

CHEMICAL TREATMENT OF WASTEWATER FROM FERTILIZER INDUSTRY

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ABSTRACT

Segregation and treatment of the washing water from the scrubbing towers via chemical coagulation - sedimentation using lime , lime aided with a non - ionic polymer , ferrous sulfate and / or ferric chloride in combination with lime were investigated . The results obtained indicated that chemical treatment is very efficient in removing fluoride , phosphorous and suspended solids , Average phosphate and fluoride removal values were 98% and 99% respectively, with corresponding average residual values of 2.3 and 9.0 mg / L . Also , 97.5 % of the suspended solids was removed while the average residual value was 19 mg / L .

INTRODUCTION

One of the major sources of water pollution in Egypt is industrial effluents . Industrial pollution can destroy commercial fishing , ruin public water supplies , creat aesthetic disasters , and threaten the public health (1) .

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In Rosetta branch of the Nile River a fertilizer plant which produces single superphosphate fertilizer and sulfuric acid discharges 20,000 m³ / d wastewater directly to the river without treatment .

Wastewater produced from phosphoric fertilizers, is normally acidic and contains phosphates, silicates, fluoride and high concentration of total dissolved and suspended solids (2 - 4) .

The most hazardous effect of fluoride bearing wastes is observed when a river water contaminated with the waste is used for domestic supplies . While fluoride up to 1 mg / L has been found to be necessary in drinking water to prevent decay of teeth , concentrations greater than 1.5 mg / L have been reported to cause dental fluorosis or " mottled teeth " (3) . However , it has been reported that industrial effluents containing fluorides up to 10 mg / L have detrimental effect on soil and plants , when used for irrigation purposes (2,5) . Also , the presence of phosphate is conducive to the growth of algal bloom . It is known that the minimum requirement of nitrate (as N) is only 0.08 mg / L and phosphorous (as PO₄) is even less , of the order of 0.015 mg / L. Thus the discharge of wastes containing these substances will create eutrophication problems in the receiving water bodies . Also , it is recognized that a soil should not receive continued application of nutrients rich water since excessive accumulation of the nutrients in the soils would in the long run , adversely affect the crops .

Therefore , the aim of this work is the reduction of pollution load produced from such fertilizer plant to final discharge .

MATERIAL AND METHODS

Manufacturing process in the plant

The company produces both sulfuric acid and single superphosphate fertilizer as main products, sodium fluosilicate and ferrous sulfate as - by products. The acid unit is essential not only for the basic sulfuric acid raw material but also for superphosphate production to produce steam for operation of vacuum evaporation equipments.

A) Manufacturing process of sulfuric acid

The raw material used is elemental sulphur which can be changed to sulphur dioxide. The sulphur dioxide is oxidized to sulphur trioxide, which combines with water to yield sulfuric acid. The oxidation of SO_2 to SO_3 is performed by the catalytic "contact" action of vanadium oxides. Figure (1) is a schematic diagram of the manufacturing process of sulfuric acid.

B) Manufacturing process of single superphosphate fertilizer

The two raw materials used in the production of normal superphosphate are 65 - 75% H_2SO_4 and grinding rock (apatite). During the reaction CO_2 , HF are released. Which make the rock porous. The porosity of the rock helps in subsequent curing.

Carbon dioxide is liberated because of limestone impurities in the rock and hydrogen fluoride because of calcium fluoride.

Some of the hydrogen fluoride attacks the silica impurity in the

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rock, resulting in the production of silicon tetrafluoride gas. The three gases CO_2 , HF and SiF_4 are sucked gently into a scrubbing tower. Silicon tetrafluoride further reacts with cold water to form the fluosilicic acid (an insecticide) H_2SiF_6 . This is the normal operation (open circuit technique). In case of the production of sodium fluosilicate, the effluents from the scrubbing towers are recycled several times until the concentration of the formed acid reaches 15 baumé (closed circuit technique). This technique is done only in the factory from time to time according to the needs of the market. In closed circuit the 15 baumé H_2SiF_6 is treated with sodium chloride and utilized to produce sodium fluosilicate, a preservative for portland cement surfaces and gives a smooth surface for tiles and ceramic product. The overall manufacturing process is shown in figure (2).

Sources of Wastewater in the Company

There are two production units in the company, the superphosphat and sulfuric acid units. In superphosphate departement there are two sources of wastewater which are; cooling water from the sulfuric acid dilution unit, and the wastes from the scrubbing towers. The cooling water which amounts to $150\text{m}^3 / \text{hr}$, is relatively clean, and discharged to the Nile River through the drainage system. The wastewater from the three scrubbing towers ($30\text{m}^3 / \text{hr}$) is discharged to the drainage system in case of the open circuit operation. When sodium fluosilicate is to be produced, closed system is applied. Accordingly, only $15\text{m}^3 / \text{bath}$ is produced and discharged to the drainage system as a shock load.

Wastewater produced from the sulfuric acid production unit is mainly cooling water (250 m³ / hr) and is discharged also to the River Nile . Table (1) illustrates the different sources of wastewater in the company

Table 1 . Sources of wastewater in the company

Source of wastewater	Quantity m ³ / hr
<u>Sulfuric acid unit</u>	
Cooling water (2 open circuits) and boiler blowdown	250.00
<u>Superphosphate unit</u>	
1. Cooling water (open circuit)	100.00
2. Washing of scrubbing towers	28.00
3. Boilers blowdown	50.00

Collection of Samples

Due to the great variations in the quality of wastewater produced from the plant , composite samples from the final effluent of the superphosphate unit , washing water from the scrubbing towers and cooling water from the same department were collected . This was carried out to give close representation of the quality of the effluent as it is influenced by the daily operation .

Analysis

The physico - chemical characteristics covered the following :

PH , electric conductivity (E.C) , total solids at 105°C (T.S), fixed residue at 550°C , total suspended solids at 105°C (TSS), turbidity (NTU) , total phosphate (T.P) , silicates (SiO₂) , chlorides (CL-) , calcium (Ca²⁺) , fluoride (F-) and sulfate (SO₄--) . The analysis , were carried out according to the APHA methods (6) .

Treatability Studies

Pendent on the plant survey it was found that the main source of pollution in the company is attributed to wastewater from the scrubbing towers . Therefore , segregation and treatment of washing water from the scrubbing towers were carried out (4,7) .

Chemical coagulation - sedimentation

Chemical coagulation - sedimentation was investigated using different coagulants . The chemical coagulants used were lime , lime aided with non - ionic polymer "Nalco 600" , ferrous sulfate and / or ferric chloride in combination with lime . "Jar test" scale treatments were performed to gain information about the optimum conditions of each coagulants under investigation . For the same coagulant the experiments were repeated 4 to 5 times for the wastewater collected at different dates and over a period of six months .

Physico- chemical analyses of the treated effluent , at the pre-determined optimum conditions , were carried out . Moreover , sludge analysis was performed for each run .

RESULTS AND DISCUSSION

Characterization of Wastewater from the Superphosphate Unit

The final effluent from this department is a mixture of cooling water and washing water (process water) from the scrubbing towers . Variations in the physico - chemical parameters of final effluent of the superphosphate production unit is recorded in Table (2) . Complete analysis of the segregated washing water from scrubbing towers indicated that it is the main source of pollution .

The results obtained in Table (2) and Figure (3) indicated a wide variation in the wastewater characteristics in terms of fluoride , silicate and phosphate contents . The data also showed that the wastewater is highly acidic . The pH value varied from 0.7 to 2.06 . Moreover , the wastewater contains a high concentration of phosphate which reached 308 mg / L with an average value of 107 mg / L. The major pollutant in this wastewater is fluoride and its concentration varied from 80-13500 mg / L according to the daily operation. Suspended solids content was as high as 1227 mg / L , while , the waste contains also considerable concentration of dissolved solids which represent 71.4% of the total residue on an average basis . From the previous results , it can be seen that wastewater from the scrubbing towers are highly contaminated with inorganic pollutants . These results are in the normal range of wastewaters produced from a typical fertilizer plants (3) .

Analysis of cooling water discharged from the superphosphate

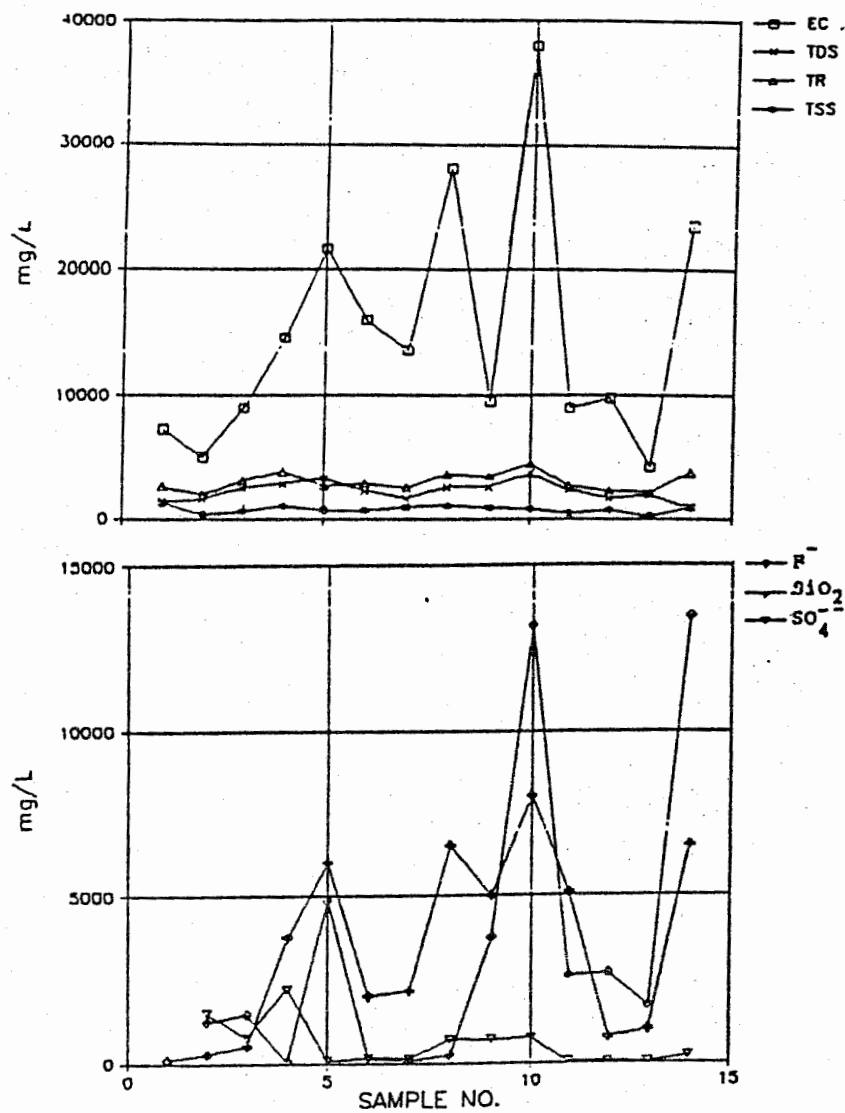


Figure (3) Variation in selected parameters of wastewater from scrubbing towers.

unit is recorded in Table (3) . The results obtained indicated that the pH was almost neutral , while the electric conductivity value ranged between 200-600 $\mu\text{mho} / \text{cm}$ with an average value of 408 $\mu\text{mho} / \text{cm}$. The average values of total solids , silicate and phosphates were 514 , 10.0 and 1.2 mg / L , respectively . These results are in the normal ranges of boiling blowdown contaminants (2) .

Table (2) Characterization of wastewater from the plant

Parameters mg /L	Wastewater from scrubbing towers		Wastewater from superphosphate unit	
	Range	Average*	Range	Average*
pH- value	0.7-2.06	-	2.37-2.81	-
Turbidity (NTU)	55-442	205	-	-
E.C $\mu\text{mho} / \text{cm}$	4200-38000	14925	1900-3300	2548.0
T.R	1891-4460	3117	872-1364	1088.0
T.D.S	917-3674	2226	723-1155	988.0
T.S.S	182-1227	705	31-243	100.0
T.P	25-308	107	10.8-90	36.5
F ⁻	80-13500	3257	-	-
SiO ₂	120-8000	3408	8.5-363.6	154.2
SO ₄ ²⁻	28-2200	528	N.D-420	108.0

* Average of twenty runs .

N.D : Not detected .

Table (3) Characterization of wastewater from the plant

Parameters mg /L	Samples Cooling water from sulfuric acid unit		Cooling water from superphosphate unit	
	Range	Average*	Range	Average*
pH- value	7.0-8.06	-	6.89-7.01	-
E.C $\mu\text{mho} / \text{cm}$	480.0-2000	1231.00	200 -600	408.00
T.R	336.0-1573	1083.00	339 -1114	513.60
T.D.S	205.5-1209	861.00	335 -1062	486.00
T.S.S	15.5-610	178.00	23.00-63.00	37.25
T.P	0.8-6.40	2.35	0.50-2.00	1.16
SiO ₂	6.5-49.10	25.30	4.80-17.50	10.21
SO ₄ ²⁻	31.1-66.00	55.30	15.00-52.80	31.10
Cl ⁻	50.0-520.0	271.4	42.50-264.00	260.00
F ⁻	N.D	N.D	N.D-1.60	0.30

* Average of twenty runs .

N.D : Not detected .

It was found necessary to analyze the other cooling water in the plant i.e. , cooling water from sulfuric acid production unit . Cooling water discharged from this unit is basically from two open circuits ; cooling water boiler blowdown and closed loop Cooling tower blowdown . The results obtained in Table (3) indicated that this water is relatively clean and the only contaminant is the dissolved inorganic salts which is represented by the electric conductivity . It ranged between 840 and 2000 $\mu\text{mho} / \text{cm}$ with an average value of

1231 $\mu\text{mho} / \text{cm}$. This value may be attributed to the use of ground water in combination with Nile water as a source of cooling water in this unit . Average concentrations of chloride , silicate , and sulfate were 271,25 and 55 mg / L , respectively

Treatment of wastewater from the Superphosphate Unit

Segregation and treatment of washing water from the scrubbing towers was carried out .

A) Use of lime

The results obtained from different runs showed that the optimum pH was around 9.3 ± 0.2 . and lime dose is ranging between 17.2 and 19.5 g / L was required . The data obtained in Table (4) showed that the use of lime was effective in removing fluoride , phosphate , and suspended solids . Average phosphate and fluoride removal values were 97.6% and 99%, respectively , with corresponding average residual values of 2.3 and 9 mg / L .

These results are similar to that obtained by Arora (3) and Vinay et al . (1) in which they obtained more than 95% removal of fluoride via chemical coagulation sedimentation using lime and calcium carbonate as coagulants .

B) Use of lime aided with Nalco

In an attempt to improve the efficiency of the treatment process , the non - ionic polymer "Nalco", was used in combination with lime .

Table (4) Average results of the chemically treated effluent using lime at optimum conditions.

Parameters mg / L	Samples		
	Raw	CTE**	%R
Turbidity (NTU)	182.000	2.470	98.60
E.C. x 10 ³ (µmho / cm)	19.000	1.925	89.80
COD	48.200	22.850	52.50
T.R 105°C	2963.000	1775.000	40.10
T.D.S 105°C	2178.000	1750.000	19.37
T.S.S 105°C	789.000	19.300	97.50
Sett. Solids < 10'	0.625	N.D	100.00
	30'	N.D	100.00
T.P.	99.000	2.300	97.60
F-	1322.000	9.700	99.30
SiO ₂	4602.000	62.600	98.60
SO ₄	809.000	5.830	99.30
Sludge Analysis			
Sludge volume ml / L		245.000	
Total weight g / L 105°C		29.700	
Inorganic weight g / L 550°C		18.360	

*Average of four results

** Chemically treated effluent

Different doses of Nalco is ranging between 0.125 and 0.75 mg /L were used with a constant dose of lime (19.0 g /L) and at pH 9.0. The results obtained in Table (5) tend to show that the use of Nalco slightly improved the removal of fluoride. The residual concentration of fluoride was 9.7 mg /L when lime was used alone, (Table 4) , while it decreased to 9.0 mg / L when lime was aided with 0.25 mg

/L Nalco .

Table (5) Average* results of the chemically treated effluent using lime (19 g/L) aided with NALCO (0.25 mg/L) at optimum conditions.

Parameters mg / L	Samples		
	Raw	CTE**	%R
E.C. x 10 ³ (µmho / cm)	19	1.500	92.10
T.R 105°C	2963	1493.000	49.60
T.D.S 105°C	2178	1477.000	32.18
T.S.S 105°C	786	16.500	97.90
T.P.	99	2.180	97.80
F-	1322	9.000	99.00
SiO ₂	4602	119.37	97.40
<u>Sludge Analysis</u>			
Sludge volume ml / L		252.500	
Total weight g / L 105°C		36.412	
Inorganic weight g / L 105°C		24.970	

*Average of four results

** CTE: Chemically treated effluent

C) Use of ferrous sulfate with lime

Due to the availability of ferrous sulfate as a by - product in the company , it was used as a coagulant , while lime was used as a coagulant aid and to raise the pH of the wastewater . Both Ca²⁺ and Fe²⁺ acted simultaneously as coagulants . The results obtained in Table (6) indicated that 19 g/L of lime was required to raise the pH

to ≈ 10 . Average dose of ferrous sulfate which produced the maximum phosphorous and fluoride removals was 0.76 mg / L. The average percentage removals of fluoride and phosphate were 99% and 98%, respectively, with corresponding residual values of 11 and 1.9 mg / L.

Table (6) Average* results of the chemically treated effluent using ferrous sulphate (0.76 g / L) with lime (19 g / L) at optimum conditions.

Parameters mg / L	Samples		
	Raw	CTE**	%R
E.C. x 10 ³ (μmho / cm)	19.0	1.70	91.00
COD	48.2	14.95	68.90
T.R 105°C	2963.0	2049.00	30.80
T.D.S 105°C	2178.0	1965.00	9.70
T.S.S 105°C	786.0	84.00	89.30
T.P.	99.0	1.93	98.00
F ⁻	1322.0	11.00	99.20
SiO ₂	4602.0	81.00	98.23
SO ₄ ²⁻	809.0	19.95	97.50
<u>Sludge Analysis</u>			
Sludge volume ml / L		215.00	
Total weight g / L 105°C		31.20	
Inorganic weight g / L 105°C		17.10	

*Average of four results

** CTE: Chemically treated effluent

D) Use of ferric chloride in combination with lime

From the Literature (8) , it is known that coagulation with the trivalent metallic coagulant (Fe^{3+}) can be carried out at two optimum pH - values . One in the acidic side tends to range from 4 - 5 , and the other falls in the alkaline range and extends from 8 - 10 .

Since the aim of this treatments is the removal of both fluoride and phosphate in one step , coagulation was carried out in the alkaline side . Calcium oxide has been used to control the pH of the wastewater to the desired value and the same time it acted as a coagulant aid . The best removal values of fluoride and phosphate were achieved pH \approx 8.5 , and with an average dose of 0.65 g/L $\text{FeCl}_3 \cdot 6\text{H}_2\text{O}$. Pendent on the predetermined optimum conditions , complete analysis of the chemically treated effluent was carried out (Table 7) .

Comparisons between the efficiency of the chemical treatment using different coagulants

Chemical coagulation - sedimentation of washing water from scrubbing towers achieved significant removals not only for fluoride and phosphorous , but also for particulate matters . The results obtained in Table (8) showed that the efficiency of using different coagulants are almost the same . The average removal values of fluoride , phosphorous , and suspended solids were 90% , 98% and 96.7% respectively .

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Table (7) Average* results of the chemically treated effluent using ferric chloride (0.65 g / L) lime (19.23 g / L) at optimum conditions.

Parameters mg / L	Samples		
	Raw	CTE**	%R
E.C. x 10 ³ (µmho / cm)	19	1.95	89.70
T.R 105°C	2963	1801.00	39.20
T.D.S 105°C	2178	1838.00	15.60
T.S.S 105°C	786	29.50	96.20
T.P.	99	5.50	94.40
F ⁻	1322	9.8	99.30
SiO ₂	4602	88.60	98.07
Sludge Analysis			
Sludge volume ml / L		262.50	
Total weight g / L 105°C		35.30	
Inorganic weight g / L 550°C		21.70	

*Average of four results

** CTE: Chemically treated effluent

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Table (8) Efficiency of chemical coagulation sedimentation using different coagulants .

Parameters									
Coagulants	pH value	T.P		F ⁻		TR		S.S	
		mg/L	%R	mg/L	%R	mg/L	%R	mg/L	%R
Raw wastewater		99.00	-	1322.00	-	2963	-	786.0	-
Lime (18.5g/L)	9.3±0.3	2.30	97.7	9.10	99.3	1775	40.1	19.3	97.5
Lime + NALCO (18.5 g/L + 0.25 mg/L)	9.00	2.18	97.8	14.72	98.8	1493	49.6	16.5	97.9
Lime + FeSO ₄ .7H ₂ O (19g/L + 0.76 g/L)	8.64	1.93	98.1	11.00	99.2	2049	30.8	84.0	89.3
Lime + FeCl ₃ .6H ₂ O (19.23 g/L + 0.65 g/L)	8.50	5.50	94.4	9.70	99.3	1801	39.2	29.5	96.2

Table (9): Characterization of treated effluent after mixing with cooling water from different departments .

Parameters	T.P	F ⁻	T.P	S.S
mg/L	0.33	0.5	190.8	13.3

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CONCLUSION

The selection of a recommended coagulant depends primarily on its availability in the local market , simplicity of handling and operation , and its economical aspects . Also , the quantity and quality of the sludge including the possibility of its reuse should be considered .

Among the above mentioned coagulants , lime is recommended for the treatment of wastewater from the fertilizer plant under consideration . The treated effluent can be discharged safely into the sewerage network .

Moreover , the sludge produced after treatment was a huge quantity to be disposed . Therefore , the possibility of its reused with the phosphate are in the production of the phosphate fertilizer was recommended .

In case of discharging the treated wastewater into surface water, it should be subjected to further treatment to satisfy the National regularity standards for wastewater disposal into surface water as shown in Table (9) . These standards specified that , fluoride , phosphate and suspended solids in the final effluents should not exceed 0.5 mg/L , 1.0 mg/L , and 30 mg/L , respectively . Cooling water is clean and should be reused .

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REFERENCES

1. Vianny Singh , Ram Narain and Chandra Prakash (1987) : Fluoride in irrigation waters of Agra District, Uttar Pradesh Water Res. , Vol . 12 , No. 8 , pp. 889 - 890 .
2. Sittig Marchal (1979) : Fertilizer Industry Processes Pollution , Control and Energy Conservation . Noyes - Data Corporation Chemical Technology Review 123 , jan . 15 Published in The United States of America by Noyes Data Corporation Noyes Building .Park Ridge , NJ 07656 .
3. Arora , H . C . and Chattopadhyya , S . N . (1974) : " A Study on the Effluent Disposal of Superphosphate Fertilizer Factory " . Indian J., Environ . Health ., Vol . 16 , No. 2 , 140 - 150 .
4. Schoeman , J.J.; Buys , I.J.M. ; Suchtte , I.B. and Macleod, H.(1988) : " Pilot Investigation on the Treatment of Fertilizer Manufacturing Process Effluent Using Lime and Electrodialysis Reversal " .Elsevier Science Publisher , B. V . , Amsterdam . Printed in the Netherlands .
5. Helaly , A . and Abou - Elela , S.I. (1972) : "Protection of Surface Water from Eutrophication via Controlled Release of phosphate Fertilizer" . Journal of Controlled Release , 12 (39 - 44) .
6. American Public Health Association (1989) : "Standard Methods for The Examination of Water and Wastewater " . 17th ed.,

Sohair and Hala El-Kamah.

Washington , DC.

7. Schoeman , J .J. and Macleod , H. (1987) : "The Effect of Particle Size and Interfering Ions on Fluoride Removal by Activated Alumina " . Water S. A . , 14 (4) , 229 - 234 .
8. Eckenfelder , V.W.Jr. (1989) : " Industrial Water Pollution Control " . 2nd Ed . McGraw _ Hill International Editions . Civil Engineering Series .

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المعالجة الكيميائية للمخلفات السائلة لمصنع الأسمدة الفوسفاتية بمدينة كفر الزيات

يعتبر نهر النيل المصدر الرئيسي لمياه الشرب في مصر ، بجانب استخدامه في الأغراض المختلفة مثل الزراعة والصناعة ، لذا فإن الحفاظ عليه من أى تلوث يعتبر مسئولية قومية ملحه يجب أن تتكاتف من أجلها جميع الجهات المعنية بالبيئة سواء كانت جهات بحثية أو تخطيطية أو تنفيذية .

ورغم اصدار القوانين والتشريعات الخاصة بحماية نهر النيل وفروعه من التلوث (القانون رقم ٤٨ لسنة ١٩٨٢) ولائحته التنفيذية المعدلة برقم ٨ لسنة ١٩٨٣ إلا أن كثيرا من المخلفات الصناعية والادمية تلقى بدون أى معالجة فى جسم النهر .

وتعتبر مدينة كفر الزيات بمحافظة الغربية ، من المناطق الصناعية الهامة فى جمهورية مصر العربية والتي يتم القاء مخلفات مصانعها فى نهر النيل عند فرع رشيد .

ويهدف هذا البحث إلى إيجاد أنسب الطرق فنياً واقتصادياً لمعالجة المخلفات الناتجة عن الشركة المالية والتي تنتج سعاد السوبر فوسفات .

معالجة المخلفات الصناعية السائلة للشركة المالية .

تعتبر صناعة الأسمدة الفوسفاتية من الصناعات الكيميائية التي ينجم عنها مخلفات سائلة غير عضوية تتصف بحامضيتها العالية واحتواها على تركيزات كبيرة من الفلوريدات ، الفوسفات ، السيليكات ، والمواد الصلبة الكلية ، كذلك المواد العالقة .

ومن المعروف أن إلقاء مثل هذه المخلفات مباشراً وبون معالجة فى المسطحات المائية لها تأثيرها السلبي على الحياة المائية بوجه عام وعلى الإنسان بوجه خاص .

وتنتج الشركة حمض الكبريتيك وسماذ أحادي السوبر فوسفات كمنتج أساسى بجانب كبريتات الحديدوز وفلوسيليكات الصوديوم والأسمدة الورقية كمنتج إضافى . وينتج عن عمليات التصنيع المختلفة للشركة مخلفات صناعية سائلة تقدر كمياتها بحوالى ٢٠٠٠٠ م^٣ / اليوم تلقى فى مياه نهر النيل مباشرة بدون أى معالجة .

ومن المسح الميدانى للوحدات الإنتاجية المختلفة بالشركة والنتائج المتحصل عليها وجد أن مصدر التلوث الرئيسى هو مياه غسيل الأبراج من وحدة إنتاج السوبر فوسفات وينتج عن هذه الوحدة حوالى ٣٠ م^٣ / ساعة ، هذا بجانب ١٠٠ م^٣ / ساعة مياه تبريد من نفس الوحدة أما وحدة حمض الكبريتيك فينتج عنها مياه تبريد نظيفة إلى حد كبير وتقدر بحوالى ٢٥٠ م^٣ / ساعة .

وقد تم فصل مياه الوحدة المسببة للتلوث ومعالجتها كيميائياً بواسطة التخثير والترويب باستخدام أنواع مختلفة من المجلطات مثل الجير الحى ، الجير الحى مع كبريتات الحديدوز ، الجير الحى مع كلوريد الحديدك ، أو الجير الحى مع النالكو .

ولقد تمت الدراسة بطريقة معملية استاتيكية .

وأوضحت النتائج المتحصل عليها أن استخدام الجير الحى ذو فاعلية عالية فى إزالة الملوثات المعنية حيث وصلت نسبة الإزالة للفلوريدات ، الفوسفات ، والمواد العالقة إلى ٩٩٣٪ ، ٩٧٧٪ ، ٩٧٥٪ على التوالى وحيث أن المخلف شديد الحامضية فإن ذلك استلزم استهلاك كمية كبيرة من الجير الحى الذى أدى فى النهاية إلى تكوين كمية هائلة من الحماء التى يصعب التخلص منها .

ومما سبق يتضح أن نوعية المخلف المعالج تتفق والمعايير المنصوص عليها فى القانون رقم ٩٣ لسنة ١٩٦٢ للصرف على شبكة الصرف الصحى .

أما فى حالة صرف المخلف المعالج على المسطحات المائية فإنه يلزم تخفيف تركيز الفلوريدات الموجودة بعد المعالجة وذلك بخلطه بمياه التبريد من وحدة السوبر فوسفات

ووحدة حمض الكبريتيك النظيفة لحد كبير مما ينتج عنه تخفيف المخلف النهائي وبذلك يتفق مع المعايير المنصوص عليها في القانون ٤٨ لسنة ١٩٨٢ ، حيث وصلت تركيز المواد الصلبة الكلية إلى ١٩٠.٨ مجم / لتر والمواد العالقة الكلية إلى ٣ ر ١٣ مجم / لتر كما وصلت نسبة تركيزات كل من الفوسفات والفلورايد إلى ٣٣ ر ٠ مجم / لتر و ٥٠ ر ٠ مجم / لتر .

ومما سبق يتضح أن أنسب طريقة لمعالجة المخلفات الصناعية السائلة للشركة المالية هو فصل المخلف المسبب للتلوث (غسيل الأبراج) من وحدة السوبر فوسفات ومعالجتها كيميائياً باستخدام الجير الحى مع خلط الناتج النهائى المعالج بجميع مياه التبريد بالشركة .

أما عن الحمأة الناجمة من معالجة المخلف كيميائياً فإننا نقترح استخدام الحمأة المجففة مع المادة الخام المستخدمة لإنتاج السوبر فوسفات وبذلك يكون تم الاستفادة والتخلص من المواد الصلبة الناتجة عن معالجة المخلفات السائلة .