Purity Water Production Technique with Multi Power Resources

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Abstract: Secure drinkable water is decisive and fundamental in order to increase the welfare of current generations and beyond. A new design study represents, small, and portable system for production high-purified drinking water depends on several sources of electric power with nanotechnology principles by using nano-membranes. This system can purify the water from rivers, lakes and marshes wells, as well as any tap water, with the lowest level of water source, this system can work by depending on both AC, and DC power. Tests carried out on the filtered water samples showed that the well water hardness before filtering was 2783.2 mg/L and decreased to 431.2 mg/L, and the pH ratio increased slightly from 7.1-7.3 and this elevation was considered ineffective. TSS decreased from 15 to 11 mg / l, also TDS, Mg²⁺, and Na⁺² were all reduced as follows (4420-290), (414.03-21.46), (120-32) respectively, and for tap water TSS, Hardness, TDS, Mg²⁺, Na⁺², and pH were all reduced as follows (6-4), (421-98), (430-127), (52.33-16.04), (27-6), (7 -7.1) .These data where compared to the World Health Organization (WHO), which showed the efficiency of the system in obtaining water within the natural specifications necessary for human use.

Keywords: Nano-membranes; tap water; water treatment.

1. Introduction

Water is an essential component of life, so if there is no water, there is no life [1, 2]. Since the beginning of creation, humans have been working to clean water and distillation it before drinking to preserve their health and for this purpose a number of methods have been used [3, 4].
Perhaps one of the most important of these methods is solar distillation, in which the researchers are still studying several designs of distillation in order to increase the productivity of distilled water [5].

The main water supply for Mahmudiya city south of Baghdad is the Tigris river. The problems of pollution and the decline of drinking water have pushed the researchers to look for other ways to purify water. Demand for the use of many types of indoor filters, which are based on reverse osmosis membranes is part of these systems [2]. The basis of these systems is the separation of clays, foams, bacteria, viruses, salts and minerals from water [6], then a percentage of the salts are mixed again, and other species contain an ultraviolet and visible device to kill living organisms [7]. The use of chlorine has many risks, chlorine function is to kill bacteria and as the bacteria is a living organisms, it dies and directly decomposition and this decomposition leads to a lot of diseases that start with a fever and end with the projection processes in pregnant women and this is confirmed by American researchers [8].

The meaning of Secure drinking water is a water without adverse health effects such as bacteria, viruses [9], harmful amount of [10] minerals, organic substances and free from [11], color, taste, odor, and turbidity. The commonly issues with water supplies which present in household are the acidity Sulfides, Sodium, hardness, chloride iron and pathogens [11], like viruses and bacteria, that’s why these parameters are used wildly to judge water quality. Various metal ions, like Calcium, Magnesium, Potassium, and Sodium, are fundamental in biological life [7, 11].

The usage of filters means that no chemical additives are needed [12]. The filtrated water is purer and tasty because of the home filtrated system contains several filters that are gathered and work as same as the human kidney that clear the excess salts and lead to separate the metal ions, salts, impurities and purify the body from the toxic substances and eject them through urine which is the result of metabolism of food [13]. Micro filtration, Ultra filtration, Nano-filtration, and Reverse membrane (MF, UF, NF, and RO) respectively, are based on the osmotic pressure principle [14]. RO membranes permit the water to pass and prevent the rest of the materials, salts, bacteria and viruses, that’s why it hasn’t been used in our current system, likewise NF membrane that needs less pressure and provide more water than the RO, therefore is preferred with better level of minerals, salts and less energy discharge [8]. RO membrane used in desalination of brackish water and seawater but NF membranes are used for drinking water [12].

There are three problems that faced the public water filtration systems: firstly it’s depending on one source of power, secondly the water source should be on a higher level consider to the system, finally this public water filtration is still use RO membranes, so the purpose of this study is to develop a newly system with weight about 8.760 kg, and it can be lift the water from any source of water like river or well and depends on several sources of power such as the usual electricity, car battery and the battery that it contain, this system uses NF instead of RO membrane which doesn’t need more pressure like RO membranes because the
pores is more bigger therefore that the amount of purified water is higher [1, 9], also it will allow some of salts and minerals to pass through it, which are necessary for the human body unlike the RO membranes which allow to pass only the water which is unhealthy to drink [10, 11], this system can works in both AC, and DC power. Mahmudiya city Tap and well water was evaluated by conducting physical and chemical properties. The Results are compared with (WHO) guideline standards to estimate the drinking water quality.

System setup

Figure 1 Explains the diagram of the system parts which composed of:

1-Nano-filter type NE1812-70. Korean origin from CSM Company. 2- Micro-tissue filters to remove the plankton and mud. 3- Filter to eliminate odors. 4- Filter to remove colors. 5- Small water pump to push water into the nano-filter, 6- Water pump to draw out water from the river or water well into the system. 7- Voltage depressor transformer from 12 volts to 24 volts. 8- Voltage crane transformer. 9- Battery for charging 24 volts. 10- Voltage Inverter 11- Switches ON and OFF 12- Safety pressure valve. 12- Electric wires to connect, and 13- The outer shell.

Figure No. (2) Shows the electric circuit which we designed, so we can see the three sources of power to run the system.

Figure No. (3) Explains the electric circle of the manufactured system which shows the resources of the electric current which can be used to switch on the system.

Figure No. (1) Explains the diagram of the system parts

Figure No. (2) Explains the outer of the system structure
2. Test Procedure

The system was operated and tested on several groundwater samples that were taken from the Mahmudiya city. Hardness, Ca$^{+2}$, Mg$^{+2}$ were measured by Titration method. TSS and TDS were measured by evaporation and drying methods according to the international standard number 2540D, Na ratio was measured by flame photometer / PFP7, Jenway, UK. The nano filter was placed for five hours in distilled water before use to clean it from the preservatives contained. All tests were conducted in the laboratories of the Environmental Research Center at the University of Technology in Baghdad.

3. Results and discussion

Potable water quality varies accordingly to several factors, such as water storage method, distribution network, water source and treatment process. Table 1 represents the analyzed mean values of physiochemical parameters and trace metals in tap as well as well water. The most critical water quality indices are the pH which the required range is from 6.5 to 8.6 according to WHO, in Mahmudiya city the tap water is neutral (pH =7) and after NF membranes (pH=7.3) it means the pH of well water changes from (7.1 to 7.3) which means that the well water after these membranes is also alkaline.
Table 1. Represents the analyzed mean values of physiochemical parameters and trace metals in tap as well as well water according to WHO limits.

| No. | Well water before NF | Well water after NF | Tap water before NF | Tap water after NF | WHO guidelines |
|-----|----------------------|---------------------|---------------------|-------------------|----------------|
| TSS mg/L | 15 | 11 | 6 | 4 | >10 |
| Total Hardness mg/L | 2783.2 | 431.2 | 421 | 98 | 500 |
| TDS mg/L | 4420 | 290 | 430 | 127 | 500 |
| Na⁺ mg/L | 120 | 32 | 27 | 6 | - |
| Mg²⁺ mg/L | 414.03 | 21.46 | 52.33 | 16.04 | 20 |
| pH | 7.1 | 7.3 | 7 | 7.3 | 6.6-8.5 |

In addition to all of this, the TDS concentration of well and tap water samples were between (4420 to 290 mg/l and 430 to 127), respectively, using this system. The concentrations of soluble solids (TDS) vary greatly according to the geological formation of the different regions, according to the type of minerals forming the composition and local topographic conditions. Although the concentrations of dissolved solids in the water of the city of Mahmudiya show record levels of not less than 1000 ppm, well’s water in this region exceeds the concentrations of solid materials with the level of Potable water, that is 4420 ppm. Also, the level of dissolved solids in the tap water studied can be attributed to the differences in the sources of this water in addition to the different treatment techniques.

Treated surface water showed a relatively high solid concentration, and effluent treatment processes successfully eliminated most of these materials. The results show that the turbidity of the water is less than 1NTU, which means effective removal of suspended solids in this water. The hardness of the water resulting from the precipitation causes the soap scum and then deposited it after evaporating the water as a result of air heating to economic losses. Measurements showed that the hardness of the studied water (tap and well water) after filtration was around 431.2, 98 ppm of COCO₃, respectively. According to the World Health Organization (2011), it is important to monitor the hardness of water (less than 100 ppm) to minimize the effect of network wear that causes low buffering capacity. In addition, the same reference indicated that there is evidence to demonstrate a clear impact on human health related to the presence of some chemicals in the water. The concluded results that gained from the study show that, the tap water in the study area does not affect human health, while well water samples have a clear toxicity level and must be filtered before drinking it.

WHO standards meet tap water quality also reflects best treatment processes. However, when TDS, TSS and the levels of sulfate, reaches to the maximum limits, these indicate a serious
situation. Eventually, the radiological tests are recommended for further work to examine the adverse effects of the tragic wars which has been presented in Iraq since the bygone years.

Conclusion

This paper presents a new design, small, and portable system for producing a high-purified drinking water within the natural specifications which necessary for human uses, which depends on several sources of electric power also using nanotechnology principles by using nano-membranes. Tests were carried out on the filtered water samples and showed that, the well water hardness before filtering was 2783.2 mg/l and decreased to 431.2 mg/l, and the pH ratio increased slightly from 7.1-7.3 and this increase was considered ineffective. TSS decreased from 15 to 4.9 mg/l also CaCO₃, TDS, Mg²⁺, and Na⁺ were all reduced as follows (4420-330), (432.06-23.57), (414.03-22.46), (120-32) respectively. Specifications and standards show the efficiency of the system for obtaining Potable water.

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