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Drinking Water Quality of Some Commercial Water Purification Systems at Sabratha Area, Libya

Hamza Mohamed Flafel[-1] Abdarazzag Kaeebah[-2] Mariam Fadel[-1]
Abdulkarim Thaher Annejjar[-3]

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Authors affiliation
1. studies and research centre for Environmental and Technology (hamza121655@gmail.com).
2. higher institute of water affairs
3. Technical college of Civil aviation and meteorology

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ABSTRACT

This study was investigated the quality of drinking water supplied in Some Commercial Water Purification Systems at Sabratha area. Water samples were collected from five stations at Sabratha region. The physicochemical parameters were mainly, pH, Alkalinity, Chloride, Nitrate, Sulfate, Magnesium, Calcium, Sodium, Potassium and TDS. The result shows that all these parameters were fall below WHO guidelines, except pH. The bacteriological result revealed that one of the studied stations was contaminated by E. coli bacteria.

الملخص

تناولت هذه الدراسة جودة المياه الشرب في بعض محطات التحلية بمنطقة صبراتة ، ومعرفة مدى ملائمة مياه هده الأنظمة لمعايير منظمة الصحة العالمية. جمعت عينات المياه من خمس محطات في المنطقة في أبريل 2019 . وقدرت المتغيرات الفيزيائية والكيميائية (الأس الهيدروجيني والقلوية والكلوريد والنترات والكبريتات والمغنيسيوم والكالسيوم والصوديوم والبوتاسيوم والمواد الصلبة الذائبة). اظهرت النتائج أن جميع هذه المتغيرات تقع دون الدلائل الإرشادية لمنظمة الصحة العالمية باستثناء الأس الهيدروجيني ضمن إرشادات منظمة الصحة العالمية. كما اظهرت النتائج البكتريولوجية وجود بكتريا قولونية في إحدى محطات التحلية.

INTRODUCTION

Inadequate water supply is still one of the major challenges in developing countries, Henry, *st al*., (2006). Access to sufficient quantities of safe water for drinking and domestic uses and also for commercial and industrial applications is critical to health and the opportunity to achieve human and economic development, Zhou, *et al*., (2012).

Water Purification Systems is an important and rapidly growing source of drinking water in the world originating from sea water or brackish water, Ghaffour *et al*., (2017). The mineral composition of the water is significantly altered and then partially reconstituted to achieve a stable product that can be distributed in pipes, Cotruvo., (2005). This water differs from natural waters in the sense that it's composition is controllable whereas natural waters vary over a very wide range of composition that is a matter of geology and chance, Wang, *et al*., (2015). A logical question is whether the ultimate composition of this and other 'manufactured' water may have some positive or negative impact on the health of long-term consumers, Fuchs, *et al*., (2011).

Water produced by Water Purification Systems methods has the potential for contamination from source water and from the use of various chemicals added at the pretreatment and Water Purification Systems and post treatment stages, Lattemann, *et al*., (2008). Natural water resources are more likely to be impacted by contamination when they are receiving waters of wastewater discharges and surface runoff, Morrison, *et al*., (2001). Therefore, some Water Purification Systems couldn't care about drinking water quality in terms of international standards, which may endanger the public health, Haneya, *et al*., (2012). More than 12,000 commercial water purification systems are in operation throughout the world producing about 40 million cubic meters of water per day, Diawara, *et al*., (2008). The number is growing rapidly as the need for fresh water supplies grows more acute and technologies improve and unit costs are reduced, Shannon, *et al*., (2010). Water Purification Systems use waters impaired with salts (seawater or brackish water) or other contaminants as their sources, Elimelech *et, al.*, (2011). Libya is one of the countries suffer intense deficit of fresh water, Wheida, *et al*., (2007). One of the basic sources of water supply is the underground water, Brika, *et al*., (2019).

MATERIALS AND METHODS

Drinking water samples (15 sample) were collected from five different Water Purification System randomly, at Sabratha district in April, 2019. The area of study (Fig. 1) was located within Sabratha city scheme limits, which is located in northwest in Libya, and about 70 km away west of the capital Tripoli ,and Coordinates. 32°47′32″N 12°29′03″E (Ministry of Planning., 2005).

Fig (1): **Sabratha District Location**

The experimental work was Physicochemical and Bacteriological analyses such as pH, Alkalinity, Chloride, Nitrate, Sulfate, Magnesium, Calcium, Sodium, Potassium, TDS and *E. coli* for carrying out the testes were used (pH meter TDS meter. $AgNO_3$ titrimetric for Chloride. spectrophotometry for Nitrate, Sulfate. EDTA titrimetric for Magnesium, Calcium Phenolphthalein and *Methyl orange* titrimetric for Alkalinity and Flame photometer for Sodium, Potassium.

E. coli estimated using Compact Dry technique as described by Aneja, *et al.*, (2008). these were analysed at laboratory in Studies and Research Center For Environmental Science and Technology. Microbiological analysis samples were transported to laboratory of Higher Institute of Water Affairs within 2 hours and analysed. The values of physico-chemical and microbiological parameters were compared to WHO guideline (WHO, 2011).

RESULTS AND DISCUSSION

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i. Physicochemical parameters

The data in Table 1 showed that all parameters (from Water Purification Systems At Sabratha) analyzed, drinking water quality parameters of all water samples were found to be less than WHO guidelines, except pH. Was found to be within WHO guidelines. pH values was found to lie within WHO standard only. According to WHO standards pH of water should be 6.5 to 8.5 Hence, in study area the pH values were between 7.68 to 8.0, the values were not exceeded the standard limit however these were falling in basic or Alkaline range. Current study revealed the concentration of Bicarbonates ranges, 19.52-39.04 mg/l, and hence these were more than the standard values. The chloride value in the study ranges from 17.75-142 mg/l. Thus, all the samples have lower concentration of standard chloride. The concentration of Sulfate range from 5.7-8.34 mg/l, the results exhibit that concentration of sulfate in Water Purification Systems was lower from standard limit.In study area magnesium was ranges from 1.2-6 mg/l, Such a low may cause some long term public health problems and could be associated with health risks of residents.

In study areas, results show that the concentration of calcium ranges from 26-40 mg/l, Calcium quality in the study was less than the limit by WHO and case may effect on public health for human. Finding shows that sodium and Potassium concentration ranges were 0, No values sodium and potassium in the study area, Lack of potassium and sodium may cause diseases associated for human. AS well, results clear that the concentration of nitrate ranges from 0-0.068 mg/l, these results indicate that the quantity of nitrate in study sites is less than WHO standard, that may threat on the health of inhabitants. TDS range is 18.7-146.3 ppm in the study area. Hence, these ranges were acceptable and concentration of TDS is not harmful. The analytical data of commercial cater purification systems showed that water samples less than the WHO guideline value of pH but the value lies within the WHO standard. Most of parameters were found to have less than WHO guidelines especially in tap water, which is not to say safe to drink. If quality of water is not improved, it may exert serious health hazard for consumers. It is a tragedy that infants and young children are the innocent victims of failure to make safe drinking water and basic the study explained that all Water Purification Systems not care WHO standard.

Table 1: Laboratory Analysis of Physical and Chemical Parameters of Study Areas and WHO Standards

Parameter	Unit	Stations					WHO guideline
		1	2	3	4	5	
pH	-	7.78	8	7.70	7.68	7.67	6.5-8.5
TDS	Ppm	74.25	18.7	146.3	69.85	69.85	500-1000
$NO^{3-}N$	Ppm	0.068	0.058	0.036	0	0.033	10-45
Cl^-	mg\l	17.75	142	71	71	142	200-600
$SO4^{2-}$	mg\l	6.16	8.34	5.7	6.07	6.88	200-400
HCO^{1-}	mg\l	39.04	29.28	39.04	28.28	19.52	10
K^+	mg\l	0	0	0	0	0	12
Mg^{2+}	mg\l	3.6	6	4.8	1.2	1.2	30-150
Na^+	mg\l	0	0	0	0	0	200-400
Ca^{2+}	mg\l	20	14	8	12	20	75-200

ii. Bacteriological analysis

The microbiological analysis of water samples revealed the presence of *E. coli* one of the stations contamination for stations, the contaminated samples are also categorized according to the risk grade for natural source, reservoir and tap samples. The data describes that there is very high risk in taps. The 2011 WHO guidelines for drinking water give a tolerance range for E. coli in drinking water as shown in Table 3. The number of bacterial colonies in station 4 exceeded 5600 per 100 mL this mean Very High Risk in station as shown in Table 4. This might be due to infiltration of contaminated water and sewage through cross connection and leakage points. Also filtered carelessness' in station may be the reasons for contamination with E. coli, while anther stations were conformity with WHO guidelines.

Table 2. WHO (2011) classification and color-code scheme for E. coli colonies per 100 mL water sample

Color	Blue	Green	Yellow	Orange	Red
Risk level	In Conformity	Low Risk	Intermediate Risk	High Risk	Very High Risk
E. coli	0	1-10	10-100	100-1000	>1000

Table 3. Bacteriological results in the of the Study Areas

Station	Count per 100 ml	Remarks
1	0	In conformity with WHO guidelines
2	0	" " "
3	0	" " "
4	5600	Very high risk
5	0	In conformity with WHO guidelines

CONCLUSION

In This study evaluated the quality of drinking water in Desalination plants at Sabratha area. Physical, chemical and biological parameters investigate and compared with the WHO standard, In general, most of the values were mismatched with WHO standard as show in Table 1. As well, one of the stations presence of *E. coli*, this might be due to infiltration of contaminated water and sewage through cross connection and leakage points.

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As with all drinking water supplies, desalinated drinking water production should strive to utilize the best available source water. The desalination plants should be located away from sewage discharge wells.

Some specific recommendations include:

1. WHO guidelines standards should be applied to systems in Desalination plant.
2. Water sources used for desalinated should be check biological parameters before treated to reach microbial quality goals set on the basis of raw water contamination and risk reduction

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