



WATER TREATMENT BY DOMESTIC LEVEL RO WATER PURIFIER AND ITS IMPACT ON HUMAN HEALTH

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Abstract: The aim of study is to check effectiveness of domestic level reverse osmosis (RO) water purifier by doing Physical and chemical assessment of water and correlate it with human health. The present work describes chemical quality of water samples. pH, TDS, Conductivity, Calcium, magnesium, sodium, potassium, chloride, nitrate, sulphate etc are the chemical parameters of water. One sample is collected before RO treatment and another sample is collected after RO process. All parameters were analyzed by AASM and EDTA titrimetric method.

Index Terms - RO water, Human health, AASM, EDTA titrimetric method

I. INTRODUCTION

Water is essential for sustaining life. It plays a central role in the growth and environmental health of cities and towns. The availability of safe and reliable source of water is one of the prime necessities for the establishment of a stable community. Water has always played a prominent role in human civilization. Water was needed for drinking, preparing food, bathing, cleaning, irrigating crops and other tasks, so it was important to have ready access to this resources. The water resources used for supplying water were not always clean however, and treating drinking water to improve its smell, taste, clarity, or to remove disease-causing pathogens has occurred in one form or another.

Water with drawn from rivers, lakes or reservoirs is rarely clean enough for human consumption, if it is not treated to purify it. The primary objective of water purification is to remove harmful microorganisms or chemicals, thereby preventing the spread of disease and protecting public health. It is necessary the water for drinking purpose is pure and safe.

There are many water treatment processes used in domestic water purifiers namely, activated carbon filter, membrane filter, reverse osmosis system, ultraviolet light system and combination units.

RO is the opposite of the natural process of osmosis. During osmosis, pure water flow through a semi-permeable membrane from the dilute side to the concentrated side until both sides have reached the same level of concentration. In reverse osmosis, the natural process of osmosis is reversed by using high pressure, pure water is forced to flow through membrane from the concentrated side to more dilute side.

1.1 Pure and natural R.O. system

Five stage process for total water treatment:

Stage 1: Pre-filter:- This filter removes larger particles such as dust, sand and other suspended particles above 5 microns and therefore it renders clarity to incoming water.

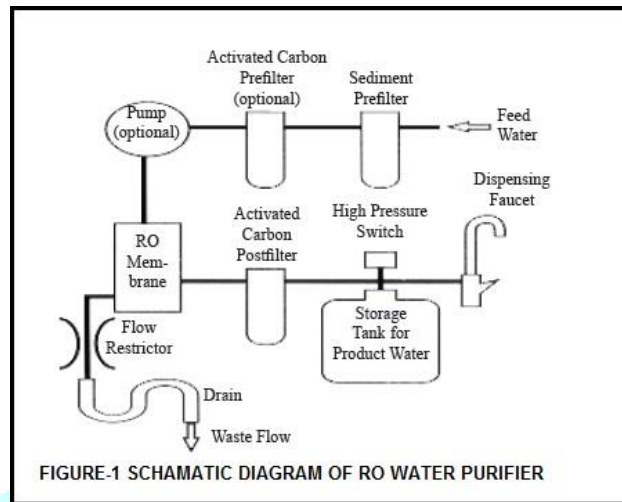
Stage 2: Granular activated carbon:- This filter removes chlorine, organic matters, colour, bleaching liquid. This makes the water crisp to taste.

Stage 3: Silver activated carbon block:- This filter removes harmful chemicals, smells, residual colour, which prevents membrane damage.

Stage 4: Reverse osmosis membranes:- The comprises removes dissolved salts, germs, bacteria, virus and all suspended particles below 0.0001 micron making the water pure, safe and crystal clear.

Stage 5: Post RO filter:- The bacteriostatic silver impregnated carbon prevents growth of bacteria at the point of use and removes colour, thereby restores the water's natural. Hence you are assured of safe drinking water.

Stage 6: RO antiscalent:- It stops scaling formation on membrane.



Calcium is the one of the alkaline earth element, fifth in abundance in the earth crust(3%), react with water, essential constituent of bones and teeth. Most common compounds: limestone(CaCO_3), gypsum($\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$), fluorite(CaF_2), also calcium carbide(CaC_2), chloride(CaCl_2), cyanamide(CaCN_2), hypochlorite [$\text{Ca}(\text{ClO})_2$], nitrate [$\text{Ca}(\text{NO}_3)_2$] and sulfide(CaS). It assists the functions of nerves and muscles. The use of more than 2.5 grams of calcium per day without medical necessity can lead to the development of kidney stones and sclerosis of kidneys and blood vessels.

There are no or very limited standards promulgated for calcium in drinking water because of no toxicity, there are no wide range surveys for determination of calcium in its element form. The expected calcium concentration in raw or treated waters may vary from close to zero or several hundred mg/L.

Magnesium has been considered as nontoxic to humans at the concentration expected in water. Magnesium salts have a laxative and diuretic effect particularly for individuals not accustomed to high dosage. The WHO international standards of drinking water list a maximum acceptable level of 50 mg/L and maximum allowable level of 150 mg/L.

Potassium is the seventh most abundant element and constitutes 2.4% by weight of the earth's crust. It is never found free in nature. Most potassium minerals are insoluble. It decompose in water, generating hydrogen and catching fire spontaneously. Chemically many potassium salts are very important: hydroxide, nitrate, carbonate, chloride, chlorate, bromide, iodide, cyanide, sulfate and chromate. It has been estimated that potassium deficiency in adults may be associated with a daily intake under 2000mg (hypokalemia).

Sodium is extremely active, alkaline element, found in nature only in combined form, sixth most abundant on earth. Most important compounds are: common salt(NaCl), soda ash(Na_2CO_3), baking sode(NaHCO_3) and caustic soda(NaOH). Sodium is considered harmful in drinking water at high concentrations to person suffering from cardiac, renal and circulatory diseases.

II. EXPERIMENTAL

Two water samples were collected. One sample was collected from the tap water. Second water sample is RO purified water. Water quality parameters were determined from these different sample by standard method "IS3025 (p-40)91 Re.03 EDTA Titrimetric No.5" and AASM method.

The various parameters included analysis of pH, TDS and conductivity, sodium, calcium and potassium contents were measured by flame photometry. Calcium & magnesium hardness, total hardness, chloride, sulphate and nitrate contents were also determined by suitable methods. All the reagents used for the analysis were of analytical grade and the instruments were of required precision and accuracy.

2.1 EDTA Titrimetric method:

2.1.1 Procedure:

Pipette an aliquot of water sample, maximum 50 ml, in a porcelain dish or 150 ml beaker and adjust the volume to approximately 50 ml.

Add 1 ml hydroxylamine hydrochloride solution (NH₂OH.HCL). Add 1 to 2 ml buffer solution so as to achieve pH of 10 to 10.1.

If the end point is not sharp, add 2 ml sodium cyanide or sodium sulphide inhibitor solution. Addition of sodium cyanide or sodium sulphide may be omitted if copper, zinc, lead, cobalt and nickel are absent and if the sample contains less than 0.25 mg of iron and 0.025 mg of manganese.

If manganese is present, add 1 to 2 small crystals of potassium ferri cyanide. Stir and wait for atleast 5 min until sodium ferri cyanide precipitates.

Add 2 ml erichrome black T indicator solution, titrate with standard EDTA solution stirring rapidly in the beginning and slowly towards the end till end point is reached when all the traces of red and purple colour disappear and solution is clear blue in colour.

2.2 AASM Method:

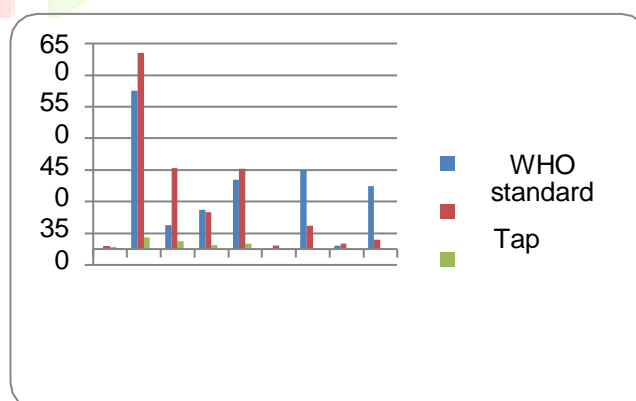
AASM method were used to determination of antimony, bismuth, cadmium, calcium, cesium, chromium, cobalt, copper, gold, iridium, iron, lead, lithium, magnesium, manganese, nickel, platinum, potassium, rhodium, rutherfordium, silver, sodium, thallium, tin and zinc by direct aspiration into an air- acetylene flame.

III. Result and Discussion

All the samples were found to be transparent and odorless. The tap water sample showed salty taste. This attributes to very high TDS in tap water.

Sr. No.	Parameter	WHO	Tap water	RO water
1	pH		7.07	6.27
2	Turbidity		621	37
3	Calcium	75	256	24
4	Magnesium		116	12
5	Sodium	200	254	17
6	Potassium		0.11	0.8
7	Chloride	250	74	3
8	Nitrate	10	16	0.2
9	sulphate		30	0.1

It is observed that the pH of the water was slightly alkaline and only minor decrease in pH was recorded in the RO water.



The WHO has suggested a limiting value of 500 ppm of TDS for potable water. While the minimum TDS for the tap water samples under present investigation is 621 ppm whereas the highest value of TDS has risen to 1390 ppm. Such high values of TDS must be reduced by suitable method to reinstate the potability of water.

The summation of calcium hardness and magnesium hardness is regarded as the total hardness of water. In the present investigation, it has been observed that the calcium concentration is at least two to three folds greater than that of magnesium. Potassium content of the tap water samples is much low.

Magnesium plays some very important role in the functioning of the human body. Almost all the cells in the human body contain magnesium. Moreover it plays a vital role in muscle contraction and transmission of nerve impulses. It also activates energy producing enzymes and expands blood vessels which reduces the blood pressure and in turn reduces the risk of heart attacks. Deficiency of magnesium can cause nervousness, lack of concentration, dizziness, headaches and migraines. Since the magnesium levels found in the RO treated water in each case is almost 60% less than the desired levels, the user must input the balance amount of magnesium through alternate source.

Calcium is an important intake for human beings of all the age. The need of calcium is much high during the fetal growth, childhood and lactation. Calcium deficiency is known to cause several diseases related to teeth and bones. Osteoporosis is commonly observed in calcium deficient people. It also helps in preventing blood clotting. Around 70% of deficiency of calcium observed in RO treated water can cause above mentioned disease if it is not properly supplemented through calcium rich diet.

Alkali metals like sodium and potassium also play vital role functioning of the human body. While excess of sodium is found to increase the blood pressure, a level of 100 ppm is recommended for drinking water. Since sodium is readily available from the common salt which is used extensively, sodium deficiency is a very rare situation in human beings. Potassium is essential for the smooth functioning of muscles. The deficiency of potassium is capable of malfunctioning of heart impulse and weakening of skeletal muscles. While the desired potassium level in drinking water is about 100 ppm, the RO treated water in present samples show almost negligible concentration. Such low concentration of potassium must be supplemented through alternated sources.

CONCLUSION

The quality of water samples subjected to study was unacceptable. RO treatment removes some harmful contaminants like bacteria and viruses but also removes some desired nutrients like calcium, magnesium, potassium etc from water. People may increase the intake of useful minerals via alternate sources.

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