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Study of Some Characters of Pepsi-Akad Soft Drinks Factory Waste Water

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Abstract: The current study included an assessment of the efficiency of the treatment plant of the soft drink factory Pepsi-Akad located in the Babylon city, Iraq. The samples were collected monthly during period from December 2016-May 2017 as three duplicates per sample. They were sampling from two locations before and after treatment plant of the factory. Some physical have been measured which affecting water quality such as temperature, turbidity and electrical conductivity, so, chemicals like pH, salinity, turbidity, chloride, total dissolved solids, total hardness, calcium, magnesium, sulphate, nitrite, nitrate, phosphate and some heavy elements contamination with bacteria also was study. It was noted that the plant was inefficient in treat of most of impunities that their concentrations after treatment were higher than it was before treatment.

Key words: Soft drink, water pollution, heavy metals, duplicates, calcium, sulphate, turbidity

INTRODUCTION

One of main food contamination ways with trace elements is air, surface and ground water which caused by soil pollution with these elements (Krejpcio *et al*., 2005; Cabrera *et al*., 1995). Each of iron, copper, zinc, cadmium, lead and manganese can lead to harmful effect on human health specially on children and young stags (Rubio *et al*., 2006) and during conlaneous uptake of these elements on recognize their effects, for example, long period uptake of cadmium in drinking water or from any other sources can lead to damage in both kidney and liver because its long biological half age (Maduabuchi *et al*., 2005).

To reduce pollution with such elements its must treat source of their pollution and for this reason the treatment units were found to prevent or reduce harmful level of pollutants and their complexity which results from industrial and danger technologies effluents (Agyemang *et al*., 2013).

Soft drink is a wide dispersal industry now days and consumed in large amounts by persons, thus, must determine the levels of heavy metals in water used to manufacture soft drink to keep health (WHO., 2005) and must treat waste water result from it to reduce trace elements level in them (Akpor and Muchie, 2010).

MATERIALS AND METHODS

Two sites were chosen to collect samples first before water treatment units and the second was after it. Water samples were collected monthly from December 2016-May 2017. Each of pH, temperature, electrical conductivity, salinity and total dissolved solids measured by multi-meter type Hanna, Oakton-USA. Turbidity by turbidity meter type Haanna/H1, chloride, total hardness, calcium, magnesium, alkalinity, sulphate, nitrite, nitrate and phosphate according to methods described by (APHA, AWWA and WPCF., 2005), (DO and BOD_5) according to methods (Clescerl *et al*., 1999) iron, copper, zinc, cadmium, lead and manganese were measured by Flame Atomic absorption spectrophotometer Shimadzu 7000A (Japan), K and Na according to methods described by Yadav and Khera by flame photometer type biotech (English). Bacterial species were identified in the water samples studied according Macfaddin.

RESULTS AND DISCUSSION

The temperature of water was very related to atmosphere temperature and the analytical static appeared a significant variation among months. Electrical conductivity define as ability of water to carry electric charges (Wetzel, 2001). Results as showed in Table 1. The treatment unite in factory was able to decrease electrical conductivity values by precipitate part of ions as sludge by using calcium carbonate as chemical treatment.

The treatment units in Pepsi-Akad factory decrease water turbidity in the effluent water in all months, this may due to action of used filter and used of calcium carbonate

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Table 1: Monthly variations of some physical parameters in studied sites ((Mean±SD), the letters a-f refer to LSD variations)

	2016	2017				
Sites/Months/Parameters	December	January	February	March	April	May
Site 1						
Water temperature (°C)	±0.34612[a]	0.300±9[b]	± 0.26412[b]	17±0.300[c]	21±0.346[d]	±0.40025[e]
E.C (µsec/cm)	1467±2.000[a]	3.000±1220[b]	± 3.0001155[c]	±3.6051236[d]	±2.6451267[e]	1070±2.645[f]
Turbidity (NTU)	3.2±0.100[a]	25.2±0.200[b]	3.6±0.200[c]	2.4±0.100[d]	6.6±0.200[e]	23.8±0.300[f]
Site 2						
Water temperature (°C)	13±0.400[a]	10±0.300[b]	14±0.200[c]	19±0.200[d]	22±0.300[e]	27±0.200[e]
E.C (µsec/cm)	1595±8.888[a]	1386±4.000[b]	1820±8.666[c]	1870±3.605[d]	1276±3.605[e]	1018±4.000[f]
Turbidity (NTU)	2.8±0.200[a]	1.3±0.100[b]	1.9±0.200[b]	1.1±0.100[c]	4.6±0.100[d]	ND±0.000[e]

Table 2: Monthly variations of some chemical parameters in studied sites ((Mean ± SD), the letters a-f refer to LSD variations)

	2016	2017				
Sites/Months/Parameters	December	January	February	March	April	May
Site 1						
pH	±0.3008[a]	6.6±0.200[b]	0.320±8.5[bc]	0.2008.6[c]	8.4±0.200[c]	8.7±0.300[c]
TDS (mg/L)	998±4.000[a]	830±2.000[b]	±4.000785[c]	840±2.645[d]	862±2.000[e]	728±2.000[f]
Salinity (%)	93.9±0.416[a]	78.1±1.100[b]	73.6±0.757[c]	79.1±1.100[c]	81.1±1.100[d]	68.5±1.300[e]
Chloride (mg/L)	250±2.000[a]	199.9±1.600[b]	.9±2.088[b]	139.9±0.953[c]	179.9±1.249[e]	180±2.000[d]
DO (mg/L)	9.8±0.200[a]	8.4±0.300[ab]	10.7±0.210[b]	10.3±0.300[c]	8.6±0.300[d]	8±0.300[d]
BOD5 (mg/L)	1±0.100[a]	2±0.100[a]	0.6±0.100[b]	1±0.100[bc]	0.5±0.050[c]	1.1±0.100[d]
Total Hardness (mg/L)	800±2.000[a]	720±1.000[b]	640±3.000[b]	600±2.000[c]	600±3.605[d]	440±2.000[e]
Calcium (mg/L)	168.3±0.900[a]	112.2±0.900[a]	128.3±0.900[b]	122.2±0.800[b]	160.3±0.900[c]	128±0.800[e]
Magnesium (mg/L)	153.9±3.200[a]	148.3±1.850[b]	124.9±2.600[c]	119±1.000[d]	107.3±0.900[e]	76.1±1.900[f]
Alkalinity (mg/L)	20±1.000[a]	28±2.000[b]	20±1.000[c]	21±1.000[c]	12±2.000[c]	16±2.000[d]
Sulphate (mg/L)	71.2±0.871[a]	32.4±1.200[b]	100±2.000[c]	77.6±1.900[d]	121.3±2.100[e]	179.2±1.800[f]
Nitritemg/L)	2.2±0.100[a]	11.2±0.100[b]	3.7±0.100[b]	1.8±0.200[c]	2.5±0.200[c]	4±0.300[d]
Nitrate (mg/L)	ND±0.000[a]	ND±0.000[a]	13.3±0.200[b]	5.9±0.300[bc]	5.6±0.300[c]	6.1±0.300[d]
Phosphate (mg/L)	4.1±0.100[a]	24.8±0.230[b]	4.8±0.200[c]	1.7±0.200[d]	6.4±0.300[e]	29.4±0.300[f]
Na (mg/L)	34.7±0.200[a]	37.9±0.400[a]	30.2±0.200[b]	31.6±0.300[c]	36.1±0.400[d]	29.7±0.200[e]
K (mg/L)	`3.6±0.200[a]	6.7±0.300[ab]	3.1±0.200[b]	3.3±0.300[b]	5.5±0.300[c]	3.6±0.100[d]
Site 2						
pH	8.3±0.200[a]	8.5±0.100[ab]	9.1±0.300[ab]	8.8±0.500[ab]	8.5±0.400[ab]	8.8±0.300[b]
TDS (mg/L)	1085±3.464[a]	942±3.000[b]	1238±5.291[c]	1272±4.000[d]	868±2.000[e]	692±2.000[f]
Salinity (%)	102.1±2.900[a]	88.7±3.100[b]	116.5±1.100[c]	119.7±2.600[d]	81.7±1.200[e]	65.2±2.000[e]
Chloride (mg/L)	149.9±2.200[a]	159.9±1.000[b]	299.9±2.600[c]	239.9±3.200[d]	300±4.000[e]	100±3.000[e]
DO (mg/L)	10.2±0.100[a]	8.8±0.200[b]	10.8±0.300[b]	10.4±0.300[c]	8.8±0.100[cd]	8.3±0.300[d]
BOD5 (mg/L)	0.8±0.100[a]	1.6±0.200[a]	0.46±0.060[a]	3±0.100[a]	0.4±0.100[b]	0.3±0.050[c]
Total Hardness (mg/L)	1040±2.000[a]	600±3.000[b]	1080±1.732[c]	800±2.645[c]	800±3.605[d]	360±2.645[e]
Calcium (mg/L)	240.5±2.000[a]	96.2±1.800[a]	224.5±0.500[b]	176.3±0.702[c]	192.4±0.800[d]	96.2±0.800[e]
Magnesium (mg/L)	195.1±2.100[a]	122.9±1.600[b]	208.7±3.100[c]	152.2±1.100[d]	148.3±0.800[e]	64.4±2.200[f]
Alkalinity (mg/L)	22±1.000[a]	40±2.000[b]	28±2.000[b]	29±2.000[c]	16±1.000[c]	20±2.000[d]
Sulphate (mg/L)	9.2±0.692[a]	53.2±0.692[b]	77.8±2.100[c]	61.6±1.300[d]	176.5±2.100[e]	220.3±2.100[f]
Nitrite (mg/L)	1.2±0.100[a]	8±0.200[b]	1.7±0.200[c]	2.5±0.300[c]	2.8±0.200[d]	13.7±0.300[e]
Nitrate (mg/L)	0.18±0.010[a]	23.1±0.200[b]	2.7±0.100[c]	11.8±0.200[d]	3.3±0.200[e]	8.4±0.300[f]
Phosphate (mg/L)	7.1±0.173[a]	8.7±0.100[b]	6.4±0.264[c]	3.3±0.100[e]	8.7±0.100[d]	49.4±0.200[e]
Na (mg/L)	36.1±0.300[a]	35.2±0.200[b]	42.5±0.300[c]	43.4±0.300[c]	36.6±0.300[d]	31.1±0.300[e]
K (mg/L)	4±0.500[a]	3.9±0.200[b]	5.1±0.100[b]	4.9±0.200[c]	5.6±0.300[c]	3.4±0.200[d]

and values ranged (0.0-2.8) NTU in May and December, respectively and this amount can release to natural surface water which can received water in such turbidity.

According obtained data that showed in Table 2 the treatment unit was not efficient during months from December until April but it was give good treatment in May. The treatment was depending on use calcium carbonate as a coagulant matter, thus, each of pH, sulphat, salinity, total hardness and calcium were increased. The other ions were increased after treatment may do to used not pure carbonate which usually come from natural sources. In general the efferent water from factory was polluted in cautions and inions according to standers of waste water that it include high concentration of phosphate about 1.7-49.4 ppm, sulphate (9.2-220.3 mg/L), magnesium (64.4-208.7 mg/L) and total hardness (360-1040 mg/L). This unit in factory was able make concentrations of D.O, BOD, nitrate within normal range except nitrate in January that was about 23.1 mg/L which has high risk on health of water body and human health that it can lead to eutrophication (Talling,

Table 3: Monthly variations of some heavy metals in studied sites; ((Mean ± SD), the letters a-f refer to LSD variations)

	2016	2017				
Sites/Months/Parameters	December	January	February	March	April	May
Site 1						
Mn (mg/L)	0.154±0.003^{a}	0.17±0.002^{b}	0.19±0.001^{c}	0.18±0.003^{d}	0.175±0.001^{e}	0.164±0.002^{f}
Cd (mg/L)	0.204±0.003^{a}	0.214±0.003^{b}	0.21±0.003^{b}	0.193±0.003^{b}	0.201±0.001^{c}	0.181±0.003^{c}
Fe (mg/L)	0.524±0.002^{a}	1.709±0.003^{b}	0.570±0.003^{c}	1.140±0.003^{d}	1.05±0.002^{e}	16.41±0.001^{f}
Zn (mg/L)	0.107±0.002^{a}	0.003±0.0^{b}	0.038±0.001^{b}	0.505±0.001^{d}	0.008±0.001^{e}	0.64±0.002^{f}
Pb (mg/L)	2.87±0.001^{a}	2.78±0.002^{a}	2.315±0.002^{b}	2.5±0.002^{c}	2.407±0.001^{d}	2.315±0.001^{e}
Cu (mg/L)	2.57±0.002^{a}	2.26±0.001^{b}	2.423±0.002^{b}	2.46±0.003^{c}	2.53±0.002^{d}	2.423±0.003^{e}
Site 2						
Mn (mg/L)	0.134±0.004^{a}	0.164±0.002^{b}	0.175±0.002^{c}	0.171±0.003^{c}	0.205±0.005^{d}	0.19±0.002^{e}
Cd (mg/L)	0.212±0.004^{a}	0.21±0.002^{ab}	0.201±0.001^{b}	0.188±0.001^{c}	0.19±0.002^{d}	0.193±0.001^{d}
Fe (mg/L)	0.501±0.001^{a}	0.866±0.003^{b}	0.137±0.002^{c}	0.16±0.001^{d}	0.82±0.001^{e}	13.788±0.003^{f}
Zn (mg/L)	0.031±0.001^{a}	0.006±0.001^{b}	0.008±0.001^{bc}	0.004±0.0^{c}	0.031±0.001^{d}	0.007±0.001^{d}
Pb (mg/L)	2.787±0.002^{a}	2.5±0.002^{b}	2.222±0.002^{c}	2.5±0.001^{c}	2.81±0.002^{d}	2.41±0.001^{e}
Cu (mg/L)	2.46±0.003^{a}	2.62±0.002^{b}	2.513±0.001^{c}	2.513±0.003^{d}	2.37±0.002^{d}	2.208±0.001^{e}

Table 4: Monthly variations of some types of bacteriain studied sites (Mean ± SD)

	2016	2017				
Sites/Months/Bacteria	December	January	February	March	April	May
Site 1						
Bacillus					+	
Enterobactera	+			+		
Escherichia coli		+		+		
Klebsiella		+				
Proteus					+	+
Site 2						
Bacillus					+	
Enterobactera	+			+		
Escherichia coli		+				
Klebsiella		+				
Proteus					+	+

1980) and methemoglobinemia (WHO., 1993), respectively. The good treatment for all studied parameter was in May which may due to improve the treatment unit after maintenance.

The concentrations of studied heavy metals were elevated in both influent and effluent water. There was a signification variations in heavy metal concentrations among months as it showed in Table 3 but there was not found between sites which mean the treatment unit was inefficient to remove them from water. The non-sufficient elements lead and cadmium must be not found in water, specially in drinking water that they lead to danger affection health (Culha *et al*., 2007), so, not found in that it polluted water then effect life in it (Salman, 2010).

The two sufficient element zinc and manganese (Culha *et al*., 2007) should be not increase than human needs while there concentration were elevated.

The soft drinking factories usually lead to polluted water with heavy element (Alzaid and Abu-Shady, 2016), the present study give the same results. These should be used specific treatment in this factories to prevent their polluted.

The results of the study indicated that water samples were contaminated with some bacterial species Table 4. This may be due to temperature tolerance and increase of organic matter with increased turbidity which protects the bacteria (Asano *et al*., 2007). Some types of intestinal bacteria such as *Klebsiella, Enterobactera, Escherichia coli*, *Proteus* and *Bacillus* species associated with fecal water pollution were found in water.

CONCLUSION

The main aim of this study is determine levels of heavy metals including (iron, copper, zinc, cadmium, lead and manganese) in wastewater and the effluent from wastewater treatment units of Akad soft drink in Babylon Government, Iraq to determine its efficiency in treatment.

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