# Engineering factors effecting the performance of locally manufactured screen filters.

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## ABSTRACT

The present study is to evaluate the engineering factors effecting on the performance of screen filters locally manufactured in Egypt. According to ISO 9912-2: **1992(E)**.The study reveals that some cylindrical screen filters can be used after sand filters when the source of water is surface water and located directly after pump station in Irrigation National Lab in Dokki – Giza governorate. The cylindrical screen filter materials are locally available. The evaluations included two solid concentrations in the water surface source (110 and 80 mg/l), two different external cartridge shapes (helically grooved and smooth) and three screen meshes (100, 160, and 200 mesh). The operating characteristics of cylindrical screen filters are predicated by knowledge of their mesh per linear inch, some hydraulic properties such as effect pressure loss, on flow rate, filtration efficiency, time, filtration cycle period, consumed for filtering cubic meter and flow rate reduction percentage.

The construction, measuring theory, operation, test, results and applications under pressure losses are described as follows:

1- The area ratio on the external cartridge surface for 65.0 orifices calculated according to **Keller (1949)**, were 33.16, 58.98 and 92.15 % with different orifice diameters perforated on the cartridge were 0.3 . 0.4, 0.5 mm, respectively.

2-The flow rate increased generally in all cases under helically-grooved cartridge surface due to path on the external cartridge surfaces and specially highest flow rate was 5.7 $m^3/h$ with high area ratio 92.15 %, screen 100 mesh and low solid concentration 80 mg/l.

3-Generally helically-grooved cartridge with 200 screen mesh gave highest filtration efficiency and flow rate reduction percentage reached to 69.0% and 38.5 at pressure loss 0.2 and 0.5 bare respectively with high area ratio 92.15% and solid concentration 110 mg/l compared with all treatments.

4-The filtration cycle period increased generally in smooth cartridge and specially under low area ratio 33.16% and screen 100 mesh under solid concentration 80 mg/l compared with all treatments.

5-The time consumed for filtering cubic meter increased generally in all cases under helically-grooved cartridge surface due to path on the external cartridge surfaces and specially under low area ratio 33.16 %, and screen 100 mesh under solid concentration 110 mg/l compared with all treatments.

**Key words**: Screen filter, area ratio, pressure loss, flow rate, filtration efficiency, time consumed for filtering cubic meter, filtration cycle period, and flow rate reduction percentage

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Senior Res., Ag. Eng. Res. Ins., Dokki, Giza.

## INTRODUCTION

Many different types of cylindrical screen filters are available on the local market at low cost, which are used mainly in pressurized irrigation systems. Use of these filters is increasing with increasing of the agriculture-irrigated area under pressurized irrigation systems (1.6 million fed.) El-Gindy 1997. **Kelley and Karmeli (1975)** mentioned that in screen filters, the whole size and total amount of open area determine the efficiency and operation limits. The screen filter is efficient for the removal of very fine particles from the irrigation water, but tends to be rapidly clogged by heavy loads of algae and other organic materials. It is customary to clean the filter when the pressure head drop is about 2.0 m, or at a fixed time determined in advance. The factors should be considered when estimating the appropriate discharge for a given screen filter are: quality of water, filtration area, desired volume of water to be passed between cleaning cycles, and allowable pressure drop on the filter surface. **Burce (1985)** mentioned that screen product in this category functions much like cartridges and strainers, expect that they are designed for much higher flow rates (about 91 $m.^3/h$) and are capable of greater solids retention. To accumulate higher flow rate, screen filters have more filtration surface area per inlet size than cartridges and strainers. Flushing is accomplished with little interruption to the operation of the irrigation system. **Pierce and Mancuso (1985)** said that exceeding recommended flow rates cause rapid build-up of collected contamination and excessive flushing or cleaning. Operation at higher than recommended pressure levels may cause damage to both the screen filter housings and filter cartridge. **Zeier and Hills (1987)** found that sand size is the main factor effecting the character of screen filter plugging. Fine sands cause a factor pressure drop across the screen filter than the coarse sand for similar quantities. Coarse sand needs a greater filter element storage volume in order to increase the time between filter cleanings, all other left the same. Increasing the volume available for sand storage would be more beneficial than increasing mesh area. The shape of the filter element should favor greater mesh surface areas for a given filter volume. **James (1988)** mentioned that cylinder screens made of stainless steel or nylon are the most commons types of screen filter used in trickle systems. The size of screens openings and hence the number of wires per inch determines the minimum particle size retained by the screen. The screen mesh should be selected that the screen retains all particles larger than one-sixth the size of the smallest passage (openings) in the trickle system. **Keller and Bliesner (1990)** said that the head loss in clean mesh filter normally rang between 2.0 and 5.0 kpa. The losses depend on the valving, filter size, percentage of open area in the screen ( sum of the holes), and discharge. The head losses through a mesh filter will normally range between 5 and 10 kpa. A mesh filter with a high discharge in relation to the screen area may require frequent cleaning and have a short life. The factors that should be considered when selecting screen filters are: water quality, system discharge: filtration area and percentage of open area per filter: desired cleaning cycle and allowable pressure drop. The maximum recommended flow rate through a fine screen should be less than 135 l/s per $m^2$ of screen open area. **Awady (1991)** stated that many factors affect on the function and capacity of water filtration for trickle irrigation . They include: 1) source of water, and amount and nature of sediments and other causes of emitter clogging carried by water 2) area served, plant grown, micro climatology, and soil factors ; 3) type and size of filter; 4) time between successive cleaning services ; 5) fertilizers, pesticides and other water treatment additives which may result in precipitation of solids, or from compounds that precipitate ; and 6) type and size of trickler , and operation pressure. **Ravine et al. (1992**) explained that reliable long-term operation of most emitter types was achieved with filtration at 80 mesh (180-micron opening) combined with daily chlorination and bio monthly lateral flushing. The difference between the levels of emitter clogging at 80 mesh filtration and 120 mesh was found to be insignificant. Hence, 80 mesh is the level of filtration recommended for manual flushing check filter in drip irrigation systems using reservoir waters. **Ravina et al. (1993)** reported that the performance of filters after primary filtration by 120 mesh filters was better than after filtration with 40 mesh primary filters or without primary filtration. The performance of the manual downstream filters with non- filtered water and after 40 mesh filtration was similar. **Barbagallo et al. (1994)** stated that different screen filters have been used in experimental filtration equipment using primary effluent (with the diameter of the circle with the same area of the screen opening) and the area ratio (ratio between open area and total of the screen) . A support made of a size plated net has been set up in respect of the currently used perforated plate, this metal support increases filtration cycle duration (time to get a prefixed hydraulic head drop and the amount of filtered water volumes per screen area unit. **Chauhan (1995)** said that screen filters constitute an important component of drip irrigation system. Screen filters are useful for removing suspended inorganic materials but cannot remove large amount of suspended and organic particles without reducing the flow and thus requiring frequent flushing. **Niekerk (1995)** reported that most of the filters make use of internally filtered water to clean themselves, but if the water is so dirty, the elements of the filters are blocked before they themselves are clean, and cannot function any longer. **Parwal et al. (1995)** reported that, filtration of irrigation water in micro irrigation system is used for preventing clogging of individual parts of the system. Three types of filters, hydro cyclone's sand or media and screen are used individually or in combination to achieve the desired objective. The study relates to flow of clean water through screen filters, besides studying the applicability of a procedure for determining pressure drop. **Philips (1995)** reported that most filtration equipment installed in micro irrigation system is being operating at less than optimum levels. A screen filter has operational limitations. Screens utilize a single barrier of woven fabric or similar device to separate the suspended solids from the water. Any failures in the integrate of the filter barrier will allow contamination to pass down stream into the irrigation systems resulting in plugg age or obstruction of the water application device. **Sagi et al. (1995)** explained that filters installed at the head of the drip irrigation systems to prevent emitter clogging were not effective in the case of colonial protozoa and sulfur bacteria, regardless of the filter type.

**El-Bagoury (1998)** reported that increasing size of suspended particles from 125 to 375 um lead to increase in filtration efficiency from 90 to 97%, 80 to 94% and 70 to 90% at concentration of contamination 10, 250, and 750 PPM respectively. The optimum duration between back washings was 3.0 hours based on head drop of 5m with 15 PPM of contamination at discharge rates 9.5 $m.^3/h$ for river water. The duration can be increased to 10 hours daily by decreasing the filter inlet discharge rate to 3.5 $m.^3/h$. **Keller (1949)** defined two hydraulic expressions named: the area ratio (AR), less or equal to unity and slenderness ratio (LR) as follow: AR= Sum of areas of all discharge opening / cross sectional area of pipe. LR = Actual active length/ pipe diameter.

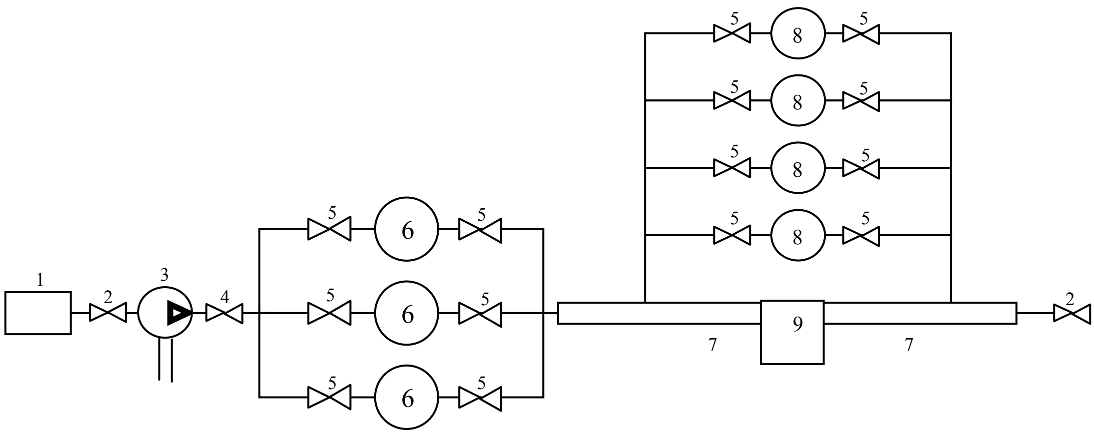
**ISO 9912 (1992 )** specified that the pressure drop shall not be more than 10.0% greater than the pressure drop declared by the manufacturer. The strainer outlet shall not exceed 0.05 % of the maximum recommended flow rate. This leakage shall remain steady or lessen during the test. I n strainers containing several filter elements, perform the test on each filter element separately. **El-Tantawy (1999)** reported that screen filters are best selected for water source with low solid concentration as insurance for (clean water) or as secondary filter downstream of a pre-filter. Filtration efficiency tests can be easily and effectively done under laboratory and field condition (surface and ground) in all filters in two different qualities water. **Sharaf et al (1998)** found that using filter 150 mesh is a satisfactory filtration as a physical treatment of the drainage water without excessive clogging. **El-Berry et al. (2000)** found that increasing of screen filter aperture size has a negative effect on emitter discharge. This effect influences all types of emitters but not equally.

The aims of this work were to study the effect of area ratio and external surface of the cartridge, different solid concentrations in the water source and different screen meshs on pressure loss, flow rate, filtration efficiency, filtration cycle period , time consumed for filtering cubic meter and flow rate reduction percentage.

## 3-MATERIAL AND METHODS

The experiments were carried out in the Irrigation National Lab in Dokki – Giza Governorate with two different solid concentrations in the surface water with $p^H$ (7.6) and E.C. (0.394 mmhos/cm). The control head used surface water in the irrigation and consisted of electrical centrifugal pump with maximum flow rate and head 100 $m^3/h$ and 55 m respectively, two sand filters with diameters 90 cm , injection fertilizer pump, and screen filters with different flow rates. The present study is to evaluate the engineering factors affecting the performance of locally manufactured screen filters in Egypt. According to ISO 9912-2: **1992(E)**.The study reveals that some cylindrical screen filters can be used after sand filters when the source of water is surface water and located directly after pump station in Irrigation National Lab in Dokki – Giza governorate. The cylindrical screen filter materials manufactured from PVC with thickness 4.0

mm /10 bar are available locally. The evaluations included two different solid concentrations in the water surface source (80 and 110 mg/l), two different external cartridge shapes ( smooth & helically-grooved) and three screen meshes (100, 160, and 200 mesh) respectively. The operating characteristics of cylindrical screen filters are indicated by knowledge of their mesh per linear inch, some hydraulic properties such as effect on pressure losses, on flow rate, filtration efficiency, time consumed for filtering cubic meter, filtration cycle period and flow rate reduction percentage effect of water quality on the operation duration. The pump unit was connected with filtration unit (media and screen filters). The screen filter was tested through pressure drop test facility and half cross-section helically –grooved cartridge in the Irrigation National Lab as shown in figs. (1 and 2) respectively.




(1) Water source (2) General gate valve (3) Pump (4) Discharge valve.
(5) Manual isolating valve (6) Electromagnetic flow rate (7) Set of straight pipes.
(8) Differential pressure gauge. (9) Screen filter to be tested.

Fig.(1) : General sketch showing the principle of the pressure drop test facility.

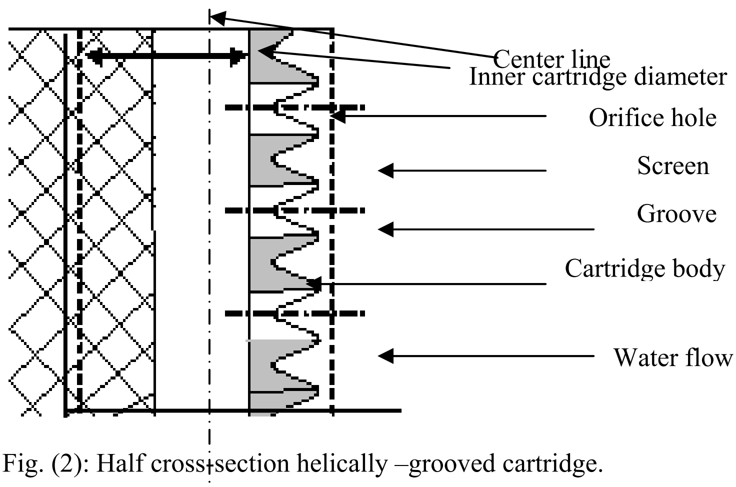



Fig. (2): Half cross-section helically –grooved cartridge.

The specifications of the screen filter tested as shown in table (1).

Table (1): Specifications of the screen filter tested.

| Specifications | Filtration unit |
|---|---|
| -Hosing length (cm). | 20.0 |
| -Hosing outer diameter (mm) | 60.0 |
| -Hosing thickness (mm). | 4.0 |
| -Maximum discharge ($m^3$/h). | 7.5 |
| -Maximum pressure (bar). | 10 |
| -Screen cartridges outer diameter (mm). | 50.0 |
| -Screen cartridges thickness (mm). | 4.0 |
| -Cartridge area ($cm^2$). | 13.854 |
| -Number of mesh per linear (inch). | 100, 160 and 200 |
| -Screen material. | Stainless steel. |
| -Cartridge material | P.V.C. |
| - Cartridge surface area ($cm^2$) | 125.6 |

The pressure loss ranged from 0.2 bar to 0.5 bar through filtration process under two different surface cartridge. The volume of filtered water ($m.^3$), filtration cycles (min) and flow rates ($m^3$/h) were measured and estimated time consumed for filtering cubic meter, and flow rate reduction percentage at increase pressure loss every 0.1 bar. One liter water samples were collected before and after filtration at each 0.1 bar pressure loss to estimates solid concentrations in (mg/l) in the two cases (110 and 80 mg/l) in surface water in National Irrigation Lab for calculating filtration efficiency (%) **El-Tantawy 1997**.

***Lab calculations through screen filter.**

- Cartridge area ($cm^2$) (Ac)

$$Ac = \Pi \ R^2 \ldots\ldots\ldots\ldots\ldots\ldots(1)$$

-Orifice area ($cm^2$) (a)

$$a = \Pi \ r^2 \ldots\ldots\ldots\ldots\ldots\ldots\ldots(2)$$

-Cartridge external surface area (As) ($cm^2$)

$$As = 2 \ \Pi \ r \ L \ldots\ldots\ldots\ldots\ldots (3)$$

-Total orifices area($\sum a$)

$$\sum a = A * N \ldots\ldots\ldots\ldots\ldots\ldots (4)$$

Where:

$\Pi$ = constant (3.14).
R = inner cartridge radius (cm).
r = orifice radius (cm).
N = number of orifices.
L = cartridge length (cm).

-Area ratio (AR) (%)

$$AR = (\sum a/Ac) /?*100 \ldots\ldots\ldots(5)$$

- Opening area ratio (Ao)(%)

$$Ao = (\sum a/As) \ldots\ldots\ldots\ldots\ldots \quad (6)$$

Where:

$\sum a$ = Total orifices area ($cm^2$).
Ac = Cartridge area ($cm^2$).
As = Cartridge external surface area ($cm^2$).

-Filtration efficiency (%) ( $E_f$)

$$(E_f) = (Ss - Si / Ss) * 100 \text{ ...........(7)}$$

Where:

Ss= the solid concentration in the entrance of water before screen filter (mg/l).

Si = the solid concentration in the filtered water after screen filter (mg/l).

-Pressure loss (bar) (P)

$$P = Pi – Po \text{ ………………………(8)}$$

Where:

Pi = average pressure before screen filter (bar).

Po = average pressure after screen filter (bar).

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

$$q = V_f / T \text{ ………………………...(9)}$$

Where:

$V_f$ = volume of water passing through screen filter.($m^3$).

T = filtration cycle (min).

-Flow rate reduction percentage (Qr)

$$Qr = (Qs - Qi / Qs) * 100 \text{ ……….(10)}$$

Where:

Qs = flow rate at starting filtration process ($m^3$ /h).

Qi = flow rate at any time through filtration process ($m^3$ /h).

-Time consumed for filtering cubic meter (min/ $m^3$) (T)

$$T = (1 /q) *60$$

-Filtration cycle (h)

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

## RESULTS AND DISCUSSION

The main objectives of engineering laboratory tests are for calculating number and orifice diameters, measuring and evaluating the performance the selected six cartridges of screen filters (100, 160, 200 mesh) under three different area ratio percentage two solid concentration and two external cartridge shapes. The tests include pressure loss, flow rate, filtration efficiency, the filtration cycle period, time consumed for filtering cubic meter, and flow rate reduction percentage. All the measurements were taken during laboratory operation. The inlet pressure at starting filtration process was 2.0 bar and pressure loss under clean water were we 0.173 , 1.85, and 0.2 bar under different screen meshes 100, 160 and 200 respectively. The pressure loss through screen filter during filtration process range 0.2 bar to 0.5 bar after back washing at the inlet. When the pressure loss reached, 0.5 bar the screen filter needs cleaning, by washing the cartridge. The results of laboratory tests can be summarized as follows:

**1-Calculation area ratio percentage , orifices numbers and diameters.**

The cartridge area was 13.854 $cm^2$; the total orifices number distributed on the external cartridge surface on triangular spacing shape were 65.0 orifices with circular shape, so the maximum orifice diameter was 0.5 mm and cartridge surface area 125.6$cm^2$ according the calculation of the areas ratio **Keller (1949).** According to the calculation, six cartridges were tested in National Irrigation Laboratory as shown in table (2).

Table (2): Specification of screen cartridges tested in Irrigation National Laboratory.

| No | Orifice diameter (cm) | Orifice area ($cm^2$) | Total orifices area ($cm^2$) | Area Ratio (%) | Opening area ratio (%) | External surface shape |
|---|---|---|---|---|---|---|
| 1 | 0.3 | 0.0707 | 4.595 | 33.16 | 3.66 | Smooth |
| 2 | 0.3 | 0.0707 | 4.595 | 33.16 | 3.66 | Helically-grooved |
| 3 | 0.4 | 0.1257 | 8.171 | 58.98 | 6.51 | Smooth |
| 4 | 0.4 | 0.1257 | 8.171 | 58.98 | 6.51 | Helically-grooved |
| 5 | 0.5 | 0.1964 | 12.767 | 92.15 | 10.16 | Smooth |
| 6 | 0.5 | 0.1964 | 12.767 | 92.15 | 10.16 | Helically-grooved |

**2- Effect of pressure loss on flow rate**

The present study succeeded to prove the possibility of using local screen filters in pressurized irrigation system in Egypt, where the pressure loss through filtration units at starting time are 0.2 bar under surface water as shown in fig. (3):

At starting, of filtration process through screen filter 100 mesh with pressure loss 0.2 bar under solid concentration 110 mg/l (s 110) and 80 mg/l (s 80) , under cartridge of helically-grooved surface, the flow rates increase with 3.6 ,4.8 , 5.7 % and 3.1 ,4.3, 5.2 % respectively compared with smooth cartridge surface with orifices diameters 0.3, 0.4 and 0.5 mm respectively. Increasing solid concentration in the irrigation water from 80 to 110 mg/l, the flow rate decreased with percentage ratio under cartridge of helically-grooved surface were 3.5 to 7.1%, while under cartridge with smooth surface, ratios were 1.85 to 9.1% with orifice diameters 0.3, 0.4 and 0.5 mm respectively.

Same trend was observed at the end of filtration process at 0.5 bar pressure loss through screen filter. Increasing solid concentration in the irrigation water from 80 to 110 mg/l, the flow rate decreases under cartridge of helically-grooved surface, 3.5 to 11.1, while under cartridge with smooth surface, 1.92 to 10.7 % with orifice diameters 0.3, 0.4 and 0.5 mm respectively, and same trend in screens 160 and 200 mesh as shown in fig. (3).

**3- Effect of pressure loss on filtration efficiency percentage**

In fig.(4) at starting, of filtration process through screen filter 200 mesh with pressure loss 0.2 bar under solid concentration 110 mg/l (s 110) and under 80 mg/l (s 80) , under cartridge with of helically-grooved surface, the filtration efficiency increase with 2.0 to 6.0 % and 2.0 to 4.0 compared with smooth cartridge surface with orifice diameters 0.3, 0.4 and 0.5 mm, respectively. Increasing solid concentration in the irrigation water from 80 to 110 mg/l, the filtration efficiency increase with percentage ratio under cartridge of helically-grooved surface were 2.0 to 4.0 %, while under cartridge with smooth surface, ratios were 1.80 to 3.1 % with orifice diameters 0.3, 0.4 and 0.5 mm respectively.

Same trend was observed at the end of filtration process at 0.5 bar pressure loss through screen filter. Increasing solid concentrations in the irrigation water from 80 to 110 mg/l, the filtration efficiencies increasing with percentage ratio under cartridge of helically-grooved surface, 2.0 to 4.0, while under cartridge with smooth surface, decreases 1.0 to 3.0 with orifice diameters 0.3, 0.4 and 0.5 mm respectively, and same trend decreasing filtration efficiency with decreasing screen mesh from 160 to 100 mesh and decreasing solid concentration from 110 to 80 mg/l as shown in fig. (4).

**4- Effect of pressure loss on filtration cycle periods**

In fig.(5) at starting, of filtration process through screen filter 100 mesh with pressure loss 0.2 bar under solid concentration 110 mg/l (s 110) and 80 mg/l (s 80) , the filtration cycle periods under cartridge with of smooth surface increased of percentage ratio from 6.3 to 11.8 % and 5.6 to 10.5% compared with cartridge with of helically-grooved surface with orifice diameters

0.3, 0.4 and 0.5 mm respectively. When increasing solid concentration in the irrigation water from 80 to 110 mg/l, the filtration cycle periods decreased under cartridge of helically-grooved surface, ranging from 13.3 to 26.6 % and under cartridge with smooth surface from 5.9 to 25.0 % with orifice diameters 0.3, 0.4 and 0.5 mm respectively.
Same trend was observed at the end of filtration process at 0.4 bar pressure loss through screen filter. When increasing solid concentrations in the irrigation water from 80 to 110 mg/l, the filtration cycle periods decreased under cartridge of helically-grooved surface, ranged from 16.6 to 50.0 % and cartridge with smooth surface, were 13.3 to 42.8 % with orifice diameters 0.3, 0.4 and 0.5 mm respectively, and same trend decreasing the filtration cycle periods decreased with increasing screen mesh from 160 to 200 mesh and increasing solid concentration from 80 to 110 mg/l as shown in fig. (5).

**5- Effect of pressure loss on times consumed for filtering cubic meter**

In fig. (6) at starting, of filtration process through screen filter 100 mesh with pressure loss 0.2 bar under solid concentration 110 mg/l (s 110) and 80 mg/l (s 80), the time consumed for filtering cubic meter decreased from 3.7 to 5.7 % and 3.0 to 19.9 % compared with smooth cartridge surface with orifice diameters 0.3, 0.4 and 0.5 mm respectively. When increasing solid concentration in the irrigation water from 80 to 110 mg/l, the times consumed for filtering cubic meter increased with percentage ratio under cartridge of helically-grooved surface, increases from 6.6 to 9.9 %, while under smooth cartridge surface , increases were 1.67 to 9.9 %, with orifice diameters 0.3, 0.4 and .5 mm respectively.

Same trend was observed at the end of filtration process at 0.4 bar pressure loss through screen filter. When increasing solid concentrations in the irrigation water from 80 to 110 mg/l, the times consumed for filtering cubic meter decreased with percentage ratio under cartridge with helically-grooved surface, 2.67 to 10.25, while under smooth cartridge surface, decreases were 2.53 to 9.8 % with orifice diameters 0.3, 0.4 and 0.5 mm respectively and same trend decreasing the times consumed for filtering cubic meter decreased with increasing screen mesh from 160 to 200 mesh and increasing solid concentration from 80 mg/l to 110 mg/l as shown in fig. (6).

**6- Effect of pressure loss on flow rate reduction percentage.**

In fig.(7) at starting, of filtration process through screen filter 100 mesh with pressure loss 0.2 bar under solid concentration 110 mg/l (s 110) and 80 mg/l (s 80), under cartridge of helically-grooved surface, the flow rate reduction percentage increase with 0.7 to 2.0 % and 0.7 to 1.5 compared with smooth cartridge surface with orifice diameters 0.3, 0.4 and 0.5 mm, respectively. Increasing solid concentration in the irrigation water from 80 to 110 mg/l, the flow rate reduction percentage increase with percentage ratio under cartridge of helically-grooved surface were 1.0 to 2.7 %, while under cartridge of smooth surface, ratios were 1.0 to 2.7 % with orifice diameters 0.3, 0.4 and 0.5 mm respectively.

Same trend was observed at the end of filtration process at 0.4 bar pressure loss through screen filter. Increasing solid concentrations in the irrigation water from 80 to 110 mg/l, flow rate reduction percentage increasing with percentage ratio under cartridge of helically-grooved surface, 2.0 to 4.0, while under cartridge with smooth surface, decreases 1.0 to 3.0 with orifice diameters 0.3, 0.4 and 0.5 mm respectively, and same trend increasing flow rate reduction percentage with increasing screen mesh from 160 to 200 mesh and increasing solid concentration from 110 to 80 mg/l as shown in fig. (7).

**7- Filtration cost**

The present study recommended using local screen filter with cartridge of helically-grooved surface with available material in local market and lower than the foreign types for different diameters with ratio 50.0% and nearly same quality and efficiency.

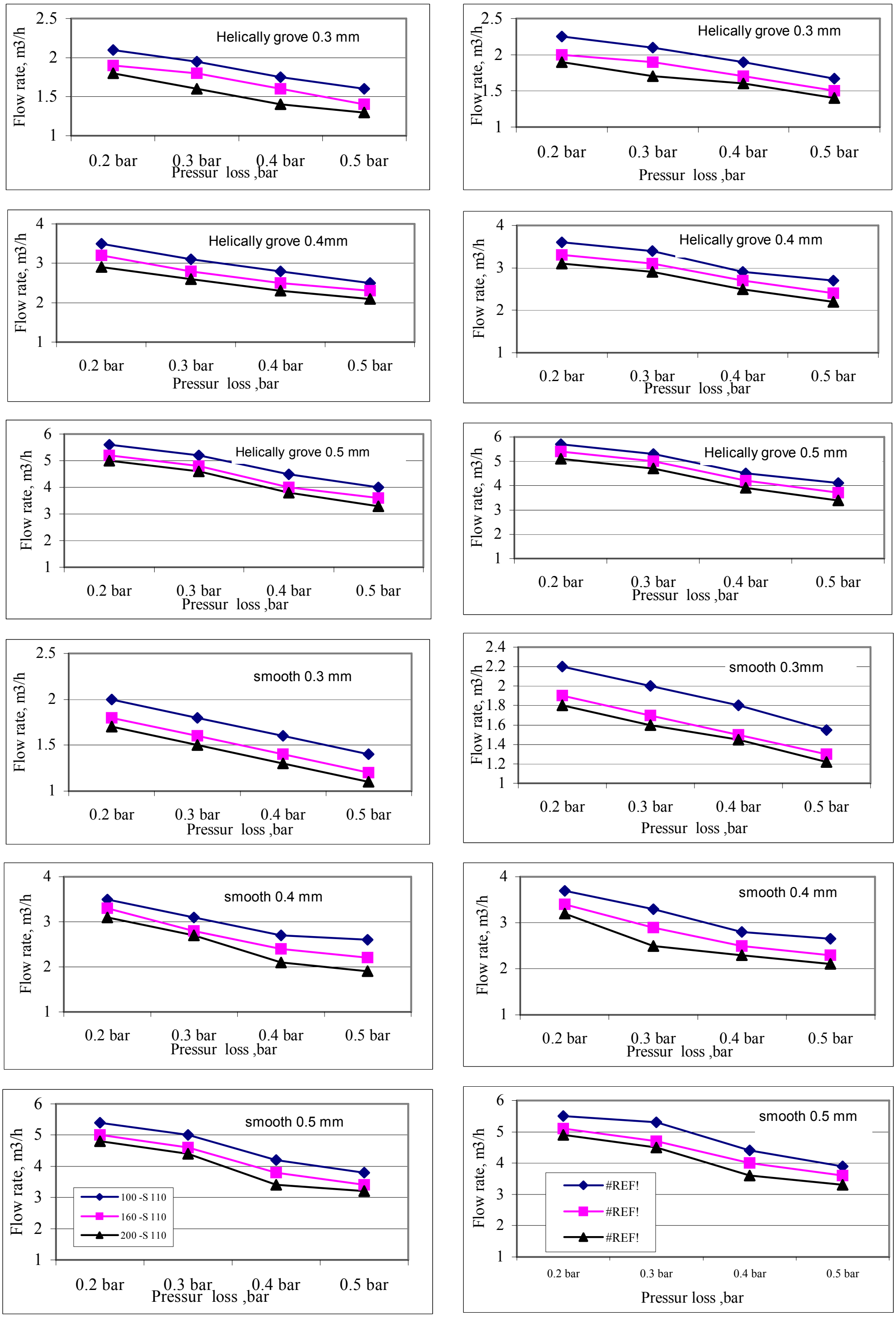



Fig.( 3 ): The relationship between flow rate and pressure loss with surface water.

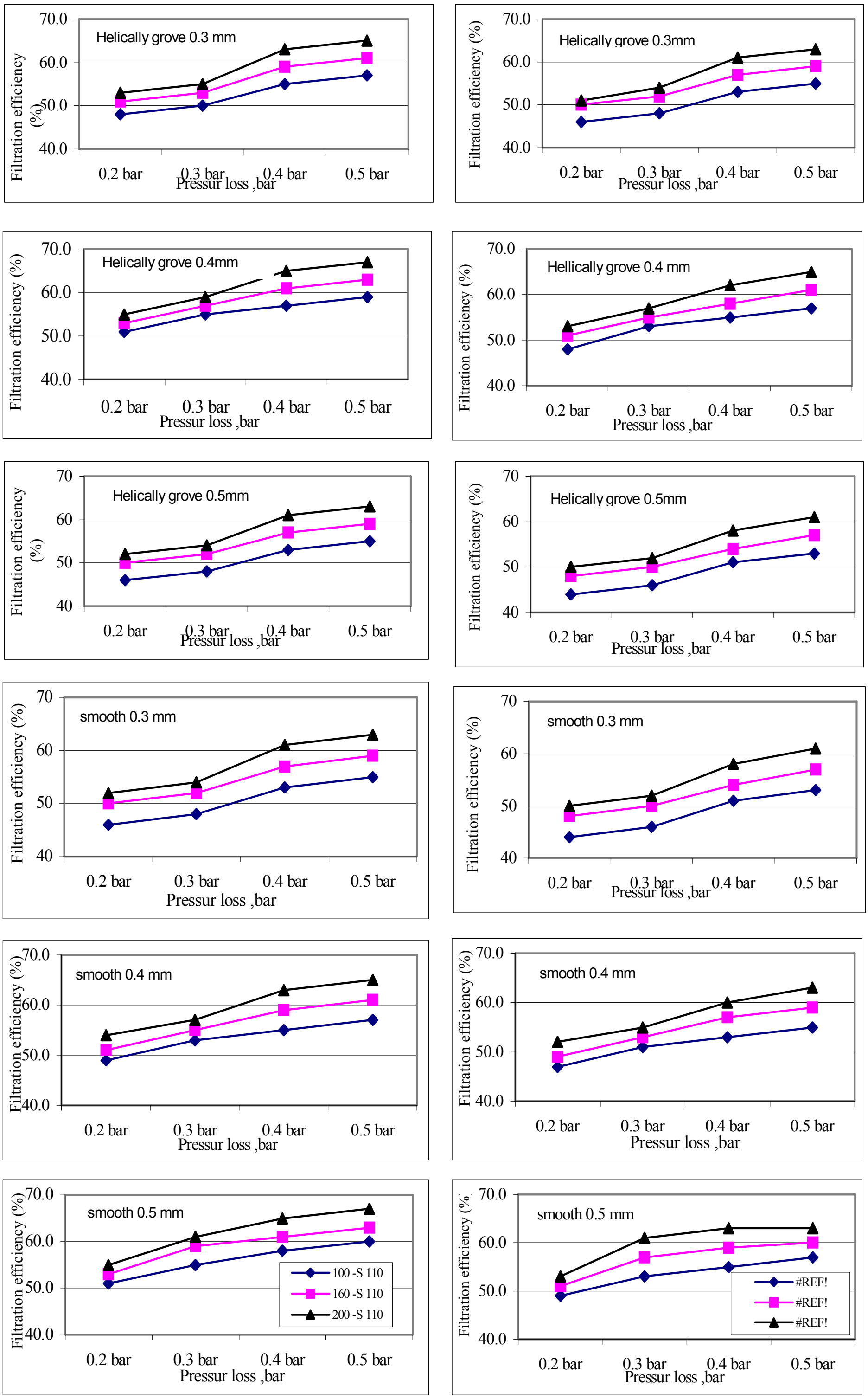



Fig.( 4 ): The relationship between filtration efficiency and pressure loss with surface water.

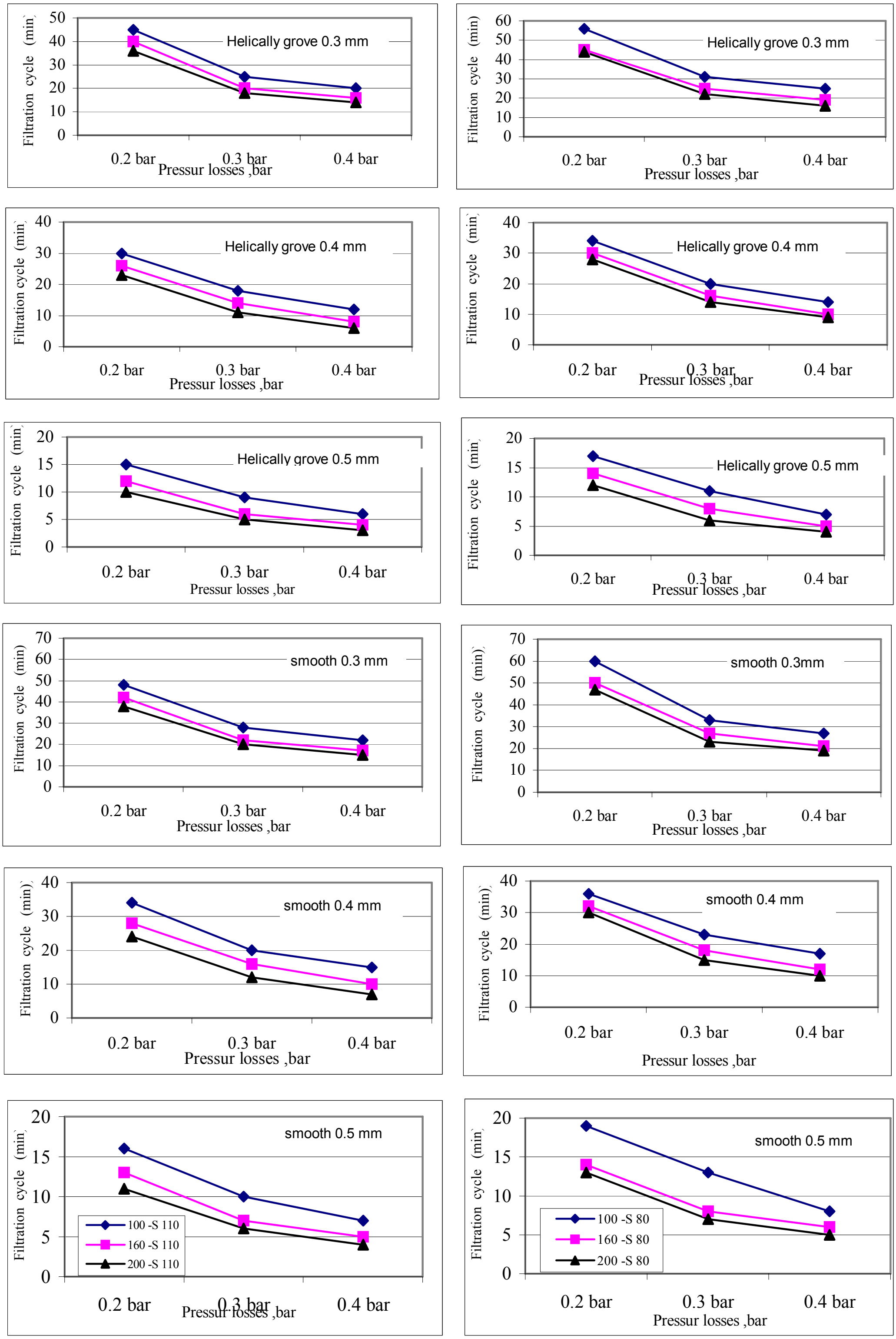



Fig.(5): The relationship between filtration cycle period and pressure loss with surface water.

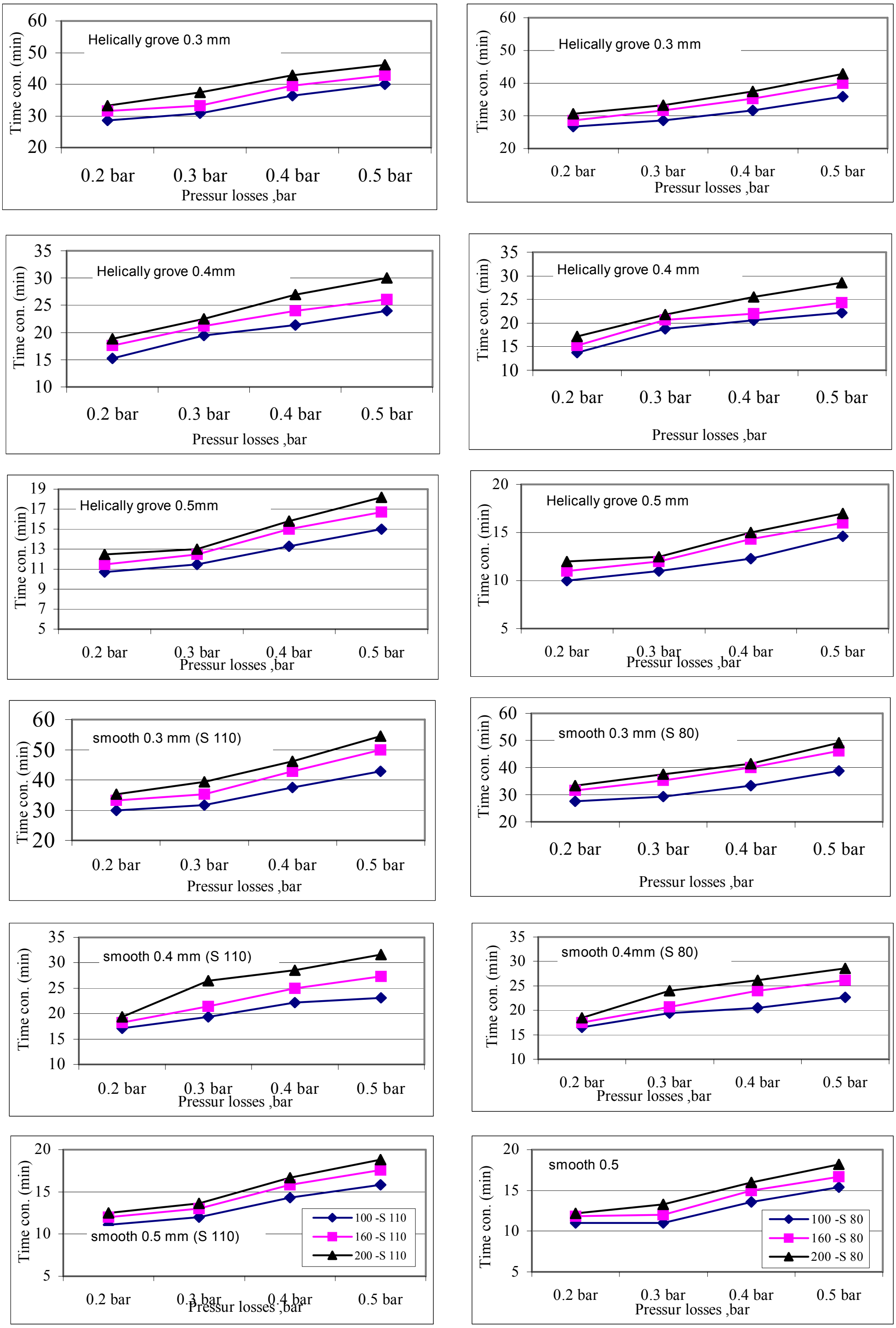



Fig.( 6 ): The relationship between time consumed for filtering cubic meter and pressure loss with surface water.

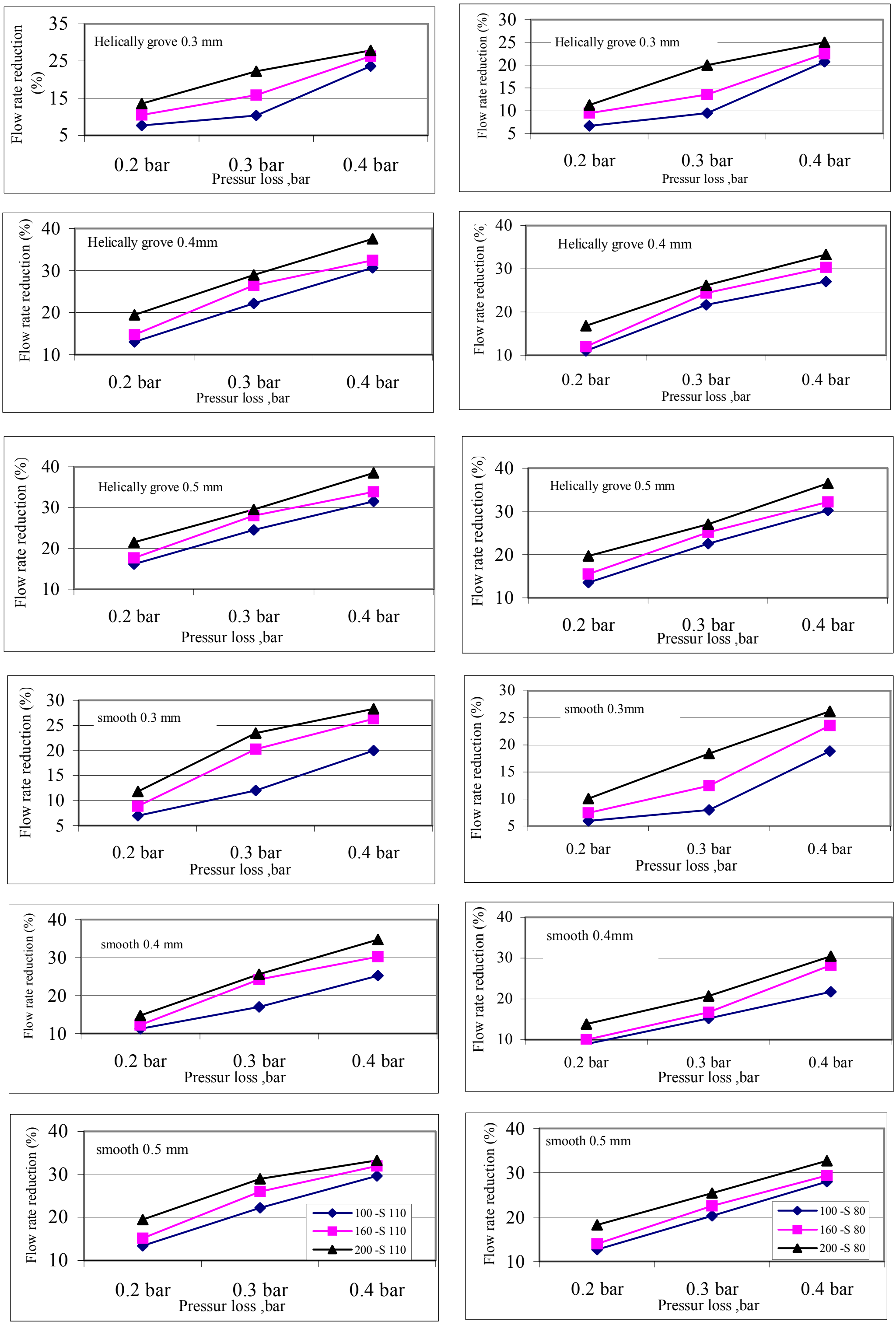



Fig.( 7 ): The relationship between flow rate reduction percentage and pressure loss with surface water.

## CONCLUSION

The present study is to evaluate the engineering factors effecting on the performance of screen filters locally manufactured in Egypt. According to ISO 9912-2: **1992(E)**.The study reveals that some cylindrical screen filters can be used after sand filters when the source of water is surface water and located directly after pump station in Irrigation National Lab in Dokki – Giza governorate.

The construction, measuring theory, operation, test, results and applications under pressure losses are described as follows:

1- The area ratio on the external cartridge surface for 65.0 orifices calculated according to **Keller (1949)**, were 33.16, 58.98 and 92.15 % with different orifice diameters perforated on the cartridge were 0.3 . 0.4, 0.5 mm, respectively.
2- Generally using cartridge of helically-grooved surface compared with smooth one increasing flow rate , filtration efficiency , time consumed for filtering cubic meter, flow rate reduction percentage, and decreasing filtration cycle period.

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