استخدام عمود فصل من الرمل والكربون المنشط لإزالة الملوثات من مخلفات صناعة الألبان والمشروبات الغازية في مدينة البصرة

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الخلاصة

استخدم في هذه الدراسة عمود من رمل المرشحات والكربون الحبيبي المنشط لمعالجة الملوثات التي تطلقها صناعتي الألبان والمشروبات الغازية في مدينة البصرة. أجريت تحاليل كيميائية وفيزيائية وإحيائية لنماذج قبل وبعد الترشيح لتحديد إمكانية إزالة الملوثات من المخلفات وذلك بتحديد نسب الإزالة لكل ملوث. بلغت أعلى نسبة إزالة للمواد العالقة الكلية بحدود 92,2 % و 72,5 % لمخلفات الألبان والمشروبات الغازية على التوالي, وللمتطلب الحيوي للأوكسجين كانت نسبة الإزالة بحدود 78,21 % و 85,3 % على التوالي, ومن القيم المتدنية للإزالة كانت للعسرة الكلية والفوسفات وبحدود27,5 % و 16,2 % على التوالي من مخلفات مصنع الألبان وللزيوت بحدود26.20 % من مخلفات مصنع المشروبات الغازية. وكانت أعلى نسبة إزالة للعناصر النزرة بحدود 100 % لعنصر الرصاص وللصناعتين في حين كانت أدنى إزالة لعنصر المنغنيز وبحدود 50 % و صفر % لمخلفات الألبان والمشروبات الغازية على التوالي.

Separating Column of Sand and Activated Charcoal for the Removal of Pollutants in Discharging Effluents from Diary and Soft Drinks Industries in Basrah City

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Abstract

In this study filtration column of filtration sand and granular charcoal was used for treatment of discharging wastes from diary and soft drinks industries in Basrah city. Chemical, physical and biological analyses were done for samples before and after filtration to evaluate the ability of pollutant removals from the waste discharges which detected by percent removal of each pollutant. The highest removal percent were recorded for TSS in the range 92.2 and 72.5% for diary and soft drinks wastes respectively, and for BOD_5 in the range 78.1 and 85.3% for diary and soft drinks wastes respectively. The lowest removal percent were 16.20% for phosphate from diary waste and 26.20 % from soft drinks waste. For trace metals the highest removal as 100 % was for lead from the discharge of both industries, while the lowest were for manganese in the range 50 and Zero % from the discharge waste of diary and soft drinks industries respectively. On the other hand bacteria were increased due to long flow time through the column.

Introduction

Food industries are wide spread in Basrah city which discharge their waste water to the inner water ways causing a local pollution, such industries are dairy and refreshments. Waste treatments in most of these industries are very rare.

Procedures for recovery in certain food industries are used world wide such as Ultrafilitration, Evaporation and Spray drier (1), Electrophoresis and Reverse osmoses (2), Bacteriology (3) … etc. Most studies were focused upon the use of Powdered Activated Carbon (PAC) in aeration tanks to remove organic matter (4), or reach percent removal up to 75% of Chemical Oxygen Demand (COD), 98.5% of Biological Oxygen Demand ($BOD_{5)}$ and 91.2% of phosphate (5).

Mertin and Iwugo (4) found that granular carbon is more effective than PAC while Dierberg (6) used column filled with wetland surface sediments to remove nutrients completely.
Column filled with layers of sand, mud or gravel was used in biological treatment of waste water from food industry to reduce trace metals(7) as well as BOD,TOC and nutrients (8).
This study aimed at the use of column filled with sand and activated charcoal to investigate its ability to remove pollutants in waste water from food industry in Basrah city.

Experimental

Waste water used in this study was that of diary and refreshments food production in Basrah city. Samples of waste water from the final tank in each industry were collected in plastic containers and transfer to the lab of water analysis in Marine Science Centre and kept in fridge prior to analysis. In the lab primary analysis, as a first stage, was done for each sample by measuring physical, chemical and biological parameters according to Standard Methods (9) as well as trace metals by means of atomic absorption spectrometry, in which Pye Unicum SP 9 Atomic Absorption Spectrophotometer was adopted for this analysis, in addition to biological detection of Total Bacterial Count and Faecal Coli form.
In the second stage, the remainder of waste water from each industry was treated by filtration column. The filtered column used was 40 cm in length and 4.5 cm diameter contains two equal layers :the upper is 0.6 -1.2 mm filtration sand and the lower is 0.15 – 0.2 mm Activated Charcoal , as shown in figure[1]. A volume of 5 litres each of diary and refreshments industrial effluent were passed through the column in a flow rate of 10 ml/min. in order to insure affective treatment. The eluted water were analysed in the same manner as in the first

Fig. 1 . Experimental Column set up in the filtration.

stage. Results of both stages were tabulated and removal percent of each parameter was determined.

Results and Discussion

The results of the detected parameters for waste water from diary and refreshments industries in Basrah city as measured in both stages before and after treatments are shown in figures [2-16], [in each figure the blocks in white are for concentration of each parameter before filtration while those in red represent the concentration after filtration] in addition to percent removal of each parameter. Moreover all the results for physical – chemical parameters are listed in table 1.

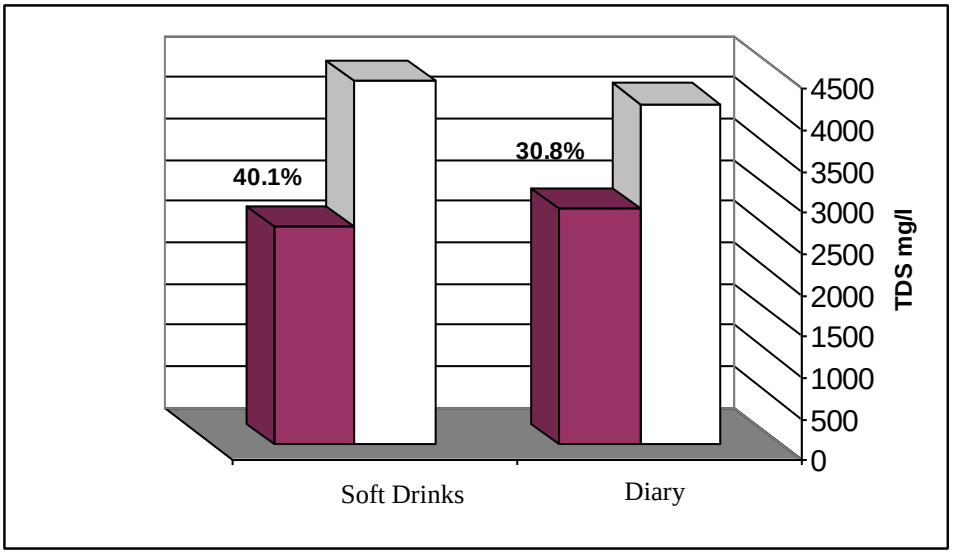

Fig.(2) Percent removal of TDS from discharges of industrial waste

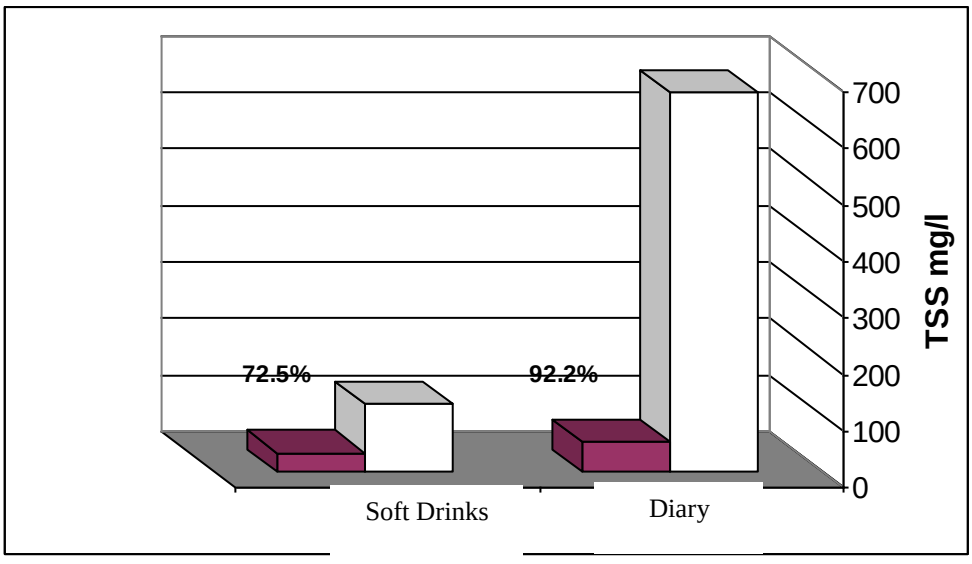

Fig.(3) Percent removal of TSS from discharges of Industrial waste

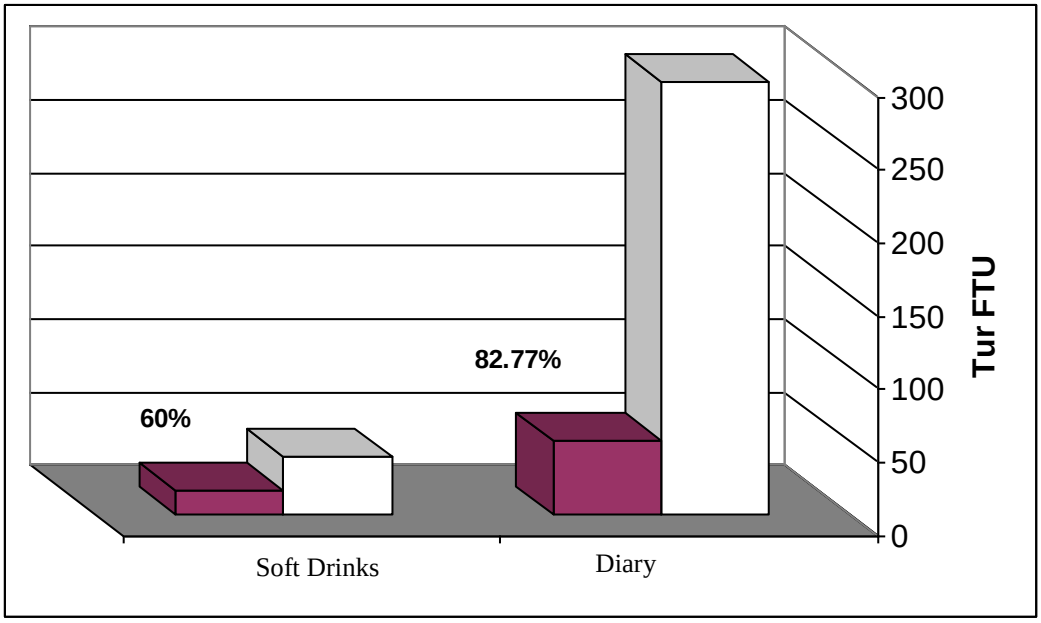

Fig.(4) Percent removal of Turbidity from discharges of industrial waste.

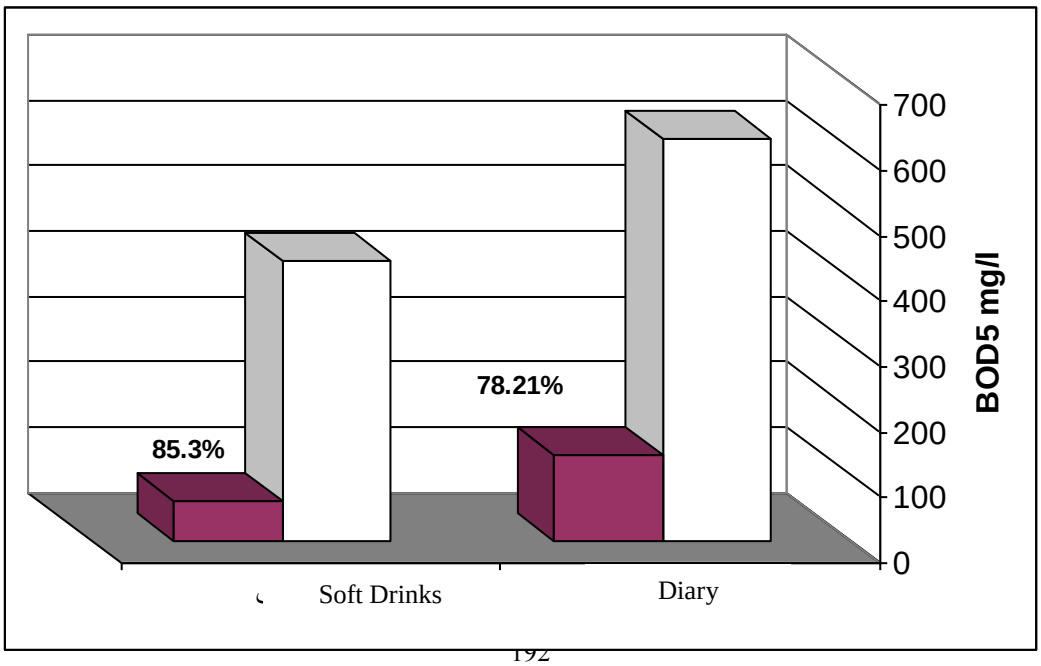

Fig.(5) Percent removal of BOD_5 from discharges of industrial waste.

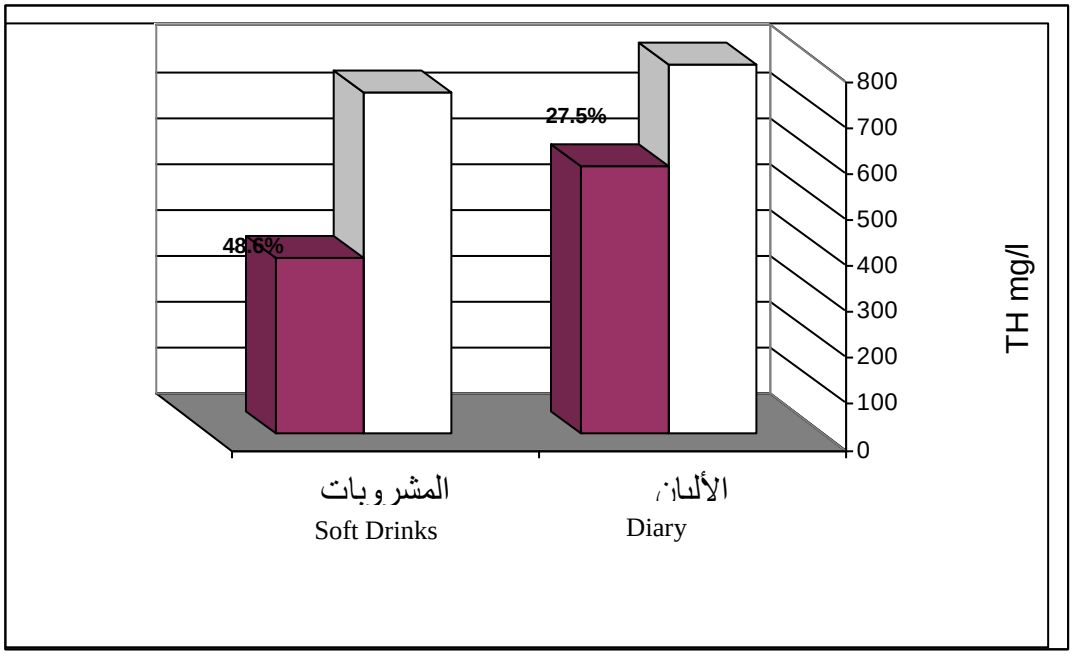

Fig.(6) Percent removal of TH from discharge s of industrial waste.

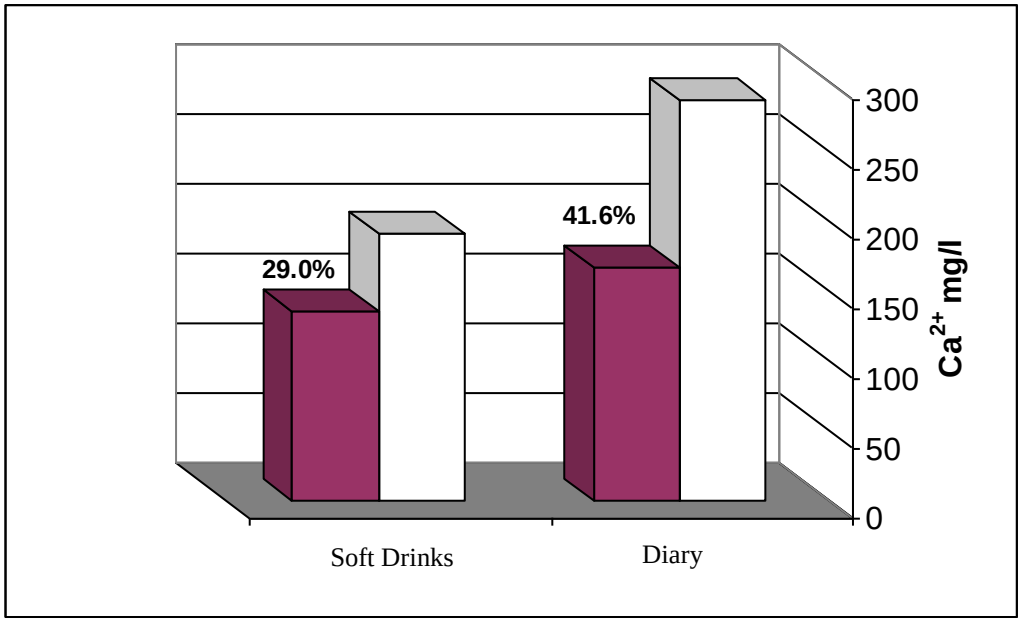

Fig.(7) Percent removal of Ca^{2+} from discharge s of industrial waste.

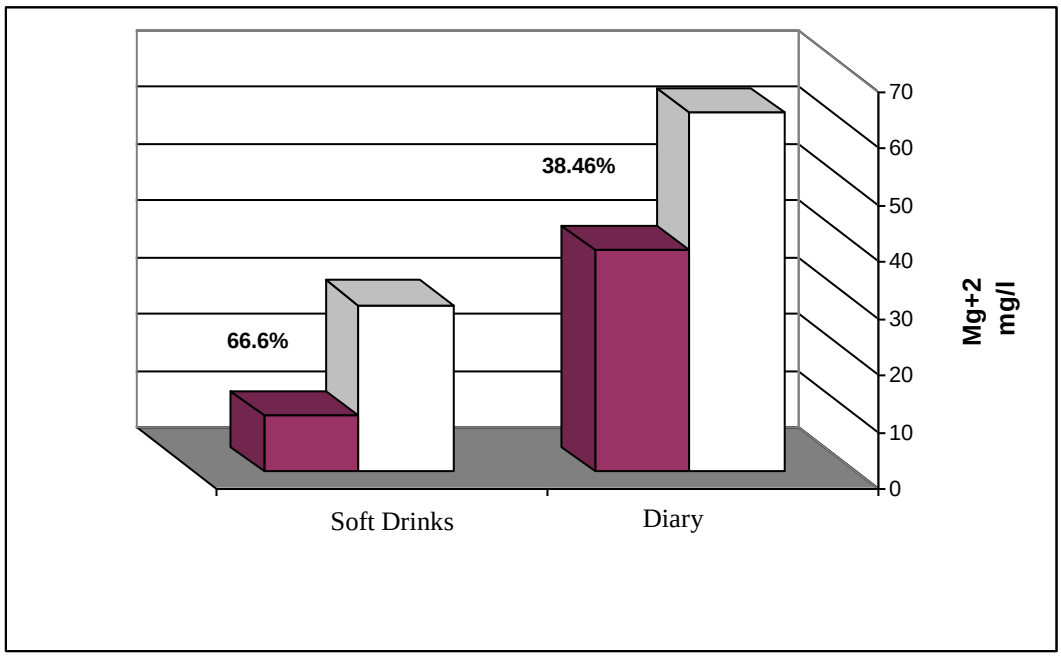

Fig.(8) Percent removal ofMg^{2+} from discharge s of industrial waste.

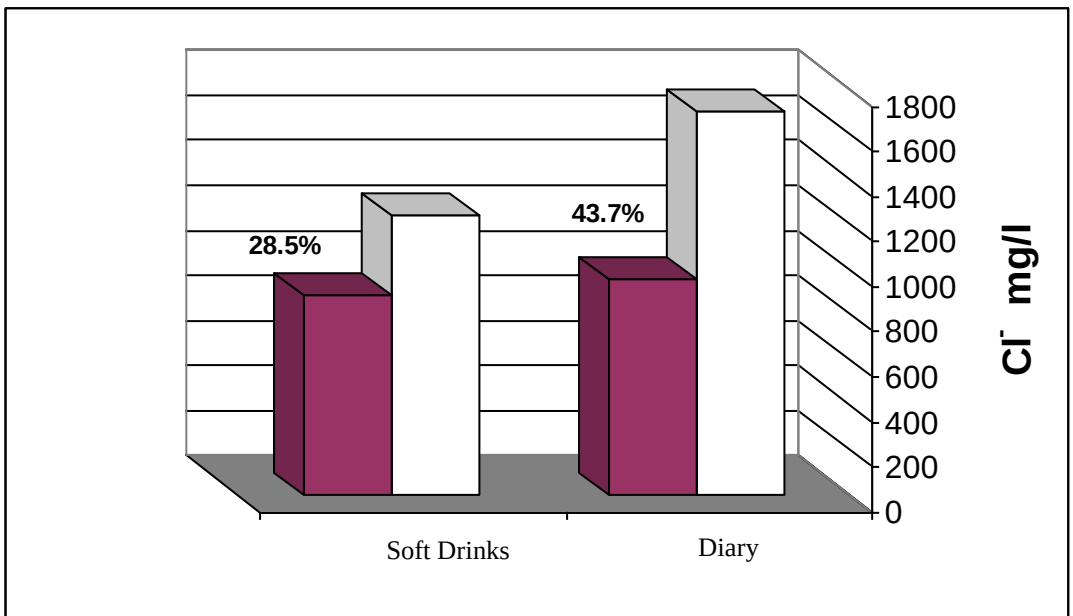

Fig.(9) Percent removal of Cl^- from discharges of industrial waste.

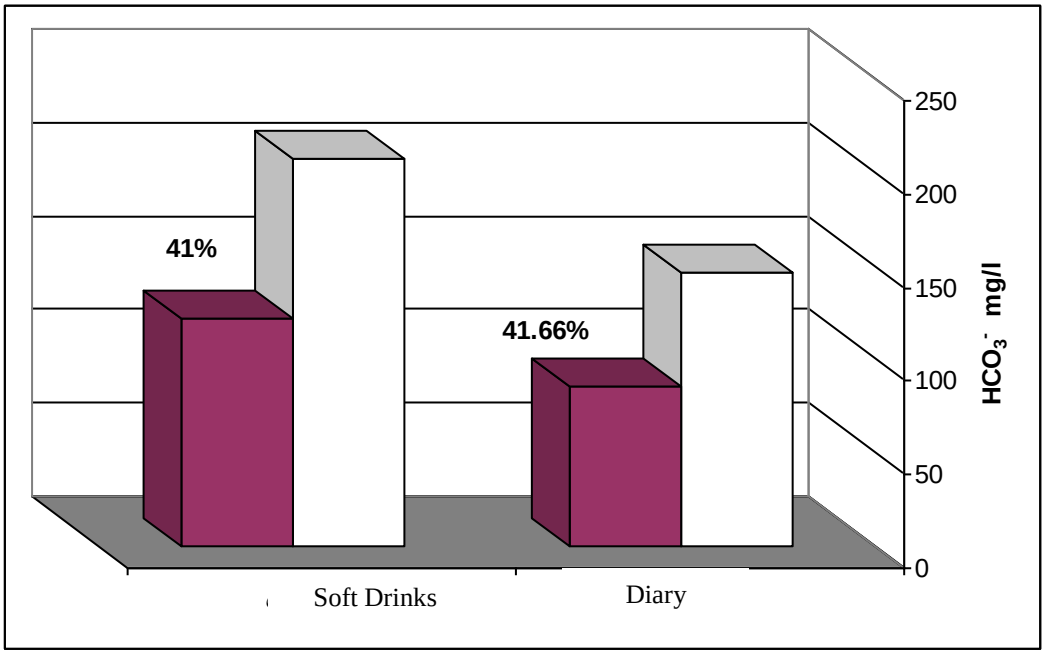

Fig.(10) Percent removal of Bicarbonates from discharges of industrial waste.

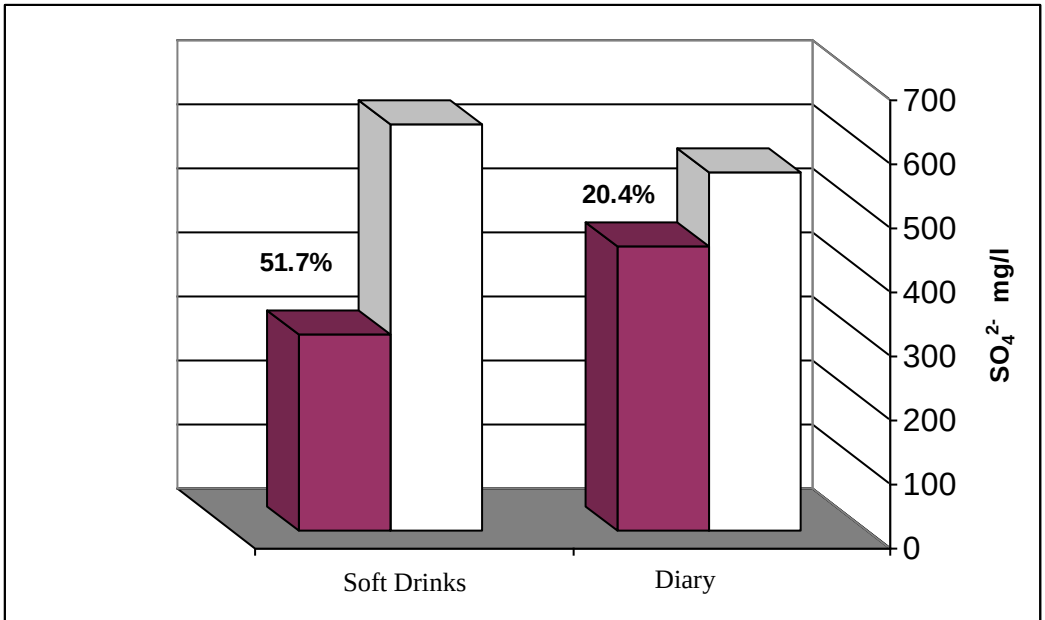

Fig.(11) Percent removal of Sulphates from discharges of industrial waste.

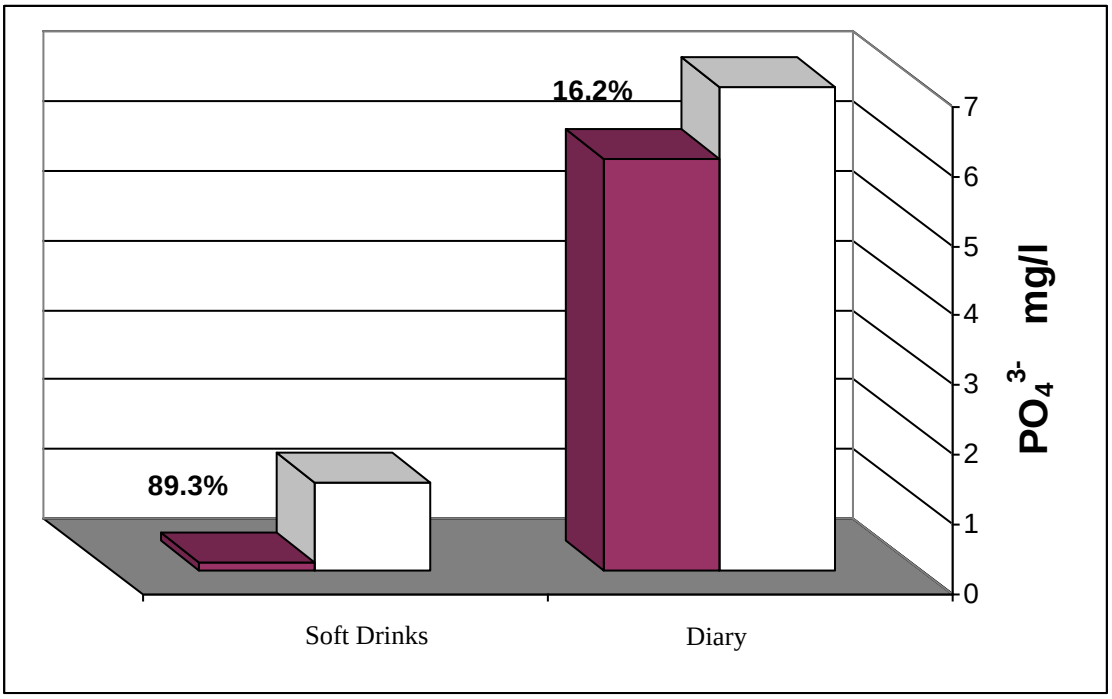

Fig.(12) Percent removal of Phosphates from discharges of industrial waste.

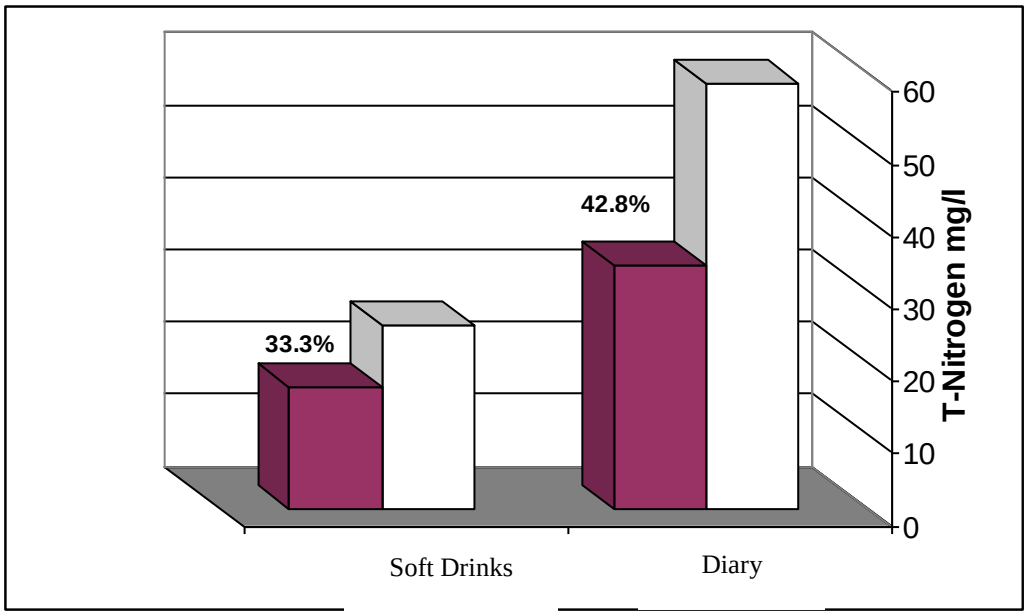

Fig.(13) Percent removal of Nitrogen from discharges of industrial waste.

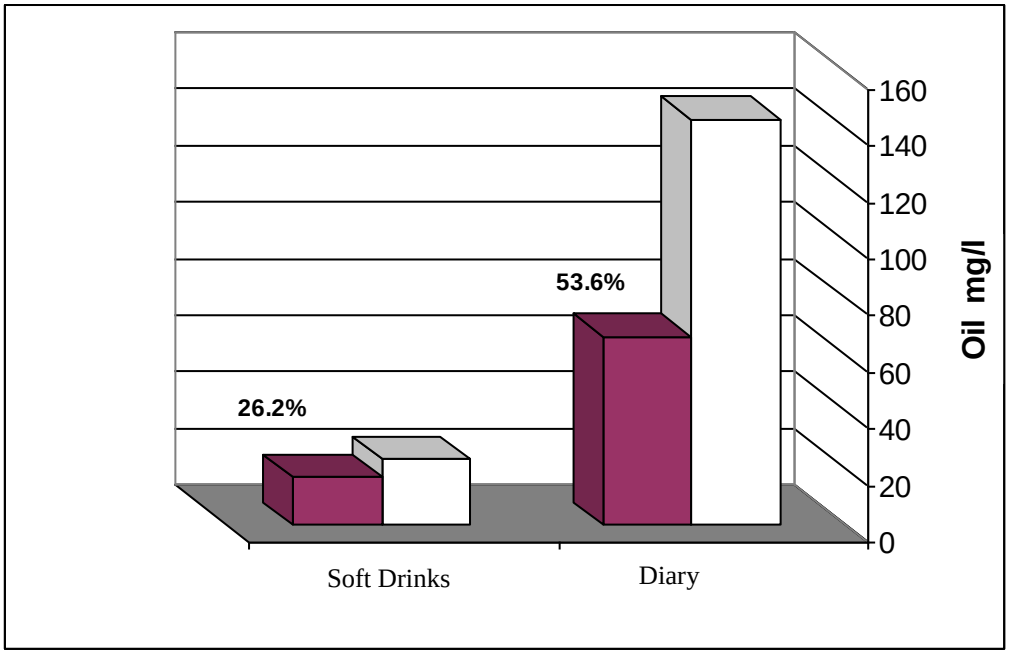

Fig.(14) Percent removal of Oil from discharges of industrial waste.

Table 1. Concentrations of studied parameters in the discharge effluent from diary and soft drinks industries in Basrah before and after filtration together with % removal of each.

Industries →	Diary			Soft Drinks		
Parameters ↓	Before	After	removal %	Before	after	Removal%

TDS mg/l	4120	2850	30.80	4400	2633	40.10
Tur FTU	296	51	82.77	40.06	16.00	60.00
TSS mg/l	670	52	92.20	120	33	72.50
BOD_5mg/l	615	134	78.21	430	63	85.30
T-H mg/l	800	580	27.5	740	380	48.64
Ca^{2+} mg/l	288.57	168.33	41.66	192.27	136.37	29. 07
Mg^{2+} mg/l	63.18	38.88	61.5	29.16	9.72	66.6
Cl^- mg/l	1704	958.5	43.70	1242.5	887.5	28.50
HCO^-_3 mg/l	146.42	85.41	41.66	207.42	122.02	41.00
SO^{2-}_4 mg/l	559.65	445.05	20.40	635.66	306.4	51.70
PO^{3-}_4 µg/l	6.972	5.837	16.20	1.263	0.134	89.30
NO^-_3 mg/l	58.8	33.6	42.80	25.2	16.8	33.30
Oil mg/l	143.6	66.5	53.60	23.2	17.1	26.20

The highest removal percent were recorded for TSS in the range 92.2 and 72.5% for diary and soft drinks wastes respectively, and for BOD_5 in the range 78.21 and 85.3% for diary and soft drinks wastes respectively, which are comparable to the findings of Specchia and Gianetto (5) who reach percent removal up to 75% of COD, 98.5% of BOD_5 and 91.2% of phosphate by using PAC. The lowest removal percent was 16.20 % for phosphate from Diary discharges, and 26.20 % for oil from soft drinks wastes.

For trace metals the highest removal as 100 % was for lead from the discharge of both industries (as shown in figure 15), while the lowest were for manganese in the range 50 and Zero % from the discharge waste of diary and soft drinks industries respectively (as shown in figure 16), for other investigated trace metals the percent removal is moderate and fall in medium ranges as shown in table 2.

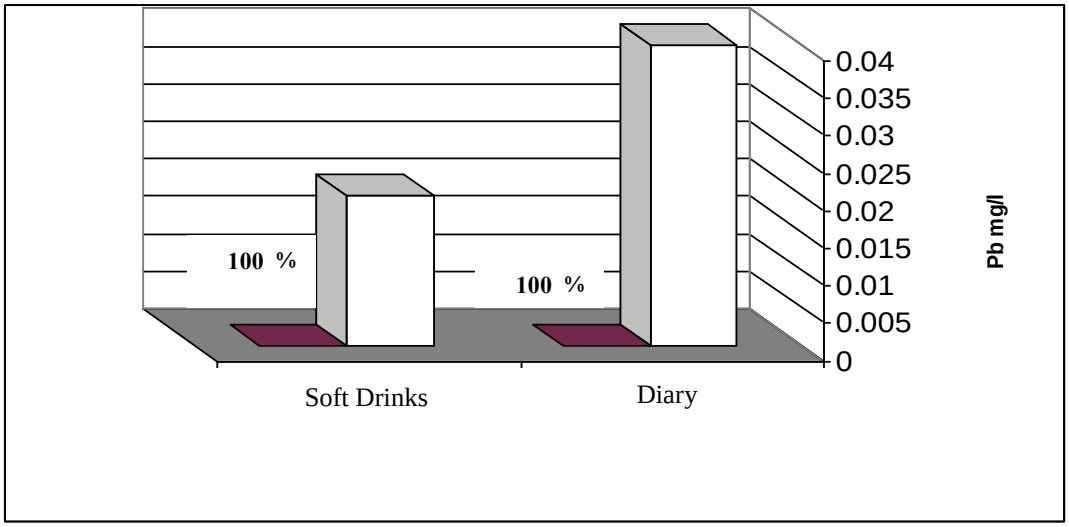

Fig.(15) Percent removal of Pb from discharges of industrial waste.

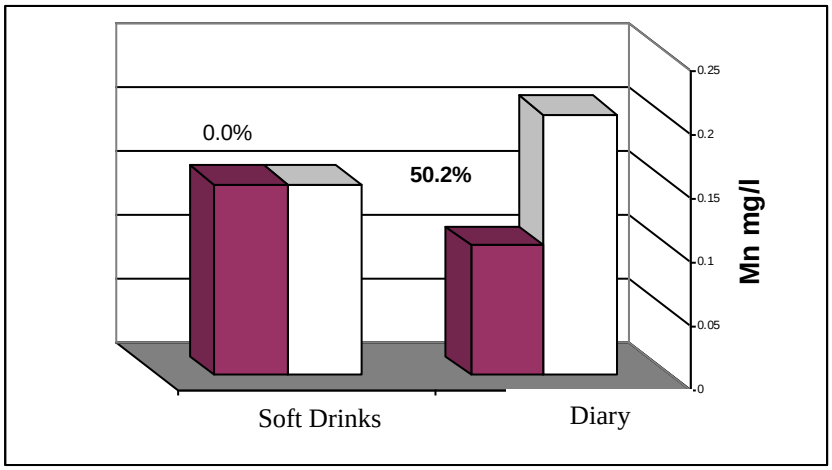

Fig.(16) Percent removal of Mn from discharges of industrial waste.

Table 2. Concentrations of studied trace metals in the discharge effluent from diary and soft drinks industries in Basrah before and after filtration together with % removal of each.

Trace metal	Diary			Soft Drinks		
	before	after	Removal %	before	after	Removal %
Ni	0.63	0.032	94.90	0.21	0.015	92.80
Zn	3.32	2.72	18	4.71	0.92	80.40
Cd	0.43	0.23	51	0.711	0.237	66.60
Pb	0.04	0	100	0.02	0	100
Mn	0.205	0.102	50.20	0.15	0.15	0
Cu	0.78	0.22	71.70	2.89	0.11	96.10
Fe	1.95	0.55	71.80	3.41	2.03	40.40

Removal of bacteria after filtration is listed in table 3. All results showed an increase in bacterial count as a total or faecal in both discharges from diary and soft drinks industrial effluent. The reason of this increase is due to time of flow during filtration which is quite long to give chance for bacteria to grow.

Table 3. Total count of bacteria (TCB) and total faecal coli form (TFC) in the discharge effluent from diary and soft drinks industries in Basrah before and after filtration.

Type of Analysis	Diary		Soft Drinks	
	before	after	before	After
TCB	$2.11x10^{12}$	$68x10^{17}$	$4.3x10^{7}$	$15x10^{10}$
TFC	$7x10^{4}$	$13x10^{6}$	$4x10^{4}$	$9x10^{5}$

Conclusion

The results in this study revealed that the suggested column with its contents is suitable for the removal of most pollutants in the discharge effluent from diary and refreshments industries with few exception for certain pollutants such as bacteria and manganese which require extra procedure for fair removal or the column with its contents need to be modified

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