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The Use Of Polyethylene Strips For In Stream Treating Of Agriculture Wastewater Drains

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Abstract:

This study aimed to apply a new technique of treatment inside stream using polyethylene sheets strips as a very cheap method for improving the efficiency of agriculture wastewater to meet the irrigation reuse needs. The pilot was built inside Faqous Wastewater Treatment plant held nearby Bahr El Bakar agricultural drain in El Sharqiyah Governorate, Egypt. polyethylene strips were used as instream media treatment where the operation program was made to determine the suitability for applying the polyethylene strips for treatment inside the stream and achieved success in BOD,COD,DO,TSS,HM removal with ratio 46.4, 28,28 ,29, and 23.6%respectively.This showed the success of the polyethylene strips in removal and if the number of polyethylene strips lines will increase and the interval distance between lines increase that gives channel the chance to return to its steady state flow and decrease its velocity and gives better results in removal.

Keywords: Agricultural Wastewater treatment, new treatment techniques, In stream treatment procedure, Artificial bio reactor, Polyethylene strips.

INTRODUCTION

Water means life. In the last decades more countries have water scarcity problems. Every day human beings perform a remarkable variety of activities involve the use of water, often in very large quantities. Water is needed in all industrial activities, in agriculture and for domestic purpose. Average water consumptions vary between 150 l per person per day in some western countries to 400 l per person per day in the USA. In some African countries where serious water shortages, freshwater consumptions are in the range of 20 l per person per day.

The World Health Organization (WHO) recommends a lower limit for survival of 15–20 l per person per day [1], which can guarantee only basic needs such as drinking, food preparation, personal hygiene, and laundry.

The percent of Egypt from Nile River is 55.5 BCM of fresh water; this percent will decrease after Ethiopian dam so finding another source of water is to be a must. Egypt and many countries are thinking about wastewater treatment and desalination of saline water to produce fresh water for reusing it in irrigation and other purpose.

LITTERATURE REVIEW

The selection of the treatment method depends on many factors such as Type of pollution, Characteristics of effluent, Average and peak flows, The required degree of treatment, The amount of treated wastewater required, The Treatment Target, Energy consumption, Operational, maintenance cost, The geography of the land and the served area.

Khalifa, A.K, et al discover that the application of plastic media in his work " Enhancement of The Stream Self-Purification After Wastewater Disposal" at ZENEEN Wastewater Treatment plant west Cairo. Used Plastic media to increase removal of TSS and

BOD efficiency. The tube media achieves higher organics removal because of higher specific surface area, and void ratio. The advantage of use plastic media is it is allowed substantial biological slime growth because of high surface area, improvement of oxygen transfer because of high void spaces and its low weight allows deeper filter [2].

Shireen used plastic media with square shape with thickness of 50,80,120,140 cm with channel width and water depth with variable length between 50, 80, 110 &140cm one for each channel, she concluded that the removal ratio of BOD and COD increased by 88.4 %, and 91%respectively [3].

Mahmoud Abd ElMoemen used the polyethylene strips for preliminary treatment or polishing for the wastewater. his study proved that the values of BOD, COD, TSS and VSS removal ratios were varied according to the surface roughness for the used polyethylene sheets. And Media type (3) which has rough surface granted the best efficiency for BOD, COD, VSS and TSS removal compared with the two other applied polyethylene sheets with smooth surface (Media type (1) and Media type (2)[4].

Zeinab El H3efny et.al, proved the success of the use of agricultural waste (rice husk) as biodegradable media for in stream agriculture wastewater treatment. Also, their study showed that the agricultural waste was the best for this in stream treatment technique compared with plastic media boxes and naturally rotating paddles that applied in their study, technically and financially [5, 6].

This study aimed to apply polyethylene sheet strips as a biodegradable media for enhancing water criteria inside the drain as a cheap methodology.

MATERIALS AND METHODS

The used material (polyethylene strips) for this study was previously used for enhancement the wastewater characteristics of sewage properties at effluent of the wastewater treatment plant in Egypt. The study was carried out on a pilot plant that was constructed by EU research project named “drains water quality enhancement”. The pilot was built inside Faqous Wastewater Treatment plant held nearby Bahr El Bakar agricultural drain in El Sharqiyah Governorate, Egypt. The experimental work was made to determine the suitability for applying the polyethylene strips for treatment inside the stream, and target to determine its efficiency for improving wastewater. Different samples are taken daily to measure BOD, COD, DO, HM, TSS according to standard to the Standard methods for water and wastewater examinations edition 22nd [7]. The samples are taken before putting the polyethylene strips, at the mid between two lines, and after 1meter from the last strip line.

Figures 1,2,3 shows the pilot and the polyethylene sheets strips used for treatment inside pilot channels.

Figure (1) The pilot photo.

Figure (2) Polyethylene sheets strips

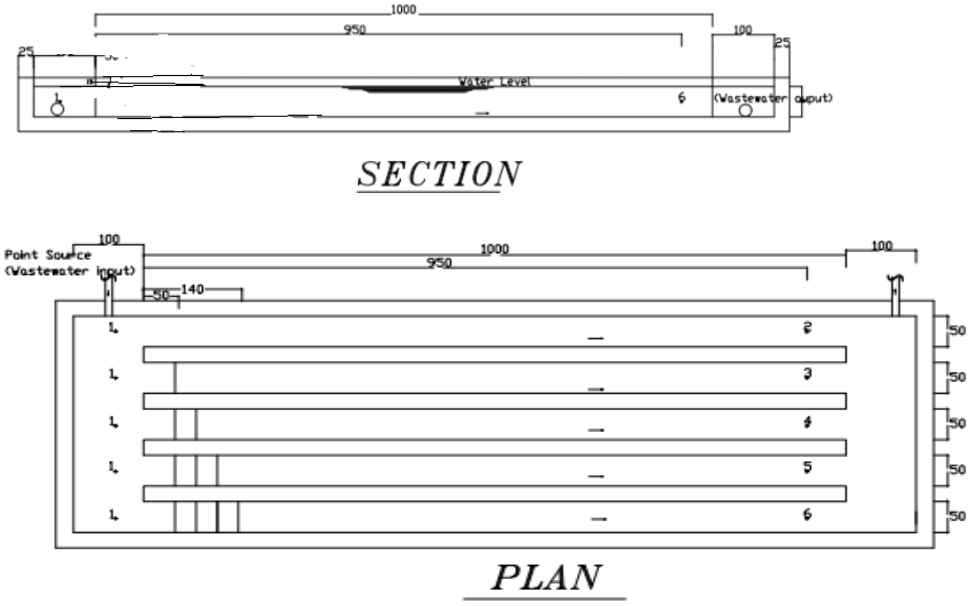

Figure (3) The pilot.

RESULTS

The results of the work done due to the operation of the pilot plant that used the polyethylene strips as bio media reactor in stream during the study period are discussed briefly, considering the changes found in different parameters affecting the removal process of the media.

BOD RESULTS

Table (1) and figure (4) present the strips lines effect on BOD removal along the channel.

Table (1) Average BOD in the five channels

Channel	Distances (m)					
	0	0.5	1			
1	485	485	485			
	Distances (m)					
	0	0.65	1.5			
2	485	404	400			
	Distances (m)					
	0	0.65	1.30	1.80		
3	485	404	355	351		
	Distances (m)					
	0	0.65	0.95	1.60	2.10	
4	485	404	355	295	290	
	Distances (m)					
	0	0.65	0.95	1.25	1.90	2.40
5	485	404	355	305	260	255

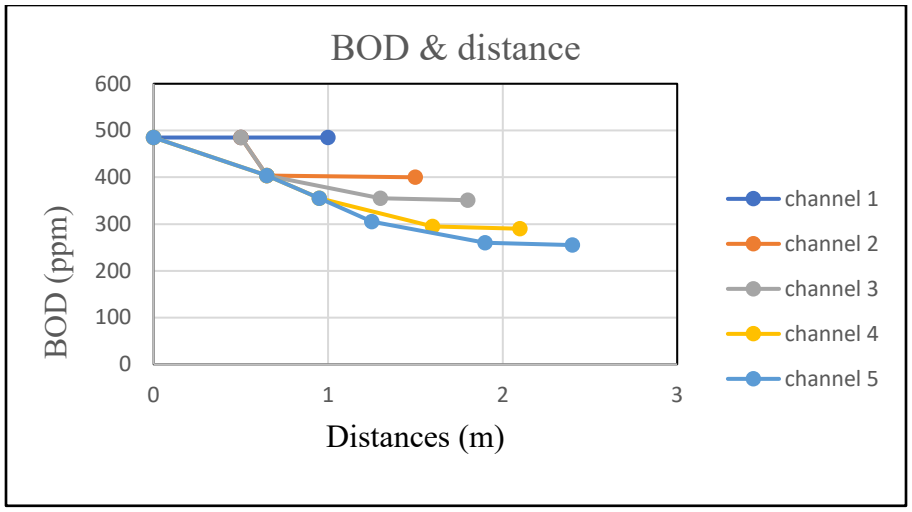

Figure (4) Effect of strips lines on BOD removal along the channel length

COD RESULTS

Table (2) and figure (5) show strips lines effect on COD removal along the channel.

Table (2) Average Results of COD in the different channels

Channel	Distances (m)					
	0	0.5	1			
1	1200	1200	1200			
	Distances (m)					
	0	0.65	1.5			
2	1200	1020	1001			
	Distances (m)					
	0	0.65	1.30	1.80		
3	1200	1020	956	954		
	Distances (m)					
	0	0.65	0.95	1.60	2.10	
4	1200	1020	956	908	903	
	Distances (m)					
	0	0.65	0.95	1.25	1.90	2.40
5	1200	1020	956	908	864	861

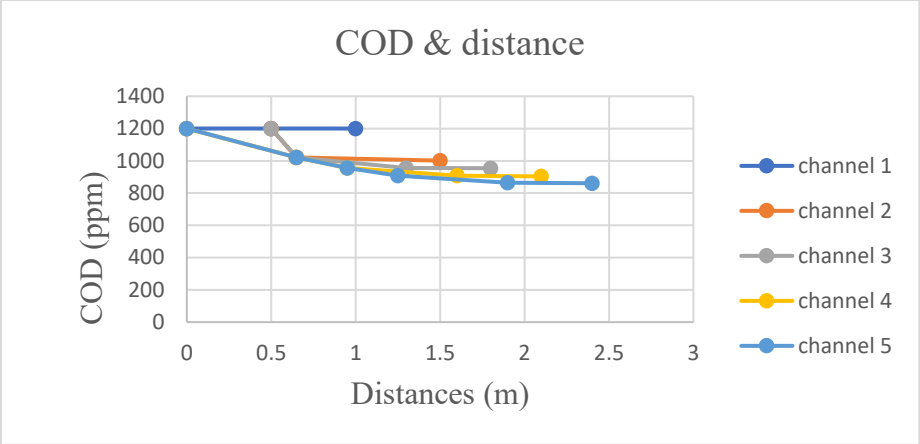

Figure (5) Effect of strips lines on COD removal along the channel length.

DO RESULTS

Table (3) and figure (6) show the effect of strips lines on DO along the channel length.

Table (3) Average Results of DO in the different channels

Channel	Distances (m)					
1	0	0.5	1			
	0.85	0.85	0.85			
2	Distances (m)					
	0	0.65	1.5			
	0.85	1.36	1.33			
3	Distances (m)					
	0	0.65	1.30	1.80		
	0.85	1.36	1.56	1.53		
4	Distances (m)					
	0	0.65	0.95	1.60	2.10	
	0.85	1.36	1.56	1.63	1.60	
5	Distances (m)					
	0	0.65	0.95	1.25	1.90	2.40
	0.85	1.36	1.56	1.63	1.70	1.67

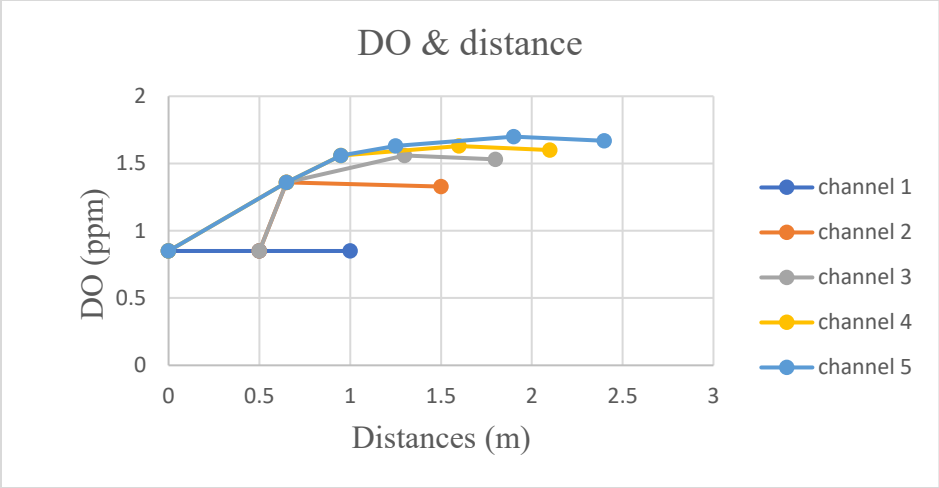

Figure (6) Effect of strips lines on DO along the channel length

HM RESULTS

Table (4) and figure (7) illustrate strips lines effect on HM removal along the channel.

Table (4) Average Results of HM in the different channels

Channel	Distances (m)					
	0	0.5	1			
1	1.27	1.27	1.27			
	Distances (m)					
	0	0.65	1.5			
2	1.27	1.04	1.04			
	Distances (m)					
	0	0.65	1.30	1.80		
3	1.27	1.15	1.03	1.03		
	Distances (m)					
	0	0.65	0.95	1.60	2.10	
4	1.27	1.15	1.06	1.00	1.00	
	Distances (m)					
	0	0.65	0.95	1.25	1.90	2.40
5	1.27	1.15	1.06	1.00	0.97	0.97

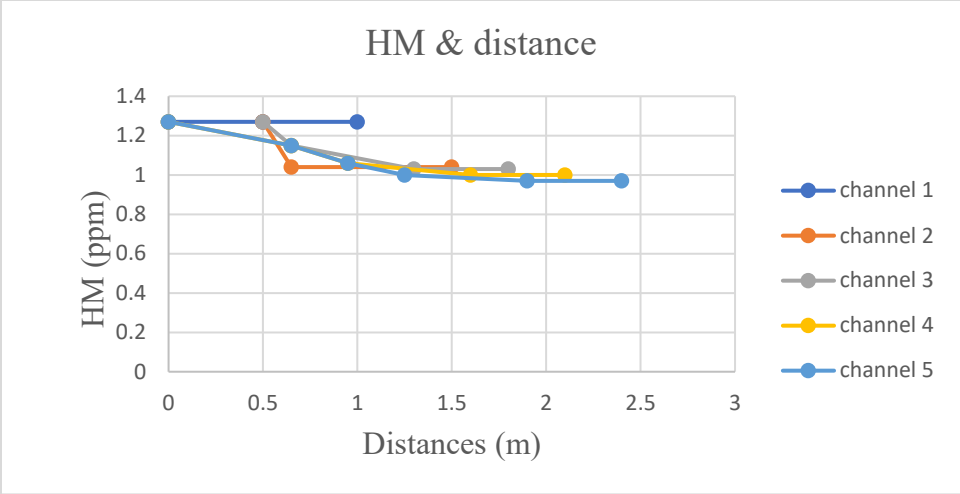

Figure (7) Effect of strips lines on HM removal along the channel length

TSS RESULTS

Table (5) and figure (8) show the effect of strips lines on TSS removal along the channel.

Table (5) Average Results of TSS in the different channels

Channel	Distances (m)					
1	0	0.5	1			
	550	550	550			
2	Distances (m)					
	0	0.65	1.5			
	550	472	467			
3	Distances (m)					
	0	0.65	1.30	1.80		
	550	472	426	421		
4	Distances (m)					
	0	0.65	0.95	1.60	2.10	
	550	472	426	406	401	
5	Distances (m)					
	0	0.65	0.95	1.25	1.90	2.40
	550	472	426	406	391	386

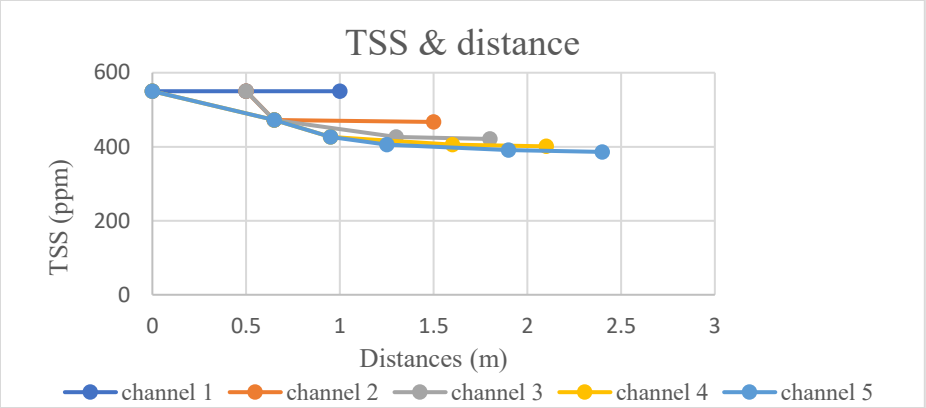

Figure (8) Effect of strips lines on TSS removal along the channel length

DISCUSSION

From the previous results, it was observed that:

- The BOD in the first channel without any polyethylene strips was 485 ppm after putting one line of polyethylene strips the removal ratio was16.7%, then26.8% after two lines, then39%after three lines reached to 46.4%after four lines of polyethylene strips, It was concluded that polyethylene strips had a good efficiency in BOD removal, it was around (13:16%) for each line of strips but with variable ratio between strips lines in different channels because the velocity of the flow increased between strips lines and did not return to its steady state flow in the short distance between strips lines.
- The COD in the first channel without any polyethylene strips was1200 ppm after putting one line of polyethylene strips the removal ratio was15%, then 20.3% after two lines, then 24.3%after three lines reached to 28% after four lines of polyethylene strips, It was concluded that polyethylene strips had a good efficiency in COD removal, it was around 15% for the first line of strips and each line was added increased the removal ratio by 5% .for each line of strips but with variable ratio between strips lines in different channels because the velocity of the flow increased between strips lines and did not return to its steady state flow in the short distance between strips lines.
- The DO in the first channel without any polyethylene strips was0.85 ppm after putting one line of polyethylene strips, it was increased with ratio15%, then 20.3% after two lines, then 24.3%after three lines reached to 28% after four lines of polyethylene strips, It was concluded that polyethylene strips had a good efficiency in BOD and COD removal reached to 46.4% and 28% after four lines of strips which increased DO ratio to 28% ,it was around 15% for the first line of strips and each line was added increased the removal ratio by 5%but with variable ratio between strips lines in different channels because the velocity of the flow increased between strips lines and did not return to its steady state flow in the short distance between strips lines.

- The HM in the first channel without any polyethylene strips was1.27 ppm after putting one line of polyethylene strips, the removal ratio15.7 %, then18.8 % after two lines, then 21.2 %after three lines reached to 23.6% after four lines of polyethylene strips, It was concluded that polyethylene strips had a good efficiency in HM removal, it was around 15.7 % for the first line of strips and each line was added increased the removal ratio by 3% but with variable ratio between strips lines in different channels because the velocity of the flow increased between strips lines and did not return to its steady state flow in the short distance between strips lines.
- The TSS in the first channel without any polyethylene strips was 550 ppm after putting one line of polyethylene strips, the removal ratio was14%, then 22.5% after two lines, then 26%after three lines reached to 29% after four lines of polyethylene strips, It was concluded that polyethylene strips had a good efficiency in TSS removal, it was around 14% for the first line of strips and each line was added increased the removal ratio by 8.5%but with variable ratio between strips lines in different channels because the velocity of the flow increased between strips lines and did not return to its steady state flow in the short distance between strips lines.

CONCLUSION

Polyethylene strips had a good efficiency in agricultural wastewater instream treatment which can remove BOD, COD, DO, TSS, HM with removal ratio 46.4, 28 ,28 ,29, and 23.6% respectively after four lines of Polyethylene strips.

If the lines of strips increased, the efficiency of removal increased but with variable ratio between strips lines in different channels because the velocity of the flow increased between strips lines and did not return to its steady state flow in the short distance between strips lines.

From discussion of the results, it was proved that increasing in number of polyethylene strips lines increased the efficiency of removal. The distance between strips lines should be increased to give a chance to the channel flow to decrease its velocity and reach to its steady state flow and give better results.

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