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Investigating Discharge Variation in Various Emitters Due to the Effect of Refined Wastewater

Y. Choopan *[,1], S. Emami[2]

[1] Department of Water Engineering, Gorgan University, Gorgan, Iran.
[2]Department of Water Engineering, Tabriz University, Tabriz, Iran.

ABSTRACT: Research indicates that the use of Emitters in more suitable for use with wastewater than other irrigation methods. In order to study the Emitter's discharge variation by using refined wastewater in drip irrigation systems, two drip irrigation systems (a water well system as control treatment and the other with a Miandoab refinery refined wastewater as main treatment) was installed and implemented. Due to the difference and sensitivity of various emitters against physical clogs affected by water-soluble, four emitters consists of 4-liter Euro-droplet emitter with 1-meter outlet distances, two 4-liter Iran drip emitter with 1-meter outlet distances and the 16mm type tube was used at 20 to 30 cm output distances. The systems were tested in a 4-meter pressure mode and it was determined that the Euro-drip emitter has the best performance and with technical and appropriate management, the system has the ability to run with the refined wastewater. The results showed that the Euro-drip emitter indicates the lowest percentage of discharge decreases. The highest emitter absolute dispersion uniformity percentage during operation with a 4-meter pressure is related to the Euro-drip with 95.6% and the lowest value for the Iran-drip with 88.15%. Also, Iran-drip emitter the most discharge decrease by 29.4%.

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1. Introduction

In recent years, population growth, the expansion of agricultural and industrial activities to provide food and successive droughts in some regions of arid and semi-arid climates have been caused the surface and sub-surface freshwater will reach its peak and will be in a critical condition in terms of quantity and quality. One of the main solutions to overcome water scarcity is the use of refined wastewater as a suitable and good solution. Research shows that the combination of drip irrigation with reuse refined wastewater makes water more efficient and effective for products [1-3]. One of the clear advantages of using refined wastewater with drop irrigation is low depth penetration, increasing soil fertility, reducing weed growth and, reducing the use of agricultural pesticides [4].

Several researchers have investigated the factors affecting the flow discharge and uniformity of drip dispersion, which can be seen from the studies of Adin and Sacks, (1991), Taylor, (1992), Taylor et al., (1995) and Trooien et al., (2000) [5-8]. The researchers identified the main cause of emitter clogs as water quality. During the study, reported that water quality and type of emitters are effective in reducing the discharge due to the use of refined wastewater [9]. Emitter clogs increase with nitrogen uptake and decrease their discharge [10].

In Iran, despite the presence of arid and semi-arid region and the urgent need to use irrigation using unconventional water and variation of water resources, conducting comprehensive studies on the operation of conventional emitters made by refined wastewater treatment, it seems necessary. Considering that the drip irrigation method has good prosperity in the Miandoab city in Azarbaijan-Gharbi. This study explores the variation in the available emitters in the country's market and compares the performance of emitters and also introduces the optimize emitter.

2. MATERIAL AND METHODS

2.1. Case Study

To achieve the objectives of this study, two drip irrigation systems were installed in a field farm in the southern region of the Miandoab city in western Azarbaijan-Gharbi, with a total area of 2000 m^2 in the formed rectangle with a length of 50 and a width of 40 m.

2.2. Preparation of Data

The way the two systems were running was the same. However, one of the systems was considered as a treatment of well water in the area (T_1) and the main treatment of refined wastewater in the Miandoab refinery (T_2). To control the pressure of the inlet water into each block, the gate valve and the pressure gauge were fitted over the water supply pipe. The system consists of hydro-cyclone, sand filter, fertilizer tank, and disc filter after good installation. The system has a semi-main pipe and a sub pipe made of polyethylene with 16 and

*Corresponding author's email: yahyachoopan68@gmail.com

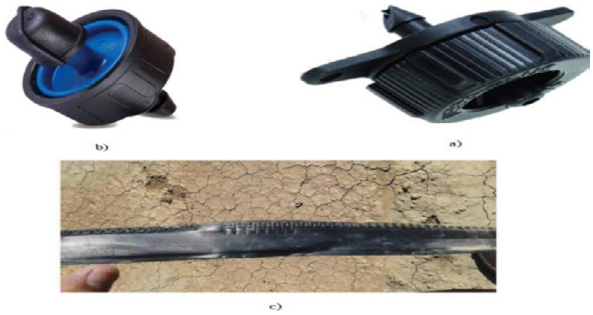

Fig. 1. (a), (b) and (c) schematic of emitters used

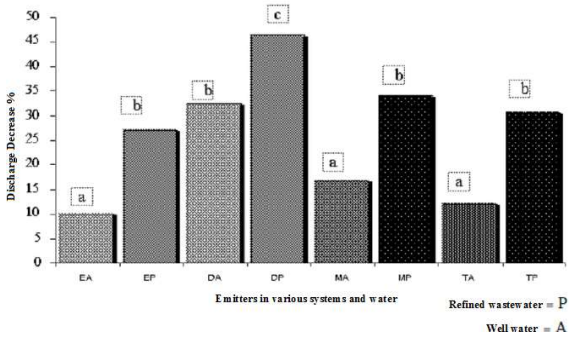

Fig. 2. Discharge decrease in various waters

Table 2. Water and wastewater quality characteristics

The standard boundary of pollutants in wastewater for use in irrigation (mg/l)	Wastewater Data	Experiment Results		Unit	Measurement Parameters
		wastewater	Well Water		
-	-	72	-	Mg/l	Fat
98	85	147	-	Mg/l	(BOD5)
-	528	1238	460	Me/l	(TDS)
98	59	26	4.3	Mg/l	(TSS)
-	-	28	4.2	Mg/l	NO3
-	-	3.4	1.2	Me/l	Ca
-	-	4.5	0.9	Me/l	Mg
-	-	8	2.1	Me/l	Na
-	-	53	1.05	Mg/l	P
-	-	14.7	18.1	NTU	Turbid
6.3----8.1	7.2	7.7	8.1	-	PH
-	-	2650	9	Per 100 Mg	Coliform
0.04	-	0.006	0	Me/l	Co
-	-	0.8	0.003	Me/l	Ar
-	1052	1260	736	Mμ/CM	(EC)

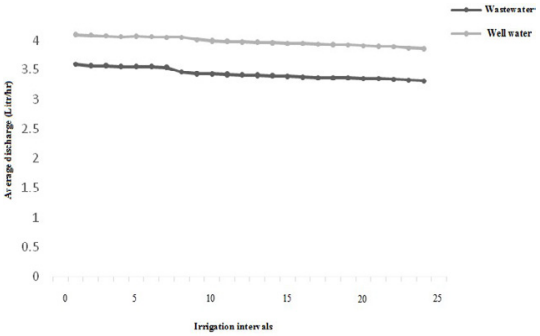

Fig. 3. Euro-drip emitter with a 4-meter pressure in 24 irrigation intervals in two systems

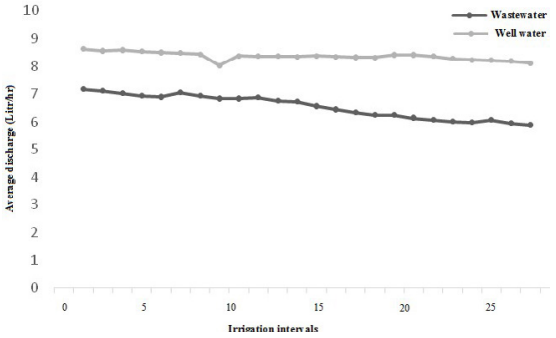

Fig. 4. The type tube at 20 cm output distances with a 4-meter pressure in 24 irrigation intervals in two systems

32 mm diameter.

To evaluate and compare the types of emitters used, the emitters of drop irrigation systems consist of four emitters, a 4-liter Iran drip emitter with 1-meter outlet distances, two 4-liter Iran drip emitter with 1-meter outlet distances and the 16mm type tube was used at 20 to 30 cm output distances. The next treatment was to examine the discharges variations of the emitters (D_1, D_2, D_3, and D_4). The emitters used in the drip irrigation systems studied water are shown in Fig. 1.

The study began in August 2017 and was completed in early December. Measurement of emitters discharge began on 25 August, and it was repeated in each period of 20 days and ended on 5 December (Table 2).

3. RESULTS AND DISCUSSION

In Fig. 2, a significant level in four emitters is presented in two irrigation systems. By investigating the effect of water quality on emitters discharge, it was found that the effect of refined wastewater on reducing the emitters discharge compared to well water was significant at 1% probability level.

In Fig. 3, the performance of the Euro-drip emitter is shown in two systems with a 4-meter pressure in 24 irrigation intervals which indicates the proper slope of the refined wastewater treatment diagram in this emitter, which is important in irrigation management.

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According to Fig. 4, the 16mm type tube with a 4-meter pressure has even better dispersion, so these types of tubes do not require high pressure, and at lower pressure, the discharge decrease is low.

The results showed that the highest rate of discharge decrease in a 4-meter pressure is related to the Iran drip emitter against the refined wastewater which is 29.4. Also, this emitter against well water has a significant discharge decrease rate and the lowest discharge decrease rate related to Euro-

drip emitter.

4. CONCLUSIONS

The results showed that the type of emitter has a significant effect on the function and decreases or increases the emitter clogs. By changing the irrigation water and emitter type, the dispersion uniformity change. Compared to the two types of water used in this study, refined wastewater and well water, refined wastewater has a more effective effect in reducing the uniformity of emitter dispersion. Reducing the discharge rate of the Iran drip emitter due to wastewater in reducing the emitter discharge compared to the well water from the other emitters, the difference being significant at 5%. The results show that the Iran drip emitter is in general standard and its discharge rate is constant. The highest and the lowest of discharge decrease in a 4-meter pressure were related to Iran drip and Euro-drip emitters with values 29.4 and 5.6%, respectively. It was concluded that the discharge decrease is the various parameter and changes with the type of water and emitter.

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