Assessment Of Drinking Water Quality According To WQI Based On Turbidity In Rabak Town - White Nile State - Sudan 2010

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Abstract: Turbidity can serve to signal potential contamination problems or difficulties within a distribution system. Increased distribution system turbidity can be indicative of microbiological problems. After collection of samples from different locations in Rabak Town, Samples were analyzed as soon as possible in field by using turbidity meter. The study revealed that all examined samples indicated high levels of turbidity, (i.e. turbidity level above standard value 5 NTU). We found values of turbidity in all examined samples ranged from 38- 76 NTU. The study according to WQI revealed that quality of water unfit for drinking without secondary treatment process. Throughout this study we observed treatment of drinking water is insufficient due to high levels of turbidity in all examined water samples, so the study recommended that: local health authorities must check drinking water supply system regularly according to WHO guidelines for drinking water to ensure from efficiency of treatment process.

Keywords: microbial quality, treatment, water quality, contamination, Rabak Town.

1- Introduction:

Turbidity in water is caused by suspended matter such as clay, silt, finely organic and inorganic matter, soluble colored organic compounds, plankton and other microscopic organisms. Turbidity is an expression of the optical property that causes light to be scattered and absorbed than being transmitted in straight lines through the sample (APHA, AWWA &WEF, 1992). Turbidity measurements are made in terms of nephelometric turbidity unit (NTU), formazin turbidity unit (FTU) and Jackson turbidity unit (JTU). WHO recommends that if water is more than 5 NTU then some form of treatment to remove turbidity is necessary before water can be effectively disinfected by chlorine. The NTU should be measured and if found to be higher than 5, then the next stage is to undertake a simple sedimentation test to establish it and how long it takes for the suspended solids to settle out (Oxfam, 2001). Turbidity is important because bacteria are often found attached to suspended particles in the water. In chlorination supplies raised turbidity may reduce the efficiency of disinfection (Howard, 2002). Turbidity is important because its effects, both on the acceptability of water to consumers and the selection of efficiency of treatment processes, particularly the efficiency of disinfection with chlorine (WHO, 1997). If not removed, turbidity can promote regrowth of pathogens in the distribution system, leading to waterborne disease outbreaks, which have caused significant cases of gastroenteritis throughout the world. Although turbidity is not a direct indicator of health risk, numerous studies show a strong relationship between removal of turbidity and removal of protozoa (EPA, 1999).

Water quality index:- Water quality Index (WQI) is defined as a technique of rating that provides the composite influence of individual water quality parameters on the overall quality of water. It reduces the large amount of water quality data to a single numerical value (Vasanthavigar, et.al, 2010).

Calculation of Water Quality Index
Water quality index [WQI] = QiWi/Wi
Where, Qi is water quality rating
Qi = 100*[Va-Vi]/[Vs-Vi]
Va = Actual value of the parameters present in water sample
Vs = Standard value
Vi = ideal value
Wi = K/Sn , Where Wi = Unit weightage
K[constant] = 1/[(1/S1) + (1/S2) + (1/S3) + ….. + (1/Sn) **(**Maruthi Devi, et al.2010).
WQI has been classified into five classes according to arithmetic method in the following table:

WQI	Quality of water
0-25	excellent
26-50	good
51-75	poor
76-100	Very poor
Above 100	Unfit for drinking

Adopted from **(**Maruthi Devi, et al.2010).

Materials and methods:
Study area: Rabak town is the capital of White Nile state; it lies in the eastern bank of White Nile channel. Geographically it lies between two lines length32-33 north and two lines width 12-13 East. Rabak Town distance from Khartoum Town (capital of Sudan) about 360 kilometers.

Sample Size: Determination of samples were completed according to WHO guidelines for drinking water quality in distribution system (1993) volume one and manual of

standards of quality for drinking water supplies (12 samples).

Analysis of samples: After collection of samples from different locations at Rabak Town, samples were analyzed immediately at field by using turbidity meter as following: Filled test tube that made from glass until mark by water sample cleaned and dried its out surface thoroughly and placed at turbidity meter. The turbidity meter read directly the level of turbidity of water in term (NTU).

Analysis of data: After revealing on data, the data had been analyzed by using computer programmes such as Microsoft word and excel. Also in this study we used WHO and Sudanese guidelines for drinking water in interpretation of results.

Results

Table (1) *free residual chlorine and pH for drinking water samples*

Sample No	Location of sampling	Turbidity (NTU)
S_1	Treatment plant	44
S_2	Treatment plant	75
S_3	Treatment plant	51
S_4	Block 20	38
S_5	Block 5	48
S_6	Block 4	46
S_7	Block 6	45
S_8	Block 16	42
S_9	Block 29	76
S_{10}	Block 12	68
S_{11}	Block 1	74
S_{12}	Block 14	76

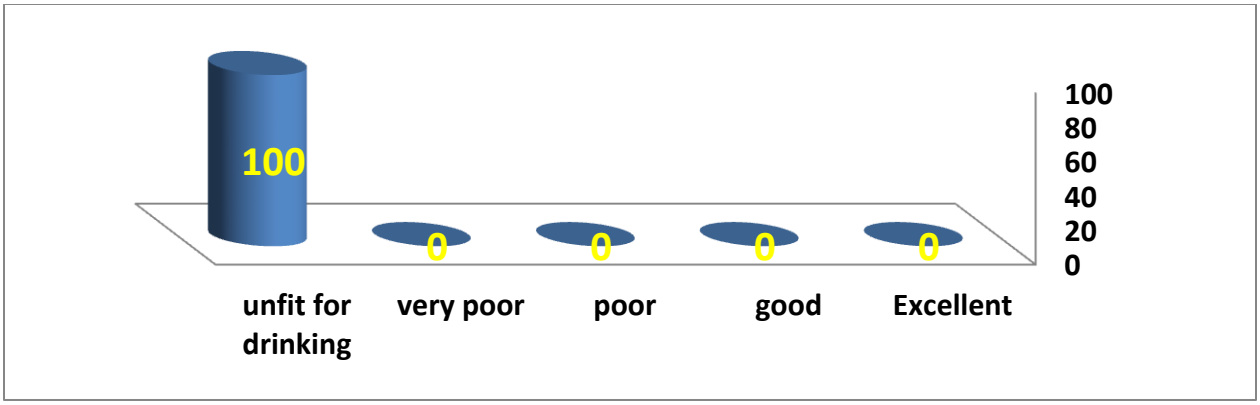
The above table shows that turbidity of water ranged from 38 to 76 NTU.

Table (2) *WQI for drinking water samples based on turbidity.*

samples	Va	Vi	Vs	V_a - V_i	V_s - V_i	K	qi	wi	Qi*wi	WQI
S_1	44	0	5	44	5	1	880	0.2	176	880
S_2	75	0	5	75	5	1	1500	0.2	300	1500
S_3	51	0	5	51	5	1	1020	0.2	204	1020
S_4	38	0	5	38	5	1	750	0.2	152	750
S_5	48	0	5	48	5	1	960	0.2	192	960
S_6	46	0	5	46	5	1	920	0.2	184	920
S_7	45	0	5	45	5	1	900	0.2	180	900
S_8	42	0	5	42	5	1	840	0.2	168	840
S_9	76	0	5	76	5	1	1520	0.2	304	1520
S_{10}	68	0	5	68	5	1	1360	0.2	272	1360
S_{11}	74	0	5	74	5	1	1480	0.2	296	1480
S_{12}	76	0	5	76	5	1	1520	0.2	304	1520
sum.∑								2.4	2732	1138

The above table shows that WQI for all samples more than 100 and general WQI is 1138.

Figure (1) *WQI for drinking water samples based on turbidity.*



The above figure shows that WQI is indicates quality of water is unfit for drinking purposes

Discussion

The study showed that the level of turbidity in drinking water ranged between 38- 76 NTU this level is very high, the reason may be due to absence of chemical coagulant and may refer also to filtration media. The guideline value of turbidity for drinking water must be less than5 NTU. We observed the level of turbidity is too high and ability of plant on removal of turbidity is very low. High levels of turbidity can protect microorganisms from effect of disinfection, when chlorine has been used in water disinfection process, also high levels of turbidity can stimulate the growth of bacteria, and give rise to a significant chlorine demand (WHO, 1997). Through findings, the present study revealed that ability of treatment plant on removal of turbidity is very low, this is may be due to fine clay particles present in the raw water, which penetrated the filter. In full- scale previous study done by (Tanner & Ongerth, 1990) they found that turbidity removal was between 0-63% due to the fine particles present in raw water and to the large fraction of fines in the new sand media used in the study. The present study showed that WQI is indicated all examined water samples were showed quality of water unfit for domestic use, so current water quality needs some types of treatment to improve its quality.

Conclusion:

All peoples whatever their stage of development and social and economic conditions, have the right to have access to drinking water in quantities and quality equal to the basic needs, throughout the results of this study we observed treatment of drinking water is insufficient due to high levels of turbidity in all examined water samples, also WQI indicated to water quality is unfit for drinking purposes without secondary treatment.

Recommendations:

According to results of this study it is recommended that: suitable coagulant must be used to degrease level of turbidity. And local health authorities must check drinking water supply system regularly according to WHO guidelines for drinking water to insure from efficiency of treatment process. Secondary treatment process must be take place at household level to decrease turbidity level and remove other contaminants.

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