W.W: Waste water**

Flow rate reduction percentage:-

The Pressure losses through filtration units was 0.5 bar at the start beginning work and after washing at the outlet of the units.
The flashing of the filtration units must be started when the pressure losses through the units increase to 1.5 bar pressure losses. The results in table (5) show that the effect of pressure losses an the flow rate reduction percentage under the same condition of filtration.

From the results with basalt appeared that media, there was not flow rate reduction when the pressure losses was 0.5 bar, but increased to 9.3 % at 0.6 bar pressure loss, 20.6% 0.7 bar pressure loss, 33.5 at 0.8 bar pressure loss, 41.5% at 0.9 bar pressure loss and 45.6% at 1.0 bar pressure loss with Nile water, also, the flow rate reduction percentage was 5.6 % at 0.5 bar pressure loss, increased to 12.66 % at 0.6 bar pressure loss, 24.46 % at 0.1 bar pressure loss, 37.92% at 0.8 bar pressure loss, 43.71% at 0.9 bar pressure loss and 49.07% at 1.0 bar pressure loss with waste- water using.

But by foam media using there was not flow rate reduction when the pressure loss was 0.5 bar pressure loss, increased to 8.81 % at 0.6 bar pressure loss, 20.0% at 0.7 bar pressure loss, 30.6% at 0.8 bar pressure loss, 36.33% at 0.9 bar pressure loss and 40.14% at 1.0 bar pressure loss with Nile water, also, the flow rate reduction was 4.4% at 0.5 bar pressure loss, 11.21 % at 0.6 bar pressure loss, 23.88 % at 0.7 bar pressure loss, 35.71% at 0.8 bar pressure loss, 40.01 % at 0.9 bar pressure loss and 45.68 % at 1.0 bar pressure loss with waste water using finally, by polyether line media, was not flow rate reduction when the pressure loss was 0.5 bar pressure loss, but increased to 8.2 % at 0.6 bar pressure loss, 17.88 % at 0.7 bar pressure loss, 28.52% at 0.8 bar pressure loss, 35.57 % t 0.9 bar pressure loss and 39.9% at 1.0 bar pressure loss with Nile water using, also, the flow rate reduction was 2.22% at 0.5 bar pressure loss, 8.9 % at 0.6 bar pressure loss, 23.06% at 0.7 bar pressure loss, 34.54% at 0.8 bar pressure loss, 39.23 % at 0.9 bar pressure loss and 43.93 % at 1.0 bat pressure loss with west water using

Table(5) : The flow rate reduction percentage under different pressure losses

Pressure Losses (bar)	Flow rate reduction %					
	Basalt		Foam		Polyethyline	
	f.w	w.w	f.w	w.w	f.w	w.w
0.5	0	5.6	0	4.4	0	2.22
0.6	9.3	12.66	8.81	11.21	8.2	8.9
0.7	20.6	24.46	20.0	23.88	17.88	23.06
0.8	33.5	37.92	30.6	35.71	28.52	34.54
0.9	41.5	43.71	36.33	40.01	35.57	39.23
1.0	45.6	49.07	40.14	45.68	39.9	43.93

The water consumption during the back wash process:-

The water consumption of back wash process is competing by the sediment concentrate and the pressure losses through the media.

Data in table (6) show the relation between the water consumption of media flashing and the different pressure losses. The results obvious that the water consumption of backwash process with a basalt media was 165 liter at 0.5 bar pressure loss, 180 liter at 0.6 bar pressure loss, 230 liter at 0.7 bar pressure loss, 320 liter at 0.8 bar pressure loss, 380 liter at 0.9 bar pressure loss and 420 liter at 1.0 bar pressure loss with Nile water using, also, the water consumption of back wash process was 180 liter at 0.5 bar pressure loss, 210 liter at 0.6 bar pressure loss, 250 liter at 0.7 bar pressure loss, 320 liter at 0.8 bar pressure loss, 410 liter at 0.9 bar pressure loss and 450 liter at 1.0 bar pressure loss with waste water using. By the foam media, the water consumption of backwash process was 153 liter at 0.5 bar pressure loss, 180 liter at 0.6 bar pressure loss, 210 liter at 0.7 bar pressure loss, 268 liter at 0.8 bar pressure loss, 330 liter at 0.9 bar pressure loss and 380 liter at 1.0 bar pressure loss with Nile water using, also, the water consumption of backwash process was 170 liter at 0.5 bar pressure loss, 210 liter at 0.6 bar pressure loss, 260 liter at 0.7 bar pressure loss, 320 liter at 0.8 bar pressure loss, 380 liter at 0.9 bar pressure loss and 440 liter at 1.0 bar pressure loss with waste water using. At last, by the polyethylene media, the water consumption of backwash process was 135 liter at 0.5 bar pressure loss, 167 liter at 0.6 bar pressure loss, 196 liter at 0.7 bar pressure loss, 230 liter at 0.8 bar pressure loss, 290 liter at 0.9 bar pressure loss and 350 liter at 1.0 bar pressure loss with Nile water using, also, the water consumption of back wash process was 155 liter at 0.5 bar pressure loss, 190 liter at 0.6 bar pressure loss, 245 liter at 0.7 bar pressure loss, 300 liter at 0.8 bar pressure loss, 365 liter at 0.9 bar pressure loss and 414 liter at 1.0 bar pressure loss with Waste water using.

Table (6) The Water Consumption of one backwash process

Pressure Losses (bar)	Water Consumption of one backwash process (Liter)					
	Basalt		Foam		Polyethyline	
	f.w	w.w	f.w	w.w	f.w	w.w
0.5	165	180	153	170	135	155
0.6	180	210	180	210	167	190
0.7	230	250	210	260	196	245
0.8	320	320	268	320	230	300
0.9	380	410	330	380	290	365
1.0	420	450	380	440	350	414

The Sedimentation Concentrate at different head losses

The relation between inlet pressure and out let pressure through the filtration system effect with accumulate the sediment in the filters.

One liter water sample were collected before and after media filter at each 0.1 bar pressure losses to estimate, the sediments concentration (gm/l).

Data in table (7) show that the sedimentation concentrate with basalt media was 6.39 gm/l at 0.5 bar pressure loss, 6.13 gm/l at 0.6 bar pressure loss, 5.92 gm/l at 0.7 bar pressure loss, 5.75 gm/l at 0.8 bar pressure loss, 5.51 gm/l at 0.9 bar pressure loss and 5.34 gm/l at 1.0 bar pressure loss with

Nile water using, also, the sedimentation concentrate was 11.19 gm/l at 0.5 bar pressure loss, 10.65 gm/l at 0.6 bar pressure loss, 10.35 gm/l at 0.7 bar pressure loss, 9.09 gm/l at 0.8 bar pressure loss, 9.61 gm/l at 0.9 bar pressure loss and 9.35 gm/l at 1.0 bar pressure loss with waste water using. But by foam media using the sedimentation concentrate was 7.27 gm/l at 0.5 bar pressure loss, 6.99 gm/l at 0.6 bar pressure loss, 6.69 gm/l at 0.7 bar pressure loss, 6.40 gm/l at 0.8 bar pressure loss, 6.22 gm/l at 0.9 bar pressure loss and 6.07 gm/l at 1.0 bar pressure loss with Nile water using, also the sedimentation concentrate was 12.35 gm/l at 0.5 bar pressure loss, 12.00 gm/l at 0.6 bar pressure loss, 11.63 gm/l at 0.7 bar pressure loss, 11.21 gm/l at 0.8 bar pressure loss, 10.85 gm/l at 0.9 bar pressure loss and 10.51 gm/L at 1.0 bar pressure loss with waste water using. At the final, the sedimentation concentrate by polyethylene media using was 6.95 gm/l at 0.5 bar pressure loss, 6.69 gm/l at 0.6 bar pressure loss, 6.38 gm/l at 0.7 bar pressure loss, 6.17 gm/l at 0.8 bar pressure loss, 5.93 gm/l at 0.9 bar pressure loss and 5.93 gm/l at 1.0 bar pressure loss with Nile water using, also, the concentrate was 12.06 gm/l at 0.5 bar pressure loss, 11.49 gm/l at 0.6 bar pressure loss, 10.97 gm/l at 0.7 bar pressure loss, 10.59 gm/l at 0.8 bar pressure loss, 10.24 gm/l at 0.9 bar pressure loss and 9.79 gm/L 1.0 bar pressure loss with Waste water using.

Table (7) The Sedimentation Concentrate at different pressure

Pressure Losses (bar)	The Sedimentation Concentrate (gm/L)					
	Basalt		Foam		Polyethyline	
	f.w	w.w	f.w	w.w	f.w	w.w
0.5	6.39	11.19	7.27	12.35	6.95	12.06
0.6	6.13	10.65	6.99	12.00	6.69	11.49
0.7	5.92	10.35	6.69	11.63	6.38	10.97
0.8	5.75	9.90	6.40	11.21	6.17	10.59
0.9	5.51	9.61	6.22	10.85	5.93	10.24
1.0	5.34	9.35	6.07	10.51	5.93	9.79

Time consumed for filtering of volume units

Data in table (8) represent the relation between time consumed for filtering cubic meter and pressure losses through the filter. The time consumed by the basalt media was 0.67 min/mat 0.5 bar pressure loss, 0.73 min/3 at 0.6 bar pressure loss, 0.84 min/m3 at 0.7 bar pressure loss, 1.0 min /m3 at 0.8 bar pressure loss, 1.14 min/m3 at 0.9 bar pressure loss and 1.23 min/m3 at 1.0 bar pressure loss with Nile water, also, 0.70 min/m3at 0.5 bar pressure loss, 0.75 min/m3 at 0.6 bar pressure loss, 0.88 min/m3 at 0.7 bar pressure loss, 1.1 min/m3 at 0.8 bar pressure loss, 1.19 min/m3 at 0.9 bar pressure loss and 1.31 min/m3 at 1.0 bar pressure loss with waste water using but, by using the foam was 0.67min/m3at 0.5 bar pressure loss, 0.75 min/m3 at 0.6 bar pressure loss, 0.83 min/m3 at 0.7 bar pressure loss, 0.9 min/m3 at 0.8 bar pressure loss, 1.05 min/m3 at 0.9 bar pressure loss and 1.11 min/m3 at 1.0 bar pressure loss with Nile water using, also, the time consumed was 0.71 min/m3 at 0.5 bar pressure loss, 0.76 min/m3 at 0.6 bar pressure loss, 0.88 min/m3 at 0.7 bar pressure loss, 1.04 min/m3 at 0.8 bar pressure loss, 1.14 min/m3 at 0.9 bar pressure loss and 1.26 min/m3 at 1.0 bar pressure loss with waste water using.

Eventually, by polyether line media, the time consumed was 0.67 min/m3 at 0.5 bar pressure loss, 0.73 min/m3 at 0.6 preseason par, 0.81min/m3 at 0.7 bar pressure loss, 0.93, min/m3 at 0.8 bar pressure loss, 1.03 min/m3 at 0.9 bar pressure loss and 1.1 min.m3 at 1.0 bar pressure loss with Nile water using, also, the time consumed was 0.68 min/m3 at 0.5 bar pressure loss, 0.75 min/m3 at 0.6 bar pressure loss, 0.87 min/m3 at 0.7 bar pressure loss, 1.02 min/m3 at 0.8 bar pressure loss, 1.11 min/m3 at 0.9 bar pressure loss and 1.23 min/m3 1.0 bar pressure loss with waste water using.

Table (8) The time Consumed for filtering of volume units

Pressure Losses (bar)	Time Consumed for filtering Cubic meter min/m^3					
	Basalt		Foam		Polyethyline	
	f.w	w.w	f.w	w.w	f.w	w.w
0.5	0.67	0.70	0.67	0.71	0.67	0.68
0.6	0.73	0.75	0.75	0.76	0.73	0.75
0.7	0.84	0.88	0.83	0.88	0.81	0.87
0.8	1.0	1.10	0.96	1.04	0.93	1.02
0.9	1.14	1.19	1.05	1.14	1.03	1.11
1.0	1.23	1.31	1.11	126	1.10	1.23

Filtration efficiency

The filtration efficiency was measured at the same condition of the sedimentation concentrate of 9.61 g/l for Nile water, and 17.13 g/l for the treated waste water. Results in table (9) and Fig. (1 and 2) show that the filtration efficiency, with the basalt media, was 66.51% 0.5 bar pressure loss, 63.81% at 0.6 bar pressure loss, 61.06% at 0.7 bar pressure loss, 59.09% at 0.8 bar pressure loss, 57.03% at 0.9 bar pressure loss and 55.06% at 1.0 bar pressure loss using rile water, also, more 65.34% at 0.5 bar pressure loss, 62.22% at 0.6 bar pressured loss, 60.42% at 0.7 bar pressure loss, 57.08% at 0.8 bar pressure loss, 56.01% at 0.9 bar pressure loss and 54.06% at 1.0 bar pressure loss using wastewater. Also, the filtration efficiency with the foam media were 75.61%at 0.5 bar pressure loss, 72.82% at 0.6 bar pressure loss, 69.71% at 0.7 bar pressure loss, 66.63% at 0.8 bar pressure loss, 64.71% at 0.9 bar pressure loss and 63.16% at 1.0 bar pressure loss using Nile water, Also, were 72.11% at 0.5 bar pressure loss, 70.06% at 0.6 bar pressure loss, 67.91 % at 0.7 bar pressure loss, 65.43% at 0.8 bar pressure loss, 63.33% at 0.9 bar pressure loss and 61.37% at 1.0 bar pressure loss using waste water. Eventually the filtration efficiency with the polyethylene media were 72.3% at 0.5 bar pressure loss, 69.61 bar pressure loss, 66.42% at 0.7 bar pressure loss, 64.22% at 0.8 bar pressure loss, 61.73% at 0.9 bar pressure loss and 61.71% at 1.0 bar pressure loss us in Nile water also, were 70.4% at 0.5 bar pressure loss, 67.12% at 0.6 bar pressure loss, 64.07% at 0.7 bar pressure loss, 61.81% at 0.8 bar pressure loss, 59.76% at 0.9 bar pressure loss and 57.19% at 1.0 bar pressure loss using waste water.

Table (9) The filtration efficiency

Pressure Losses (bar)	Filtration Efficiency %					
	Basalt		Foam		Polyethylene	
	f.w	w.w	f.w	w.w	f.w	w.w
0.5	66.51	65.34	75.61	72.11	72.30	70.40
0.6	63.81	62.22	72.82	70.06	69.61	67.12
0.7	61.6	60.42	69.71	67.91	66.42	64.07
0.8	59.8	57.8	66.63	65.43	64.22	61.81
0.9	57.3	56.1	64.71	63.33	61.73	59.76
1.0	55.6	54.6	63.16	61.37	61.71	57.19

Cost analysis of filtering cubic meter

Data in table (10) and Fig. (3) represented the consequence of the caste analysis comparison of basalt, foam, and polyethylene media filter under study. The result show that, the coast of filtering one cubic meter of water was 0.13 pound by basalt media, 0.06 pound by foam media and 0.09 pound by polyethylene media.

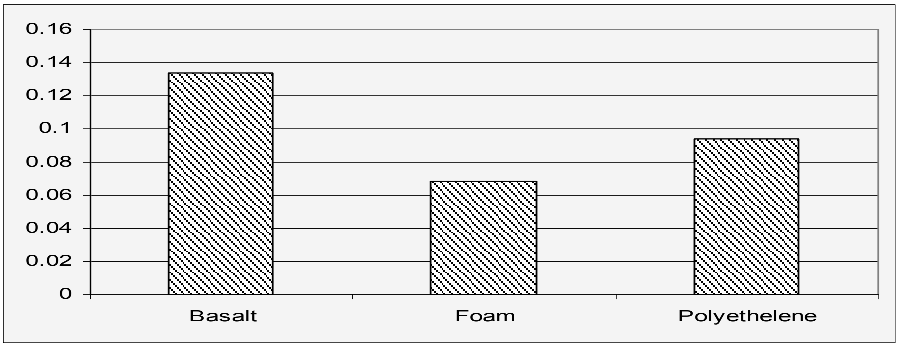

Fig. (3) : effect of different media on the cost of filtration.

Table 10: Economical analysis of one cubic meter water filtration for different types of media filters under tested

Media Types	Market price L.E/T	Media capacity of one tank Lg/Tank	Media price of one tank L.E/Tank	Total operation time (h.)	Yearly Operation time (h.)	Age operation year	Total filtered water (m^3)	Filtered area (m^2)	Filtration capacity $m^3/hr/m^3$
Basalt	1800	480.0	864.00	10395	2310	4.5	642661	0.92	67.2
Foam	20000	15	300	6930	2310	3.0	443742	0.92	69.6
P.Eth	3800	260.0	988.00	16170	2310	7.0	1048786	0.92	70.5

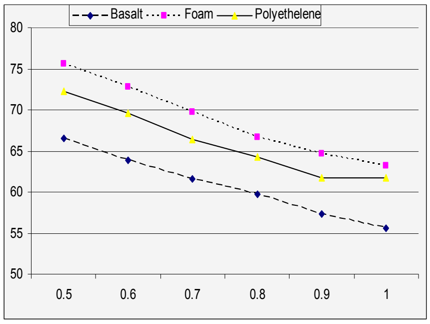

Fig. (1): Effect of Nile water on the filtration efficiency

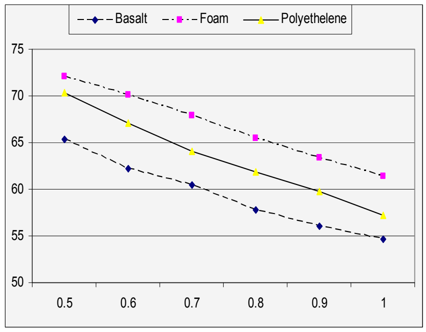

Fig. (2): Effect of west water on the filtration efficiency

Conclusion

The obtained results indicate that the foam media be recorded a highest filtration efficiency as 75.61% with Nile water and 72.11% with waste water at 0.5 bar pressure losses; also it might be recorded a least cost of cubic mater filtration as 0.068 Egyptian pound. At the second level, the polyethylene media be recorded a filtration efficiency as 72.03% with Nile water and 70.04% with waste water, also it might be recorded 0.094 Egyptian pound of cubic meter water filtration cost. At the final level, the basalt media be recorded 66.51% with Nile water and 65.34% with waste water at 0.5 bar pressure loss; and it's recorded 0.134 Egyptian pound for cubic water meter filtration cost. For that, it might be recommend to use a foam media in a filtration process from through a media filter. Technically and economically, it can concluded that, under using Nile water and wast water, the foam media is the best filtration way compared with polyethylene and basalt media. At the average, the foam media is recorded 8.13% and 2.8% of filtration efficiency increase than using basalt and polyethylene media by the Nile water, respectively. Also it is recorded 7.29% and 3.3% of filtration efficiency increase than using basalt and polyethylene media by waste water, respectively. At the final, the foam media recorded the least cost per cubic meter filtration 49.3% and 27.7% less than basalt and polyethylene media respectively.

REFERENCES

Adin, A. (1997): clogging in irrigation systems resulting and effluents at its prevention. Water science and technology WSTED. 4. vol – 19(12) : 323-328.

Benami, A. and A. Often (1984): Irrigation engineering: Sprinkler, Trickle, Surface irrigation, Principles desigen and agricultural practices. ASAE 6(2) 156-158.

Boswell, M.J. (1990): Micvo-irrigation design manual. Fourth Edition , James Hardie irrigation , Inc. P: (3-1 to 3-3), (9-3 to 9-5).

Chavez, N.R. and T.W. Sammis (1992): Desiging of trickle irrigation filters using an expert system first International conferences on Expect systems and Development (ICESD-92), April 19-23, P: 205-215.

Dasberg, S. and E.Bresler (1985): Drip irrigation manual published by international irrigation center (III P.O.B. 49, Volcani-center, Bet Dagan, Isreal, PP:12, 23-25.

Hilled, D. (1982): Advances in irrigation Principles, Practices and potentialies of trickle (drip) irrigation Dvances in irrigation, Vol. (1), 219-298.

Jensen, M.E. (1983): Design and operation of farm irrigation systems. an ASAE, monograph No. 3 in a series published by ASAE 2950 Niles rood, Michigan 49085, pp: 707-709.

Jobling, G.A. (1974): Trickle irrigation design manual part 1, No. 7. September, published by the New Zealand. Agr. Eng. Ins. Lincoln college. Conterbury, New Zealand. P: 50-63.

Jusoh, A., M.J.MMN. and A.H. Ghazali (1989): Effects of effective size in rapid sand filtration pertanika 12: 1, 113-117; 4 ref.

Keller j. and R.D Bliesner (1990): Sprinkler and trickle irrigation. An avi Book, Newyork P: 441-445.

قياس أداء الفلترة للمرشحات الوسطية الخاصة بنظم الرى الحديثة بإستخدام أوساط ترشيح مختلفة

على فرج حسن

معهد بحوث إدارة المياه

تعتبر أوساط الترشيح من أهم العوامل المحددة لأداء وحدات الفلالتر ذات الأوساط الداخلية حيث يرتبط أداء الفلاتر بقدرة أوساطها على حجز الشوائب وعلى تصرف تلك الفلاتر لوحدة الزمن لنفس الحجم من الفلاتر عند فروق الضغط المختلفة.

أجريت التجارب الحقلية بمنطقة المنصورية بمحافظة الجيزة وكذلك بمنطقة البستان بمحافظة البحيرة ، حيث تم إختيار ثلاثة أنواع من أوساط الترشيح تتمثل فى وسط الترشيح الفوم ، والبولى إثيلين والبازلت.

وأستهدفت الدراسة :-

- معدل السريان عند الضغوط المختلفة (m^3/h) ، معدل إنخفاض السريان عند فواقد الضغط المختلفة (m^3/h) ، قياس كمية الشوائب المحجوزة عند فروق الضغط المختلفة (جم/م^3) ، حساب الزمن المستهلك لفلترة وحدة الزمن (دقيقة) ، قياس كفاءة الأداء للأوساط المختلفة (%).

وكانت أهم نتائج الدراسة :

- أفضل معدل سريان تحقق مع وسط البولى إثيلين حيث يتراوح من ٩٠م^3/س إلى ٥٤.٠٩م^3 ساعة عند فواقد ضغط ٠.٥ إلى ١.٠٠ بار مع مياه النيل ، ٨٨.٠٠م^3/س إلى ٥١.٨٠م^3/س عند فواقد ضغط ٠.٥ إلى ١.٠٠ بار مع مياه الصرف المعالج.
- أفضل معدل إنخفاض للسريان تحقيق مع وسط البولى إيثلين حيث تراوح من ٨.٢% عند فاقد ضغط ٠.٦ بار إلى ٣٩.٩% عند فاقد ضغط ١.٠٠ بار وذلك مع مياه النيل. كما كان ٢.٢٢% عند فاقد ضغط ٠.٥بار إلى ٤٣.٩٣% عند فاقد ضغط ١.٠٠ بار مع مياه الصرف المعالج.
- أقل كمية مياه مستهلكة لغسيل الفلاتر كانت مع واسط البولى إيثلين حيث سجلت النتائج ١٣٥.٠٠ لتر عند فاقد ضغط ٠.٥ بار إلى ٣٥٠.٠٠ لتر عند فاقد ضغط ١.٠٠ بار وذلك مع

مياه النيل ، ١٥٥ لتر عند فاقد ضغط ٠.٥ بار إلى ٤١٤ لتر عند فاقد ضغط ١.٠٠ بار مع مياه الصرف المعالجة.

- أما بالنسبة لحجز الشوائب فقد وجد أن وسط الترشيح المقوم كان أعلاهم حجزاً للشوائب حيث سجلت النتائج ٧.٧٢ جم/لتر عند فاقد الضغط ٠.٥ بار إلى ٦.٢٣ جم/لتر عند فاقد الضغط ١.٠٠ بار وذلك مع مياه النيل أما مع مياه الصرف المعالج فقد سجلت ١٣.٤٨جم/لتر عند فاقد ٠.٥بار إلى ١٠.٧٢ جم/لتر عند فاقد ضغط ١.٠٠ بار ونتيجة لذلك بلغت كفاءة وسط الترشيح القوم قد سجلت أعلى النتائج حيث سجلت ٨٠.٠٣% عند فاقد ضغط ٠.٥بار إلى ٦٤.٨٢% عند فاقد ضغط ١.٠٠بار.

قام بتحكيم البحث

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