PHYSICAL TREATMENT OF PETROCHEMICAL WASTEWATER

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ABSTRACT

Statistical study was conducted on the results of sample analysis of about two years from different sources in the petrochemical company. These sources are VCM (Vinyl Chloride Monomer); Chlorine, PVC (Polyvinyl Chloride) and utilities sewers discharge about 1700 m^3/hr into El-Tahreer canal.

Keywords: VCM (Vinyl Chloride Monomer), PVC (Polyvinyl Chloride), Utilities, Separation, Sedimentation, Neutralization, Settler.

INTRODUCTION

Industrial wastewater has been considered as the most important problem for the environment. Discharging industrial wastewater into Nile or Nile branches and canals has been causing health troubles, especially on drinking water. In Egypt, there are thousands of industrial plants discharge dangerous wastewater onto potable surface water. Egyptian Petrochemicals Company in Alexandria is considered one of largest companies in Egypt; it has many sectors and produce large number of petrochemicals products. The objective of this research was evaluation the state of the discharge wastewater and finds the way to decrease its effect on the surface water bodies. In this paper we present the state of wastewater in this company and the pretreatment arrangements as a case study research work. About two years have been spent to collect the data and make analysis to find a reasonable solution to decrease the effect of discharging about 1700 m^3/hr in the water bodies.

EXPERIMENTAL WORK

This study was conducted at the Egyptian petrochemical company, which because of its situation away of the sea and any sewerage system has been facing a problem with discharging wastes. The chlorine, VCM, utility and PVC are the four sectors in this company discharge industrial wastewater of about 1700 m^3/hr. The basic process flow at the plant is shown in Figure (1). Wastewater is discharged into El-Tahreer canal after fast sedimentation in catch basins. Each of four sources has been discharging wastewater with different

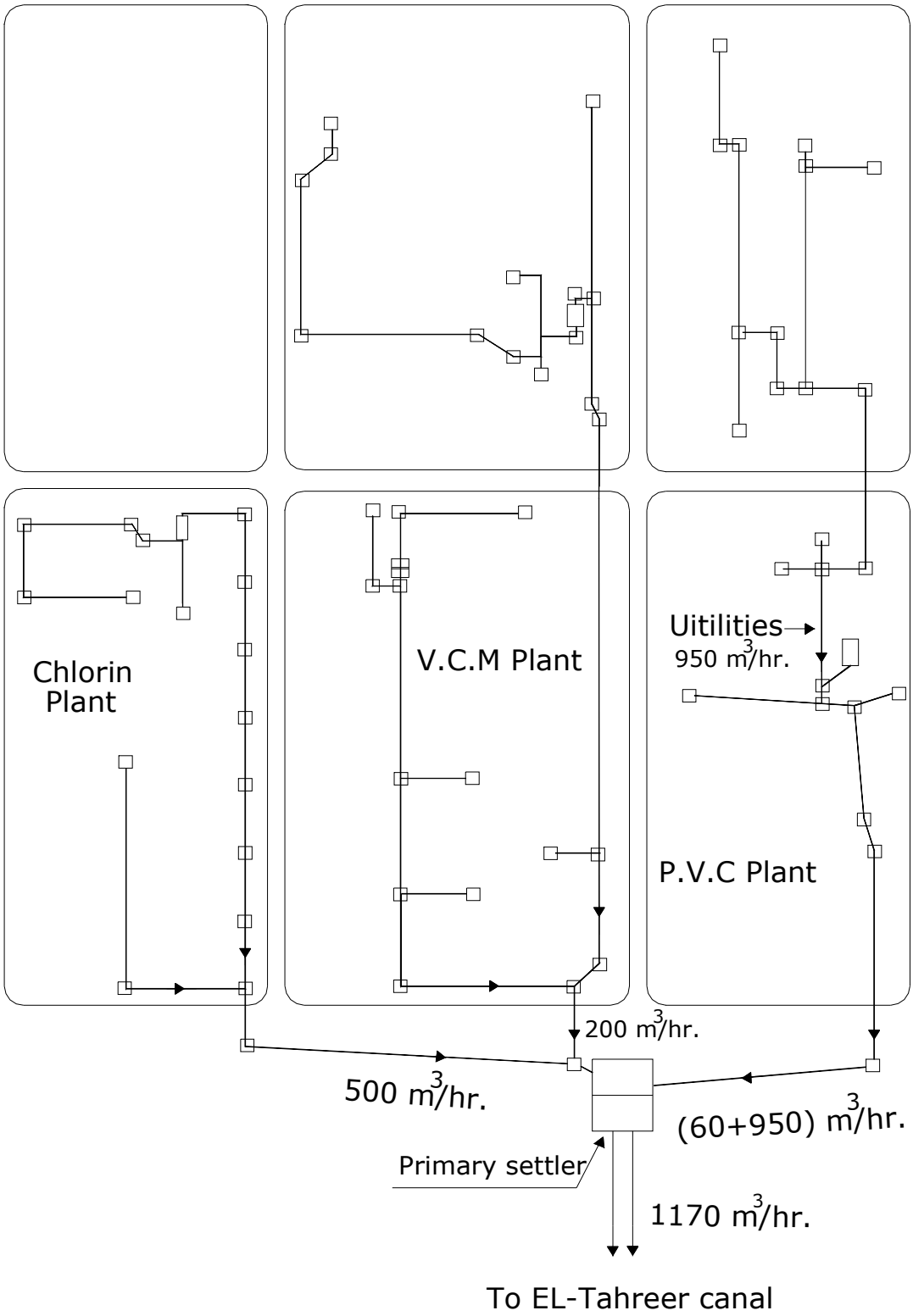


Figure (1). Layout of production area of chlorine ,V.C.M. and P.V.C. with wastewater flow rate m^3/hr.

chemical and physical characteristics. Samples were collected from the general sewer before going to catch basin, (results of analysis are shown in Table (1)). Samples were collected and analyses were done for all parameters according to the Standard Methods [2].

Table (1) Values of parameters in the general sewer

Parameter	Value		Parameter	Value	
	Min.	Max.		Min.	Max.
BOD	2.3	31	T.D.S	3.2	14980
COD	10	1465	No_4	2.0	16.4
pH	3	12.6	No_3-N	5.5	10.7
Oil&Grease	0.00	258	Fluoride	0.4	5.5
Temp.	14	38	Sulfide	0.00	2.6
TSS	11.3	4000	Heavy Metals	0.012	10.3

Pretreatment specific study was required to make a decision about suitable type of treatment or separation of sources before treatment. Sample analysis and statistical study was conducted for about two years to get a clear idea about the plant and the type of treatment to satisfy the EER (Egyptian Environment Requirements) and protect the environment.

RESULTS AND DISCUSSION

This study was done on the effective parameters of law 48/1982 for about two years. Samples were collected regularly from each source but with different number of samples and at different time every week.

The following results show the actual behavior of each source from different sectors. There are four sewers from (PVC) sector, (VCM) sector, Chlorine sector, and Utility sector which discharge about 1700 m^3/day. From Figure (1), and Figures (3, 6) it is shown that there are three sources have flow of about 760 m^3/day, and one source (Utility) has flow of about 950 m3/day. The average values of the parameters show that pH (7.93) and COD (193 mg/l) are higher than values of EER and require a simple treatment. Tables (3, 5 and 6) and Figures (2, 4 and 5) show that concentrations of BOD, TSS and TDS are lower than required values in EER. Figures (2, 3, 4, 5 and 6) show that the wastewater characteristics from VCM and Chlorine are accepted only for BOD and TSS but

they are out of EER for the other parameters.

El-Tahreer canal is classified as non-potable surface water according to law 48/1982. The wastewater goes through this drainage to the Mediterranean Sea. The Egyptian Environment Requirements for this category is shown in Table (2).

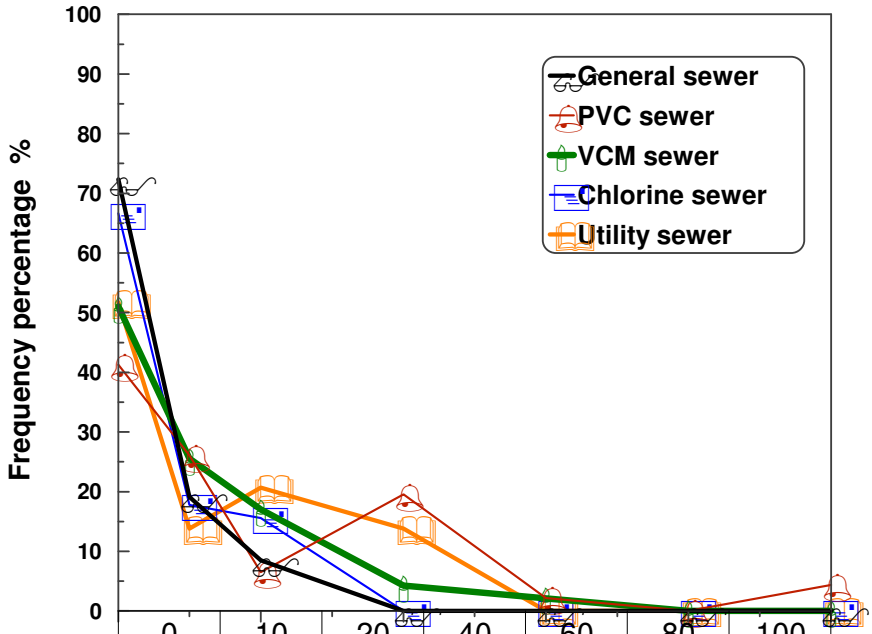
Table (2) EER as law 48/1982

Parameter	Concentration	Parameter	Concentration
BOD (5day, 20°C)	60	T.D.S	2000
COD	100	Po_4	10
pH	6.9	No_{3-}-N	40
Oil & Grease	10	*Fluoride	0.5
Temp. (°C)	35	Sulfide	1
TSS	60	*MPN/100ml	5000

Notes: All units are in mg/l, except pH. (*) Are absent in this waste.

During last period, the petrochemical company had been discharging the four sources together, considering that mexation of utility source with other sources would improve the characteristics of general effluent. Separation of utility source and studying of each other source will give better results and decrease the treatment coast. Separation arrangements of PVC source has been started to treat this waste with settling tank and mix it with water from utility sewer.

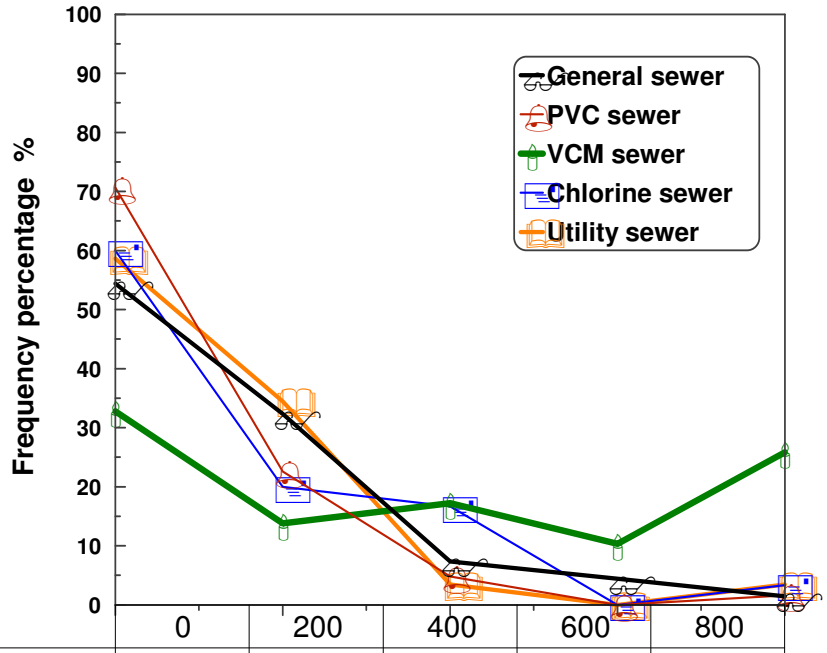
Bench scale study was conducted for utility wastewater with sedimentation arrangement. The results showed that COD concentration decreased to about 110 mg/l. The requirement concentration for discharging into non-potable water bodies is 100 mg/l. Sedimentation tank for PVC sewer with HRT = 1 hr will be enough to decrease COD to accepted level. For the other sources there is a plan to review the pollution sources and prevent it. Bench scale study was conducted to evaluate the COD removal efficiency with sedimentation requirements for COD, TDS and pH specific physical and chemical treatment to decrease values of COD and TDS and neutralize pH.



	0	10	20	40	60	80	100
General sewer	72.34	19.14	8.51	0	0	0	0
PVC sewer	41.3	26.08	6.52	19.56	2.17	0	4.37
VCM sewer	51.06	25.53	17.02	4.25	2.13	0	0
Chlorine sewer	66.67	17.78	15.56	0	0	0	0
Utility sewer	51.72	13.79	20.69	13.79	0	0	0

BOD concentration range mg/l	0 to 10	20 to40	40 to 60	60 to 80	80 to100	>100

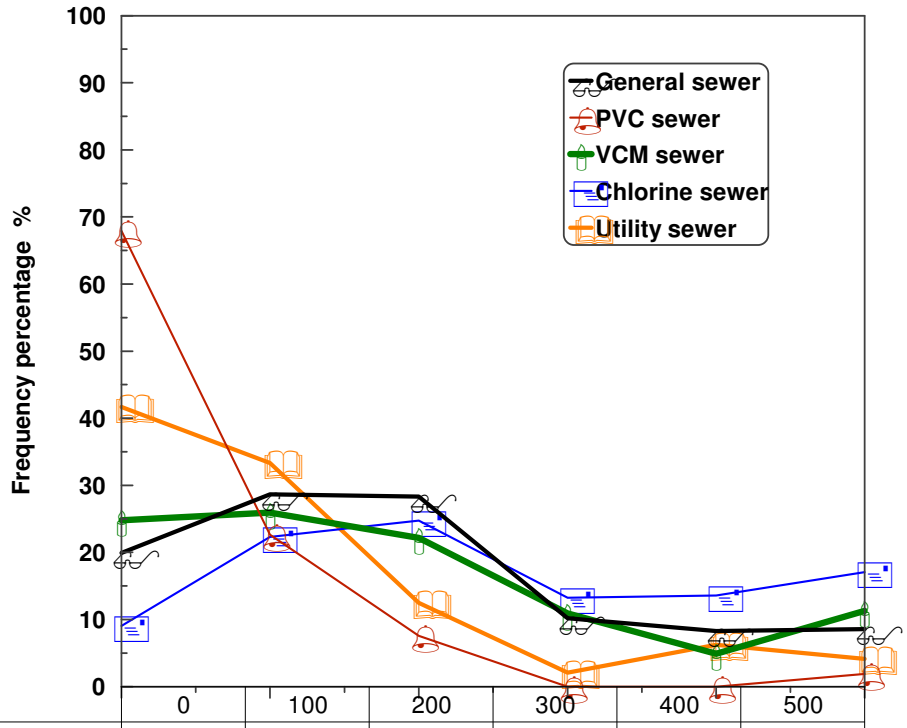
Figure (2): Frequency percentage against range of the concentration of BOD in mg/l



	0	200	400	600	800
General sewer	54.411	32.35	7.35	4.41	1.47
PVC sewer	70.67	22.58	4.84	0	1.61
VCM sewer	32.76	13.79	17.24	10.34	25.86
Chlorine sewer	60	20	16.67	0	3.33
Utility sewer	58.62	34.48	3.45	0	3.45

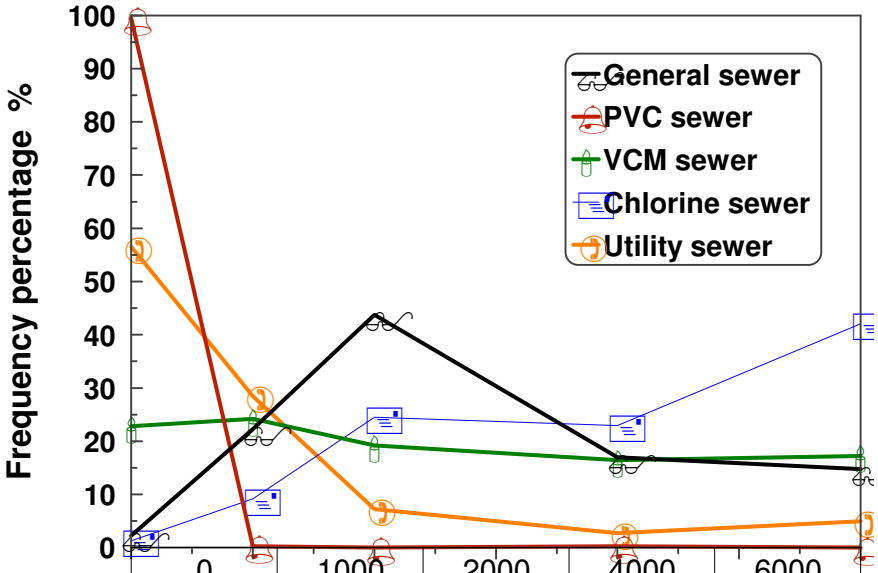
COD concentration range mg/l	0 to 200	200 to400	400 to 600	600 to 800	>800

Figure (3): Frequency percentage against range of the concentration of COD in mg/l



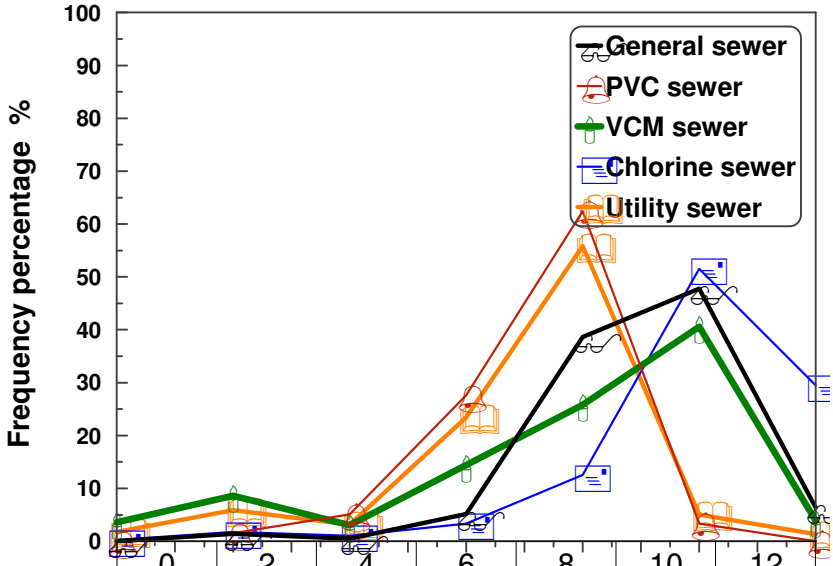
TSS concenteration range mg/l	0 to 50	50 to100	100 to 200	300 to 400	400 to500	> 500
General sewer	19.92	28.66	28.34	10.19	8.28	8.6
PVC sewer	67.92	22.64	7.55	0	0	1.89
VCM sewer	24.81	25.93	22.19	10.9	4.88	11.28
Chlorine sewer	9.06	22.3	24.73	13.24	13.58	17.07
Utility sewer	41.66	33.33	12.5	2.08	6.25	4.16

Figure (4): Frequency percentage against range of concentration of TSS in mg/l



	0	1000	2000	4000	6000
General sewer	2.25	22.25	43.75	17	14.75
PVC sewer	99.49	0.26	0	0.26	0
VCM sewer	22.84	24.23	19.22	16.43	17.27
Chlorine sewer	1.28	9.18	24.49	22.96	42.09
Utility sewer	56.56	28.5	7.24	2.71	4.98
TDS range in mg/l	**0 to 1000**	**1000 to 2000**	**2000 to 4000**	**4000 to 6000**	**>6000**

Figure (5): Frequency percentage against range of concentration of TDS in mg/l



General sewer	0	1.4	0.49	5.17	38.67	47.78	6.4
PVC sewer	0	1.53	5.11	27.62	62.4	3.33	0
VCM sewer	3.61	8.61	3.06	14.44	25.83	40.56	3.89
Chlorine sewer	0.26	1.79	1.03	3.33	12.56	51.53	29.49
Utility sewer	1.8	5.86	3.153	23.42	55.86	5.04	1.35
pH range	0 to 1.99	2 to 3.99	4 to 5.99	6 to 7.99	8 to9.99	10 to11.99	>12

Figure (6): Frequency percentage against values of (pH)

CONCLUSION

Pretreatment study on the wastewater from different sewers in the petrochemical industrial plant was very important to get a simple and effective conception about the treatment. Separation and individual treatment for each source was a good alternative against treatment full quantity after mixing of different sources. Statistical study gave a clear idea about the actual conditions of wastewater and its characteristics.

ACKNOWLEDGMENT

I acknowledge the chemist and civil engineers at the Petrochemical Company who supported this study for about two years to save our environment.

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