EFFECT OF HUMAN HEALTH DUE TO CONSUMPTION OF REVERSE OSMOSIS(RO) WATER

A Mini Project Report Submitted in Partial Fulfillment of the Requirement for the Degree of

BACHELOR OF TECHNOLOGY

IN

CIVIL ENGINEERING

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(Approved by AICTE, Accredited by N.B.A, NewDelhi, NAAC-A+ Grade)

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CERTIFICATE

This is to certify that the Project Report entitled ”EFFECT OF HUMAN HEALTH DUE TO CONSUMPTION OF REVERSE OSMOSIS(RO) WATER” that is being submitted by

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in partial fulfillment of the requirement for the award of B.Tech in Civil Engineering in the **RAJEEV GANDHI MEMORIAL COLLEGE OF ENGINEERING AND TECHNOLOGY,**Nandyal (Affiliated to J.N.T University, Anantapur) is a bonafide record of confide work carried out by her under our guidance and supervision. The results embodied in this technical report have not been submitted to any other university or institute for the award of any Degree.

Signature of the Project Guide

Signature of Head of the Department
Dr. G. Sreenivasulu Ph.D (IISC),
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Examiner:
Date:

Dedicated to my beloved parents, and teachers who have worked hard throughout my education.

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Abstract

REVERSE OSMOSIS(RO) is a very effective method in minimizing the concentrations of some elements in drinking water treatment.WORLD HEALTH ORGANISATION(WHO) says in search for clean drinking water, it removes many essential minerals from water.Scientists further studied that this mineral loss was not compensated by our diets, RO water was responsible for an increased elimination of minerals from the body.

The goal of this study is to measure the concentrations of some important parameters for human body and the role of Reverse Osmosis (RO) method in the local drinking water treatment stations in minimizing these constituents.

Those parameters are PH, TDS, Ca, Mg, K, F, Na and TH.Deficiency in Calcium leads to Osteoporosis, Arthritis, Depression, Mood Swings, Irritability, Bone Loss, Hair Loss etc.Deficiency in Magnesium lead s to Diabetes, Fatigue, Insomnia, Hypertension,Coronary heart disease etc..
For testing of RO water, the samples(RO water) was collected from nandayal local water plants.
With this we can conclude that what amount of parameters is maintained by the RO plants at Nandayl.
Finally, we can conclude the water standards are not maintained and the quality of water and the proper distribution to the households or not.
KEY WORDS: Reverse Osmosis ,Human Health, Demineralization, TDS.

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Chapter 1

Introduction

1.1 Introduction

Water is the elixir of life. The requirement of water for very existence of life and preservation of health.The water can get contaminated, polluted and become a potential hazard to human health. Water in its purest form devoid of natural minerals.Limited availability of fresh water and increased requirements has led to an increased usage of personal, domestic and commercial methods of purification of water.Demineralised water is defined as water almost or completely free of dissolved minerals as a result of : distillation, deionization, membrane filtration (reverse osmosis or nanofiltration),electrodialysis or other technology.

1.1.1 Reverse Osmosis(RO)water

Reverse osmosis (RO) is a water purification process that uses a partially permeable membrane to remove ions, unwanted molecules and larger particles from drinking water. In reverse osmosis, an applied pressure is used to overcome osmotic pressure, a colligative property, that is driven by chemical potential differences of the solvent, a thermodynamic parameter. Reverse osmosis can remove many types of dissolved and suspended chemical species as well as biological ones (principally bacteria) from water, and is used in both industrial processes and the production of potable water. The result is that the solute is retained on the pressurized side of the membrane and the pure solvent is allowed to pass to the other side. To be "selective", this membrane should not allow large molecules or ions through the pores (holes), but should allow smaller components of the solution (such as solvent molecules, i.e., water, H2O) to pass freely. In the normal osmosis process, the solvent naturally moves from an area of low solute concentration (high water potential), through a membrane, to an area of high solute concentration (low water potential).

Figure 1.1: Mini ROtreatment plant

The driving force for the movement of the solvent is the reduction in the free energy of the system when the difference in solvent concentration on either side of a membrane is reduced, generating osmotic pressure due to the solvent moving into the more concentrated solution. Applying an external pressure to reverse the natural flow of pure solvent, thus, is reverse osmosis. The process is similar to other membrane technology applications. Reverse osmosis differs from filtration in that the mechanism of fluid flow is by osmosis across a membrane. The predominant removal mechanism in membrane filtration is straining, or size exclusion, where the pores are 0.01 micrometers or larger, so the process can theoretically achieve perfect efficiency regardless of parameters such as the solution's pressure and concentration. Reverse osmosis instead involves solvent diffusion across a membrane that is either nonporous or uses nanofiltration with pores 0.001 micrometers in size. The predominant removal mechanism is from differences in solubility or diffusivity, and the process is dependent on pressure, solute concentration, and other conditions. Reverse osmosis is most commonly known for its use in drinking water purification from seawater, removing the salt and other effluent materials from the water molecules.

1.1.2 Reverse Osmosis(RO) and Removal of Minerals from Drinking Water

Reverse Osmosis (RO) removed nearly 90-99including minerals from the drinking water supply.Most mineral constituents of water are physically larger than water molecules and they are trapped by the semi-permeable membrane and removed from drinking water when filtered through a RO.The evidence is strong that calcium and magnesium are essential elements for human body.Reverse Osmosis will generally remove calcium , magnesium, sodium, iron,flouride, potassium etc..The quality of drinking water is powerful environment for human health. Water which is essential for life, growth and health can also be a source of spread of disease and cause of ill-health, if contaminated or improperly handled and stored. The World Health Organization (1993) has estimated that in India 21 Every year 1.5 millions children under five years of age die of water born diseases and the country loses 18 millions people per hour (over 200 millions people per day) each year due to these diseases. About 10 per cent of the rural and urban population does not have access to regular safe drinking water and many more are threatened. Safe drinking water is one of the most important indicators of food absorption.Scientists further studied that this mineral loss was not compensated by our diets. RO water was responsible

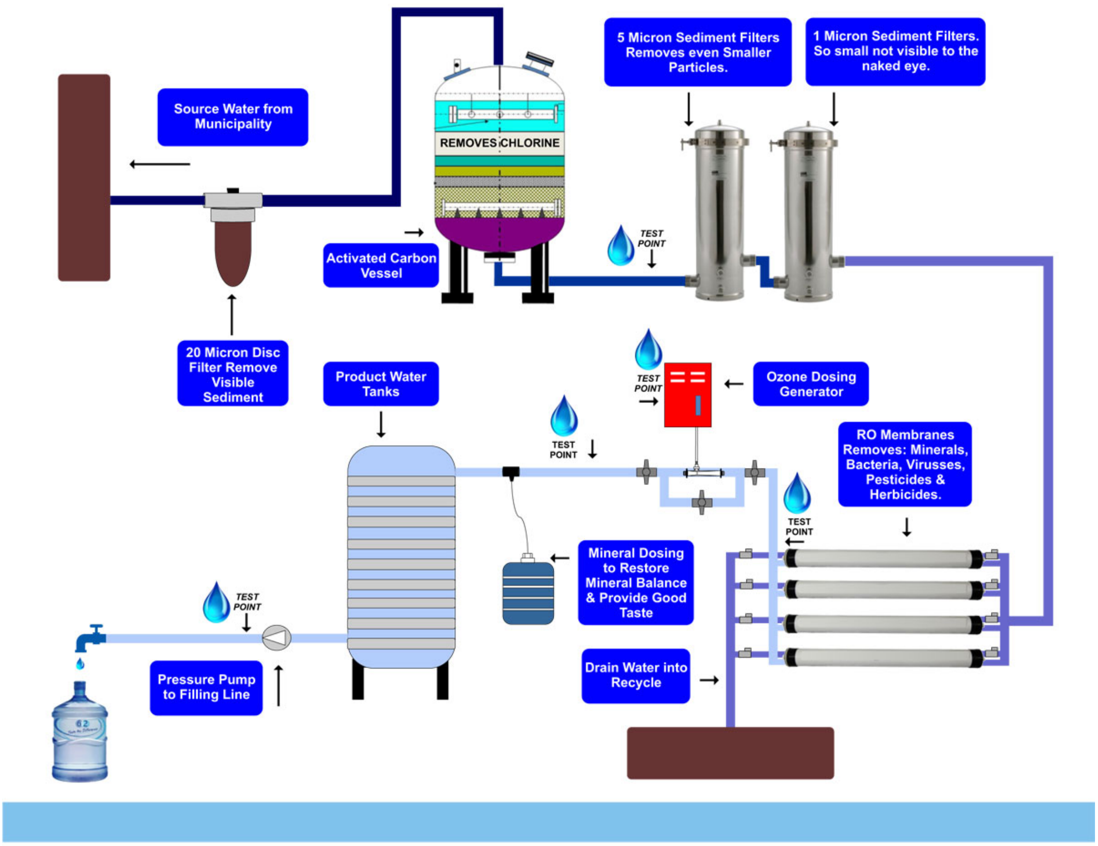

Figure 1.2: Step by step process of removal minerals of RO water

for an increased elimination of minerals from the body.Consumption of RO water leads to the dilution of the electrolytes dissolved in the body water.Calcium (Vitamin-D) and Magnesium (the Calming mineral) get removed from your body by RO Water. Deficiency in Calcium and Magnesium leads to: Osteoporosis, Diabetes, Arthritis, Fatigue, Depression, Cramps, Mood Swings, Insomnia, Irritability, Hypertension, Bone Loss and Coronary heart diseases and, Hair Loss. Osteoporosis. Just about everyone knows that Reverse Osmosis (RO) systems excel at removing water impurities, but few are aware that they also remove the beneficial minerals. In fact, the reverse osmosis process removes 92-99After analyzing hundreds of scientific studies concerning demineralized or reverse osmosis water, the World Health Organization released a report stating that such water "has a definite adverse influence on the animal and human organism."

Consumers have been so concerned with removing as many things from water as possible that they have forgotten to ask if the resulting water actually improves health or causes health problems. It's assumed that no toxins equals better health, but there is simply more to healthful water than a lack of toxins, as the World Health Organization clearly points out. What is alarming is that consuming reverse osmosis water for even just a few months can create serious side effects. "The effects of most chemicals commonly found in drinking water manifest themselves after long exposure." However "only a few months exposure may be sufficient 'consumption time effects' from water that is low in magnesium and/or calcium. Illustrative of such short-term exposures are cases in the Czech and Slovak populations who began using reverse osmosis-based systems for final treatment of drinking water at their home taps in 2000-2002. Within several weeks or months various health complaints suggestive of acute magnesium (and possibly calcium) deficiency were reported. Among these complaints were cardiovascular disorders, tiredness, weakness or muscular cramps." Again, serious side effects within just several weeks or months.But it gets even worse. Because reverse osmosis water doesn't have enough minerals, when it is consumed, it also leaches minerals from the body. This means that the minerals being consumed in food and vitamins are being urinated away. Less minerals consumed plus more minerals being excreted equals serious negative side effects and big health problems. In a scientific study performed to see if minerals consumed in food can make up for the lack of minerals in reverse osmosis water, scientists concluded that "reduced mineral intake from water was not compensated by their dietslow-mineral water was responsible for an increased elimination of minerals from the body."

"It has been adequately demonstrated that consuming water of low mineral content has a negative effect on homeostasis mechanisms, compromising the mineral and water metabolism in the body.” Consumption of reverse osmosis water ”leads to the dilution of the electrolytes dissolved in the body water. Inadequate body water redistribution between compartments may compromise the function of vital organs.Side effects at the very beginning of this condition include tiredness, weakness and headache; more severe symptoms are muscular cramps and impaired heart rate.”Despite being torn to shreds by the marketing executive at the meeting, I never believed the RO industry claim that it didn’t matter if their systems removed everything from the source water because the human body couldn’t absorb inorganic molecules anyway. After all, most of the supplements that are available on the market are inorganic, which means that either the RO industry was protecting its ”ass-ets” or the entire supplement industry was a scam. The RO industry has been disseminating inaccurate (that’s about as politically correct as I can get information for years. Doctors and other health care professionals have unwittingly been endorsing the ”RO water is the best drinking water” message for years which makes the myth worse because we trust these people with our health.

Chapter 2

LITERATURE SURVEY

Awareness of the importance of minerals and other beneficial constituents in drinking water has existed for thousands years, being mentioned in the Vedas of ancient India. In the book Rig Veda, the properties of good drinking water were describe follows :

Sheetham (cold to touch) Sushihi (clean) Sivam (should have nutritive value, requisite minerals and trace elements) Istham (transparent) Vimalam lahu Shadgunam (its acid base balance should be within normal limits) A Past survey conducted by WHO,estimated that 80

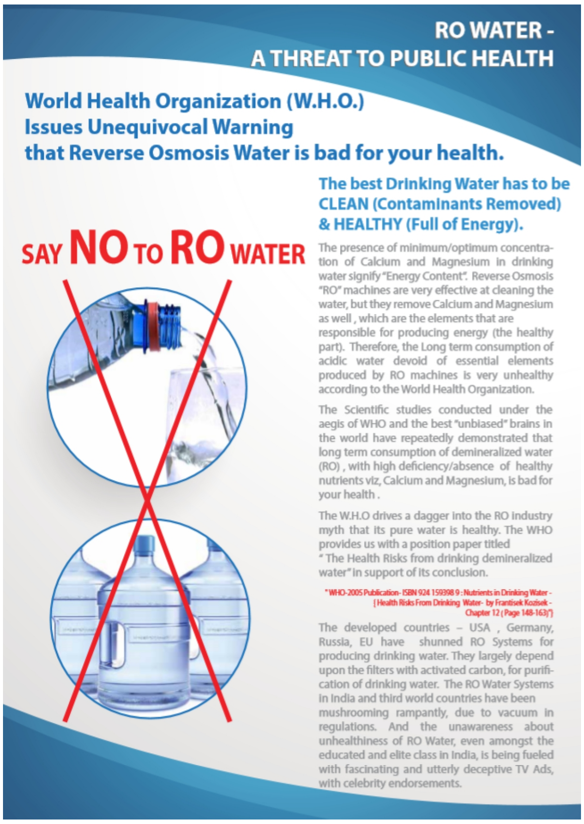

Figure 2.1: who says reverse osmosis water is bad for your health

For the above two reasons the strongest probable cause is RO Water. WHO says In search for clean drinking water, we remove many essential minerals from water RO Water actually causes health problems. Reverse Osmosis is capable of removing up to 99particles, colloids, organics, bacteria and pathogens from the feed water. A Past survey conducted by WHO,estimated that 80 Recent reports also suggests 8 out of 10 people in Delhi suffer from vitamin D deficiency. For the above two reasons the strongest probable cause is RO Water. WHO says In search for

YEAR	AUTHOR	TITLE	DISCUSSED ON
2013	▪ K.C.Verma ▪ Lt A.S.Kushwaha	*Demineralization of drinking water: Is it prudent?*	Due to long consumption of RO water , it create a mineral deficiency i,e (SUN SHINE VITAMIN), VITAMIN D

Table 2.1: WHO also reveals a report on RO water quality standards

clean drinking water, we remove many essential minerals from water RO Water actually causes health problems. Reverse Osmosis is capable of removing up to 99particles, colloids, organics, bacteria and pathogens from the feed water

	Water Contaminants	**EFFICIENCY**
Reverse Osmosis (RO) Systems	Protozoa	VERY HIGH
	Bacteria	VERY HIGH
	Viruses	VERY HIGH
	Chemicals	• Will remove common contaminants (metal ion, aqueous salts), • Including sodium chloride, copper, chromium , and lead; • Also reduce arsenic, fluoride, radium, sulfate, calcium , magnesium, potassium , nitrate, fluoride and phosphorus.

Table 2.2: Guidelines on water purification by Reverse Osmosis(RO)from govt. of india

Chapter 3

THEORETICAL STUDY

3.1 WATER CONSTITUENTS AND SUPPLY

Water varies greatly in concentration of dissolved substances, both with geographical location and with the season of the year. It is not possible to define an average water constituency, for there is no agreement on its exact composition.Calcium and magnesium ions are the two major divalent cations, and collectively constitute some 95perc of what is known as "hardness" in water.However, the other polyvalent cations can contribute to it. The resultsof many important epidemiological studies in the past have been expressed in terms of "hardness" rather than as concentrations of individual ions.For this reason the term "hard water", and its converse, "soft water", cannot be entirely discarded from being used in this report. However, preference should now be given to the measurement of the concentration of calcium and magnesium ions insted

Most communities face a very limited choice of water supplies. If the ori- ginal supply of a community should become inadequate as the population in- creases, arrangements may have to be made to introduce and add water from a distance. If the latter is a surface water of low mineral content and the for- mer was a highly mineralized ground water, the composition of the mirxture is likely to vary seasonally and between districts. In some areas water rich in calcium and magnesium ions is softened before distribution; in others the water may be softened in individual home units to different degrees. Some commu- nities accept such water without attempting to change it. When water con- tains a high proportion of bicarbonate ions it can be softened with lime, which raises the pH and precipitates calcium carbonate; at higher pH, magnesium hydroxide is also precipitated. No ions are added to the water by this process and, in fact, the mineral content is reduced. If the principal anion is sulfate, the water may still be softened if the pH is raised with sodium carbonate, but the concentration of sodium ions is thereby increased.

A third method employs sodium bound to an ion exchange resin, and replaces calcium and magnesium ions with twice as many sodium ions. Ion exchange units are the only form of domestic softener, and in some areas this method is also used for municipal water treatment.A water supply is frequently blended to augment the quantity available.When water is softened by precipitation, it is usually most economical to remove nearly all of the calcium and magnesium from a portion of the water and then blend it with unsoftened water to produce an acceptable product. likewise, desalinated water can be blended with an existing water supply to increase the volume, to add mineral ions and thereby improve the taste, and to reduce its aggressiveness. Sea water is unsuitable for blending with desalinated water, although on ships and on arid islands some addition of minerals may be necessary. A convenient method, which provides both magnesium and calcium in desirable proportions, is to pass the water over dolomitic limestone.Also, carbon dioxide may be added to provide sufficient buffer capacity in the water. Whenever chemicals are to be added to water, including sodium chloride used for regenerating water softeners, the quality of the additives should be of the highest possible purity, and comparable to the standards applicable to food additives and edible products.

Recently it has become possible to remove virtually all the salts from saline water and to prepare a product that meets current drinking-water stan- dards. Distillation of sea water is practised in a number of arid areas to provide part or all of the drinking-water supply. Also, highly mineralized groundwater may undergo treatment by distillation or membrane separation. The fact that pollution products such as ammonia, nitrites, and some volatile organic substances are not removed by distillation or membrane separation and may be concentrated in the water, means that water to be used for desalination should be free from gross pollution. Water softeners operated in the home may become breeding beds for bacteria. Yet so long as such softened water is used only after being boiled or effectively pasteurized, these bacteria are probably of no consequence. In this connexion a previous WHO working group has al- ready recommended that water from the municipal supply be taken for drink- ing and food preparation before being softened in the home (5). The increasing use of desalinated water raises two important issues: first, what are the adverse effects, if any, on health arising from the use of such water and second, which removed substances should be returned to make it a good water? Opinion in the Working Group differed about the addi- tion of any minerals to natural water, even if it was very low in important minerals. Some members felt that magnesium and/or other minerals should be added only if the water had been artificially demineralized; there was also a feeling that such artificially demineralized water might be adverse to health unless its mineral composition had been ”corrected” by returning certain ionic constituents. Others felt that the problem should perhaps be approached, for each element, in terms of its nutritional requirements and availability to the human body, regardless of the source of the water and whether the mineral-insufficient water was collected, for example, from a natural granite basin or from a desalination plant. In any event, either option should be based on a careful risk-benefit evaluation.

3.2 WATER REQUIREMENTS

The most urgent of all nutritional needs is the need for water. Under normal conditions in a moderate climate, the adult daily water requirement lies between 35 and 50 g of water per kg of body weight. In a tropical climate, or while working in hot areas, this need will be considerably higher. The daily requirement of an infant is 100-150 g of water per kg of body weight, i.e, some three times higher, weight for weight, than that of an adult (9). Water is consumed not only in the form of beverages, such as tea, coffee, soft drinks, juice, wine, and beer; about 1 litre is obtained from food daily. In this report,a quantity of 2 litres has been taken as the average amount of tap water consumed by a normal adult each day (10, J I). This includes its constitution by the consumer into drinks such as tea and squashes but not its consumption in the form of bottled drinks such as beer or ”mineral water”. Ingested water carries with it

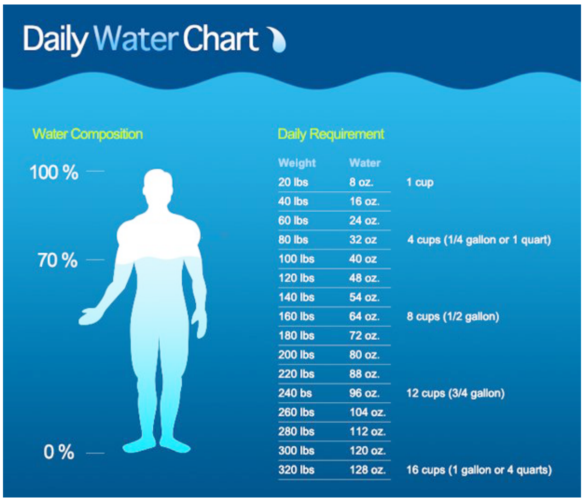

Figure 3.1: Daily water chart

minerals and organic substances, the indi- vidual concentrations of which may be low. However, because the volume of water consumed may be large, the amount of desirable and undesirable sub- stances contained in it may be significant. Therefore, the nutritional aspects, biological availability, and possible toxic levels of such substances must be considered. When studying the effects of individual substances, it must be appreciated that there may be interactions between the substances themselves, as well as interactions with other food components, which may reduce or en- hance their availability and their effect on health.

3.3 WATER REQUIRMENTS AND CONSUMPTION

vary considerably, depending on the consumers' age, diet, and work and on climatic conditions. Substances that may have no appreciable effect when normal quantities of water are consumed may become im- portant when greater quantities are ingested;increase during pregnancy and breastfeeding; are affected by pathological states, such as diabetes insipidus or diseases accom- panied by profuse sweating. Population groups at high risk should be given special consideration from the toxicological and nutritional viewpoints.

Water Consumption for Various Purposes

	Types of Consumption	Normal Range (lit/capita/day)	Average	%
1	Domestic Consumption	65-300	160	35
2	Industrial and Commercial Demand	45-450	135	30
3	Public Uses including Fire Demand	20-90	45	10
4	Losses and Waste	45-150	62	25

Figure 3.2: water consumption for various uses

3.4 HEALTH SIGNIFICANCE OF INDIVIDUAL SUB- STANCE

The Working Group considered that the health significance of sub- stances in drinking-water cannot be based only on adverse effects due to their presence and possible excess, but also on possible adverse effects due to their decreased concentration. Evidence that such a deficiency may impair health is based both on a consideration of its nutritional importance and on its acute and long-term effects on morbidity. Such evidence is derived from laboratory and animal studies and from epidemiological investigations of human populations. Judgements can only be made from evidence that is available at this time. The nature of health impairment is such that the existing pool of evidence will be continually supplemented as results become available from long-term surveillance of the health of populations, and as technical advances in the detection of morbidity occur. Judgements and recommendations will therefore need to be kept under

HEALTH EFFECTS OF CHEMICAL PARAMETERS:

Parameter	BIS Guideline value (maximum allowable)	General & Health effect
Total dissolved solids	2000 mg/L	Undesirable taste; gastro intestinal irritations;
pH	6.5-8.5	mucous membrane; bitter taste; aquatic life
Hardness	600mg/l	Poor lathering with soap; deterioration; scale forming; skin irritation;
calcium	200mg/l	skin irritation, bone diseases
Magnesium	100mg/l	deterioration of clothes;
Fluoride	1.5mg/l	Dental and skeletal fluorosis; non-skeletal

Table 3.1: Health effects of chemical parameters

regular review.Adverse effects of pollutants in water are, on the whole, easier to dem- onstrate than beneficial effects of normal constituents, and this has tended to dominate the thinking of regulatory agencies and those who set standards. It has long been believed that some constituents of water can be beneficial to health. It has been observed, for instance, that people living in areas where the water supply contains relatively high levels of calcium and magnesium (”hard water”) have lower death rates from heart disease than people living in areas with a low content of these minerals. The evidence for such a relationship has been well documented (72) and a number of theories have been proposed to account for it. Many assume that there is a substance present that is beneficial to health. However, it is not known whether this presumed ”benefit” takes the form of protection against leaching of toxic metals from the plumbing, or arises from the presence of supplemental quantities of an important nutritional component. Another theory suggests that many ”soft” waters contain an excess of ions, such as sodium, cadmium, and lead, that may exert a toxic effect With the recognition that water may contribute significantly to man’s nutritional requirements, it is important to look at its constituents to see whether natural water is a significant nutritional source for some of them.Much of the evidence on the effect of water substances on medium- to long-term morbidity will result from epidemiological investigations, such as the search for the association between the distribution of a disease in a given population and the distribution of suspected chemicals or other factors in the water supply to which this population is exposed. An association by itself, however, does not establish a cause and effect. Often,this has to be ascertained by difficult and painstaking inquiries to determine the consistency of the association (from place to place, from population to population, and over time), its strength (i.e., the size of the risk of disease among those exposed compared with those not exposed), and its biological plausibility in laboratory and animal experiments. The temporal relationship (i.e., the confidence with which exposure to the suspected cause can be judged to have antedated the onset of the disease) and, eventually, the search for a dose-response relationship (such as exists between fluoride and dental caries, or smoking and lung cancer) are essential prerequisites to the judgement that an association is likely to be a causal one. Modification, or even elimination of the suspected cause in non-causal associ- ations, will have no effect on the frequency of the disease in question. For this reason, it is essential that good evidence of causality, such as that outlined above, be obtained before changes in the mineral content of drinking-water are recommended.

3.5 WATER QUALITY STANDARDS

Various parameters used in the study have desirable and permissible values as per the BIS standards (2012).

Chemical Parameters for Drinking Purpose as per (BIS, 2012 and WHO, 2006)

S.No	Parameter	BIS Standards		WHO Standrards
		Desirable	Permissible	
1	pH	6.5-8.5	-	6.5-8.5
2	TDS as mg/l	500	2000	500-1500
3	Total Hardness as mg/l	300	600	100-500
4	Calcium as mg/l	75	200	75-200
5	Magnesium as mg/l	30	75	30-150
6	Flouride as mg/l	1	1.5	1-1.5
7	Potassium as mg/l	10	-	12
8	Sodium as mg/l	100	-	50-200

Table 3.2: Water quality standards/guidelines

3.6 IDENTIFICATION OF POTENTIALLY IMPORTANT SUBSTANCES

The first task of the Working Group was to draw up a broad list of inor- ganic substances occurring naturally in drinking-water. This list was as follows:aluminium, antimony, arsenic, barium, beryllium, boron, bromine, cadmium,calcium, carbonates, chromium, cobalt, copper, fluorine, iodine, iron, lead,lithium, magnesium, manganese, mercury, molybdenum, nickel, nitrates, phosphates, potassium, selenium, silicon, silver, sodium, strontium, sulfates, thallium, tin, titanium, vanadium, and zinc. A number of additional minor elements and ions, which also occur in water in very small quantities, were not recognized as having any nutritional significance and were not further considered.

From the above list, the Working Group selected nine substances: cal- cium, chromium, fluorine, lithium, magnesium, potassium, selenium, sodium, and zinc, for discussion in greater detail because of evidence suggesting that these may be important to health in the context of drinking-water. These substances are usually added to demineralized or desalinated water by blend- ing it with natural water in order to adjust the concentrations of calcium, magnesium, and bicarbonate ions. It was felt that such an addition should be acceptable. However, under no circumstances should the resulting blended water product depart from appropriate drinking-water standards.

3.7 ADVANTAGES OF REVERSE OSMOSIS(RO)WATER

Reverse osmosis (RO)water purifier is the best solution for treating hard water.

RO water purifier removes toxin such as lead, mercury, Fluoride, Arsenic, Chlorine which case human body to be ill. Lead metal can cause brain damage and anemia.

RO water filter is great for removing commonly found Cryptosporidium in lake, river and public supply water.

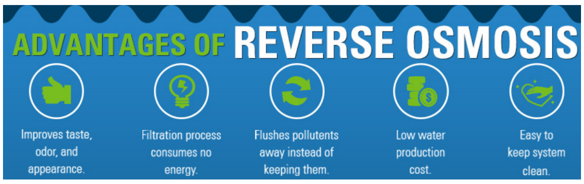

Figure 3.3: Advantages of RO water

3.8 DISADVANTAGES OF (RO)WATER

Removes essential minerals:While RO water purifier removes dissolved impurities it removes natural mineral such as iron, magnesium, calcium and sodium which are essential to the human body and cause a mineral deficiency in the body.

Not kills bacteria, viruses:RO water purifier does not kill waterborne disease-causing bacteria and viruses. There high probability that microorganisms can pass through RO membrane

Water taste altered:As natural minerals are removed water gets de-mineralized as a result water taste affected, it becomes tasteless.

More time to purify:RO water purifier takes too long to the purification of water.

Water wastage:Approximately much more water compared to filtered out water flushed down as waste water.

Figure 3.4: Disadvantages of RO water

3.9 APPLICATIONS AND USES OF RO

The objectives of an RO plant for industrial use are distributed in the following way: 50perc in desalination of seawater and brackish water; 40perc in the production of ultrapure water for the electronic, pharmaceutical and energy production industries; 10perc as decontamination systems for urban and industrial water.

Chapter 4

TESTS CONDUCTED

4.1 pH

Pure water is neutral. When an acid is dissolved in water, the pH will be less than 7 (25 C). When a base, or alkali, is dissolved in water, the pH will be greater than 7. A solution of a strong acid, such as hydrochloric acid, at concentration 1 mol dm?3 has a pH of 0. A solution of a strong alkali, such as sodium hydroxide, at concentration 1 mol dm?3, has a pH of 14. Thus, measured pH values will lie mostly in the range 0 to 14, though negative pH Applications values and values above 14 are entirely possible. Since pH is a logarithmic scale, a difference of one pH unit is equivalent to a tenfold difference in hydrogen ion concentration. The pH of neutrality is not exactly 7 (25 C), although this is a good approximation in most cases.However the pH of the neutral NaCl solution will be slightly different from that of neutral pure water because the hydrogen and hydroxide ions' activity is dependent on ionic strength, so Kw varies with ionic strength. If pure water is exposed to air it becomes mildly acidic. This is because water absorbs carbon dioxide from the air, which is then slowly converted into bicarbonate and hydrogen ions (essentially creating carbonic acid).

Figure 4.1: pH meter

4.2 TOTAL DISSOLOVED SOLIDS

TDS in water supplies originate from natural sources, sewage, urban and agricultural run-off, and industrial wastewater. Salts used for road de-icing can also contribute to the TDS loading of water supplies. Concentrations of TDS from natural sources have been found to vary from less than 30 mg/litre to as much as 6000 mg/litre.

Figure 4.2: Total dissoloved solids

4.3 TOTAL HARDNESS

Small water supplies using groundwater often encounter significant levels of hardness, but some larger surface water supplies also have the same issue. Calcium concentrations up to and exceeding 100 mg/l are common in natural sources of water, particularly groundwater. Magnesium is present in natural groundwater usually at lower concentrations (from negligible to about 50 mg/l and rarely above 100 mg/l), so calcium-based hardness usually predominates (National Research Council, 1977). Estimated daily intakes of magnesium from water of about 2.3 mg and 52.1 mg in soft-water and hard-water areas, respectively, have been reported, based on adults drinking 2 litres of water per day (Neri et al., 1985).

Figure 4.3: Total hardness

4.4 CALCIUM

Calcium concentrations in water vary significantly according to the source. In most instances, US bottled spring and purified waters have similar calcium concentrations to tap water. Mineral waters, in general, and tap water.In terms of the recommended calcium intake, the highest calcium waters can contribute up to 13

4.5 MAGNESIUM

Magnesium is present in seawater in amounts of about 1300 ppm. After sodium, it is the most commonly found cation in oceans. Rivers contains approximately 4 ppm of magnesium, marine algae 6000-20,000 ppm, and oysters 1200 ppm. Dutch drinking water contains between 1 and 5 mg of magnesium per liter. Magnesium and other alkali earth metals are responsible for water hardness. Water containing large amounts of alkali earth ions is called hard water, and water containing low amounts of these ions is called soft water.

4.6 POTASSIUM

The level of potassium in drinking water depends on the type of treatment used. Water that goes through potassium permanganate has lower levels of potassium than water that uses potassium-based water softener. The level of potassium found in drinking water is low enough not to be a concern for healthy individuals, says the WHO.

Figure 4.4: Flame photo metric method

4.7 SODIUM

The sodium ion is ubiquitous in water. Most water supplies contain less than 20 mg of sodium per litre, but in some countries levels can exceed 250 mg/litre. Saline intrusion, mineral deposits, seawater spray, sewage effluents, and salt used in road de-icing can all contribute significant quantities of sodium to water. In addition, water-treatment chemicals, such as sodium fluoride, sodium bicarbonate, and sodium hypochlorite, can together result in sodium levels as high as 30 mg/litre. Domestic water softeners can give levels of over 300 mg/litre, but much lower ones are usually found.

4.8 FLOURIDE

Traces of fluorides are present in many waters; higher concentrations are often associated with underground sources. In seawater, a total fluoride concentration of 1.3 mg/litre has been reported (Slooff et al., 1988). In areas rich in fluoride-containing minerals, well water may contain up to about 10 mg of fluoride per litre. The highest natural level reported is 2800 mg/litre. Fluorides may also enter a river as a result of industrial discharges (Slooff et al., 1988). In groundwater, fluoride concentrations vary with the type of rock the water flows through but do not usually exceed 10 mg/litre.

Figure 4.5: Flouride method

Chapter 5

METHODOLOGY

5.1 STUDY AREA

For testing of RO water, the samples(RO water) was collected from nandayal local water plants.

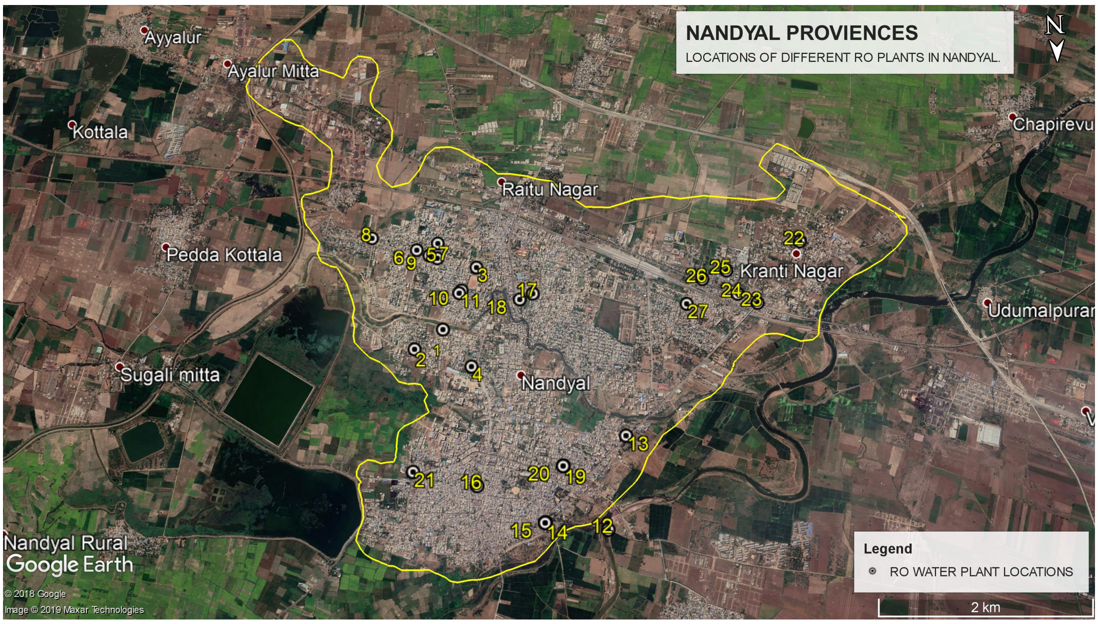

Figure 5.1: Location of RO plants in nandayal area

5.2 TEST PROCEDURES

5.2.1 pH

Three major steps are involved in the experiment. They are: 1. Preparation of Reagents 2. Calibrating the Instrument 3. Testing of Sample

PREPARATION OF REAGENTS

1. Buffer Solution of pH 4.0 Take 100 ml standard measuring flask and place a funnel over it. Using the forceps carefully transfer one buffer tablet of pH 4.0 to the funnel. Add little amount of distilled water, crush the tablet and dissolved it. Make up the volume to 100 ml using distilled water. 2. Buffer Solution of pH 7.0 Take 100 ml standard measuring flask and place a funnel over it. Using the forceps carefully transfer one buffer tablet of pH 7.0 to the funnel. Add little amount of distilled water, crush the tablet and dissolved it. Make up the volume to 100 ml using distilled water. 3. Buffer Solution of pH 9.2 Take 100 ml standard measuring flask and place a funnel over it. Using the forceps carefully transfer one Buffer tablet of pH 9.2 to the funnel. Add little amount of distilled water, crush the tablet and dissolved it. Make up the volume to 100 ml using distilled water.

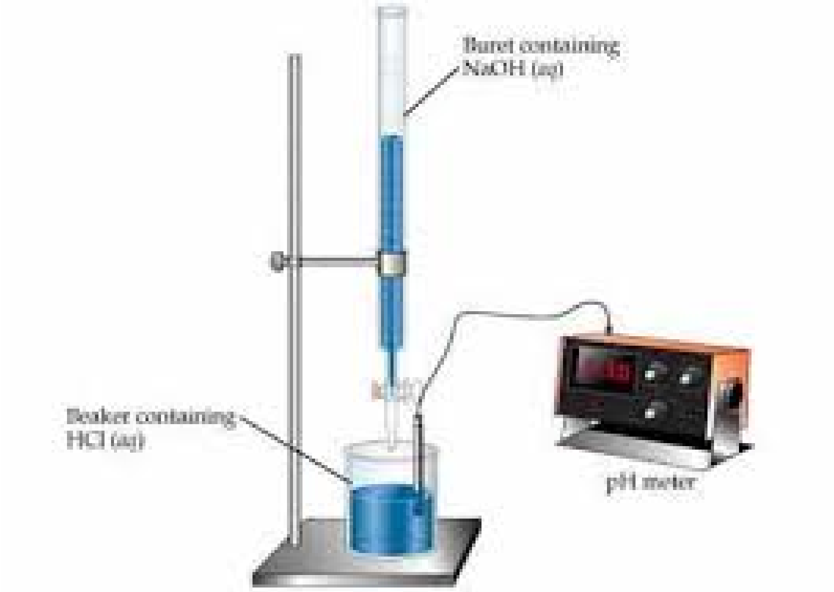

Figure 5.2: pH Test

CALIBRATING THE INSTRUMENT: Using the buffer solutions calibrate the instrument. Step 1 In a 100 ml beaker take pH 7.0 buffer solution and place it in a magnetic stirrer, insert the Teflon coated stirring bar and stir well. Now place the electrode in the beaker containing the stirred buffer and check for the reading in the pH meter. If the instrument is not showing pH value of 7.0, using the calibration knob adjust the reading to 7.0. Take the electrode from the buffer, wash it with distilled water and then wipe gently with soft tissue. Step 2 In a 100 ml beaker take pH 4.0 buffer solution and place it in a magnetic stirrer, insert the Teflon coated stirring bar and stir well. Now place the electrode in the beaker containing the stirred buffer and check for the reading in the pH meter. If the instrument is not showing pH value of 4.0, using the slope knob adjust the reading to 4.0. Take the electrode from the buffer, wash it with distilled water and then wipe gently with soft tissue. Step 3 In a 100 ml beaker take pH 9.2 buffer solution and place it in a magnetic stirrer, insert the Teflon coated stirring bar and stir well. Now place the electrode in the beaker containing the stirred buffer and check for the reading in the pH meter. If the instrument is not showing pH value of 9.2, using the slope knob adjust the reading to 9.2. Take the electrode from the buffer, wash it with distilled water and then wipe gently with soft tissue. Now the instrument is calibrated.

TESTING OF SAMPLE

In a clean dry 100 mL beaker take the water sample and place it on a magnetic stirrer, insert the teflon coated stirring bar and stir well. Now place the electrode in the beaker containing the water sample and check for the reading in the pH meter. Wait until you get a stable reading. The pH of the given water sample is given Take the electrode from the water sample, wash it with distilled water and then wipe gently with soft tissue.

5.2.2 TOTAL DISSOLOVED SOLIDS

Calibration:

1. Switch ON the instrument half an hour before the conduction of experiment

2. Electrode/probe is to be washed with Distilled water and do not dip in any solution

3. Press ENTER for getting SELECTION MODE. Select mode as (TDS) using direction keys (? or?) and presses ENTER.

4. Enter TDS Factor as 0.50. (Press ESC if it is desired to enter a different TDS Factor say 0.56.,) and press Enter

5. Enter Cell constant value as1.00. (Press ESC key, if cell of different cell constant say 0.5., is being used and enter the cell constant value) and press Enter.

6. If automatic temperature meant is desired and thermo probe is not connected in which case connect it and press Enter key to get temperature.

7. If the temperature is desired to be entered manually, press ESC key and enter temperature.

8. If the actual temperature is not what is displayed as default, measure the temperature with a thermometer, press ESC key and enter the temperature.

9. Keep the sample-filled-container near the cell/probe stand and lower the holding clamp to dip the sensor part of the cell in the sample. Insert thermo-probe also into the sample.Press ENTER key and it display cell constant value as 1.00 and then dip the cell in the sample and press Enter. There temperature and TDS values are displayed.

Figure 5.3: TDS Test

5.2.3 TOTAL HARDNESS

TOTAL HARDNESS DETERMINATION

1. Take 50ml well mixed sample in conical flask

2. Add 1-2 ml buffer solution of ammonia.

3. To each aliquot add a pinch of Eriochrome Black-T powder (indicator) or 2 drops of Eriochrome Black-T. The aliquots are wine-red in color.

4. Titrate each aliquot using the standard EDTA (0.01M) solution (in burette).

5. At the end point the aliquots change color from wine-red to blue.

6. Note down the volume of EDTA required (A)

7. Run a reagent blank if buffer is not checked properly. Note the volume of EDTA required for blank (B)

8. Calculate the volume of EDTA required for sample i.e., (A-B)

9. Value B may taken as 0 , if double distilled water and A R grade chemicals are used.

PROCEDURE FOR CALCIUM HARDNESS DETERMINATION

Figure 5.4: Total hardness Test

a. Take a 50 mL of sample in conical flask.

b. Add 1 mL NaOH solution to raise PH to about 12.0.

c. Add a pinch of ammonium purpurate (murexide) powder (indicator).

d. Titrate using the standard EDTA solution (in burette) until color change occurs from pink to purple.

e. Note the volume of EDTA used (C).

CALCULATIONS:

1. Total Hardness (mg/l) as CaCO 3 = (A-B) *1000/ ml of sample taken.

2. Calcium Hardness (mg/l) as CaCO 3 = C *1000/ ml of sample taken.

3. Magnesium Hardness (mg/l) as CaCO 3 = Total Hardness Calcium Hardness.

5.2.4 FLOURIDE

1.Take 10ml of filtered water sample in the test jar, provided.

2.Add 1 drops of FD1.Mix well. If yellow color does not appear, then add FD2a drop wise till you get yellow color.

3.Now add FD2b till the solution becomes colorless. Add 5 drops more of FD2b.

4. Add 2 spoonful's of FD3, mix well to dissolve.

5.Now drop wise add FD4L, counting the no. of drops while mixing until the color changes from yellow to the first distinct pink color.

6.Observe this color change against a white background held below the test jar. If the expected fluoride of the test sample is more than 2ppm, then use FD6 instead of FD4L.

Calculations: fluoride ppm as F=0.1*(no, of drops of FD4L) =1.0*(no. of drops FD6)

5.2.5 POTASSIUM AND SODIUM

Follow instructions of flame photometer manufacture for selecting proper photocell, wavelength, siltwidth adjustments, fuel gas and air pressure,steps for warm up, correcting for interference and flame background,rinsing of burner, sample ignitition,and emission intensity measurments prepare a blank and potassium calibration standards in any of the applicable ranges,0-100,0-

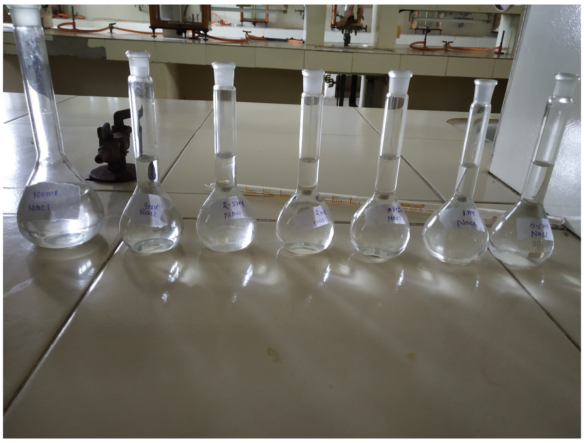

Figure 5.5: Potassium and sodium test

10,or 0-1mg KŁ.Measure emission at 766.5nm and prepare calibration curve.Determine potassium concentration of the sample,or diluted sample from the curve.

Chapter 6

RESULTS AND DISCUSSIONS

6.1 Results of Munciplaity and Different company water bottles and Nandayal RO water plants

The results of PH, TDS, and TH,Cl HARDNESS AND Mg HARDNESS are shown in below :

Table 6.1: Muncipality results

sampleno.	pH	TDS(PPM)	TH(mg/l)	ca(hardness mg/l)	mg(hardness mgł)
1	7.39	805.4	356	236	120
2	7.35	807	332	140	192
3	7.79	102.4	0	86	0
4	7.39	497.5	272	130	142
5	6.91	1624	660	150	504
6	7.73	116.2	0	100	0

Table 6.2: Location of samples at muncipality

sampleno.	Location of sample	Type of sample
1	kowluru	Muncipal water
2	kowluru	Bore water
3	Panyam	R.O Water
4	Panyam	Bore water
5	Vaddugandla	Bore water
6	Nerawada	R.O water

6.1.1 Graphs are representing the parameters are within limits(or)not Muncipality water

As we see the results of (pH, TDS, TH, CA, and MG)some of the village bore water and muncipal water are satisfy there limits. And it is useful to drinking purpose. Remaining RO water are not satisfyed there limits why, because RO water TDS is '0'. When total dissoloved solids is not present in water that water should like distilled water and it doesnt have any mineral content.So the drinking of RO water is not good for human health.

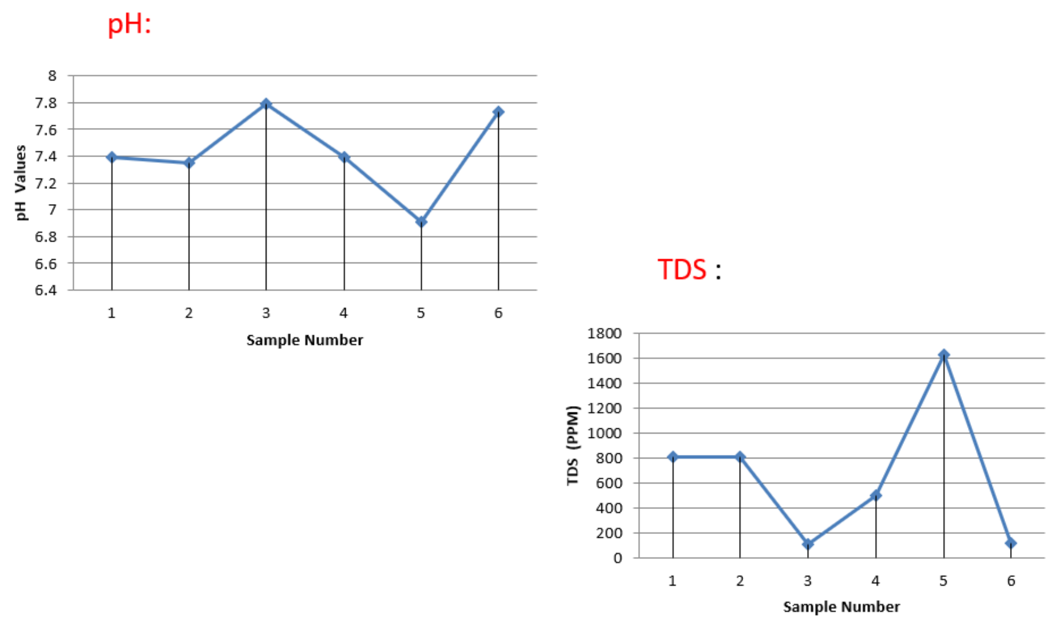

Figure 6.1: pH and TDS GRAPHS

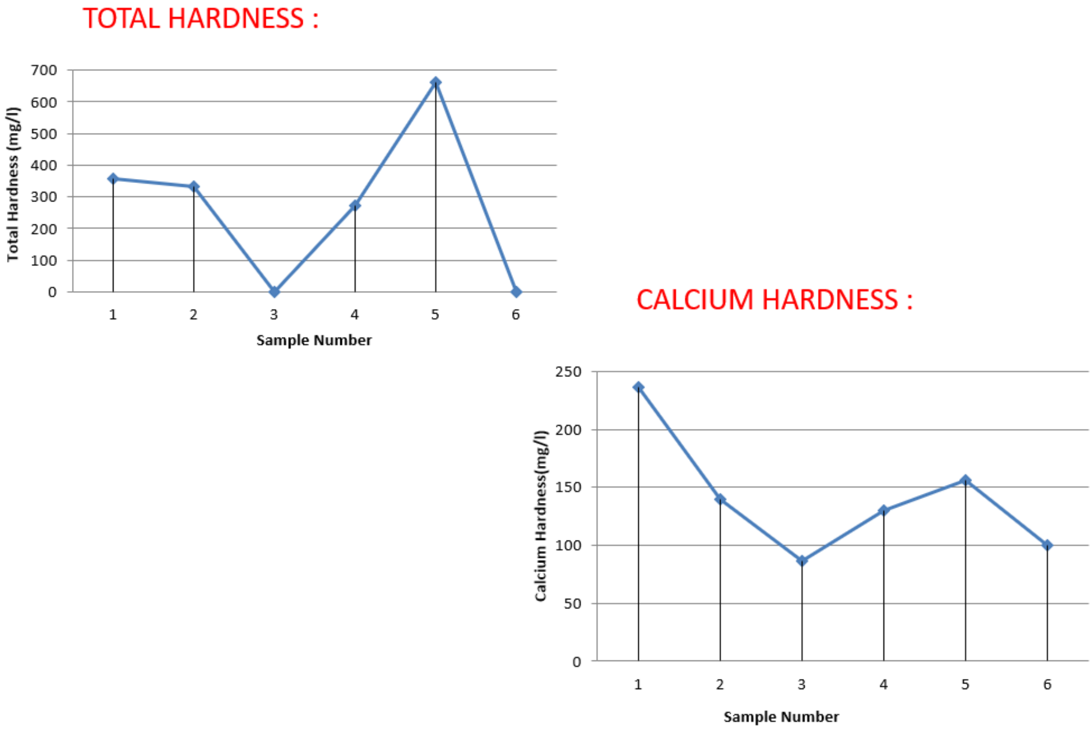

Figure 6.2: Total hardness and calcium graphs

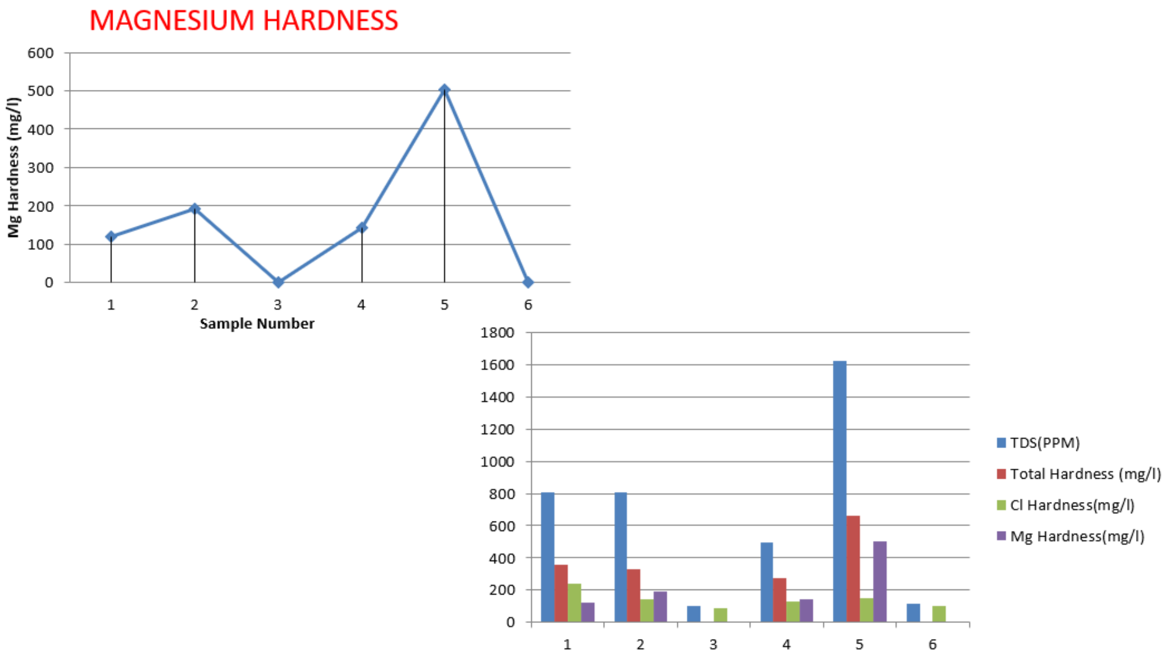

Figure 6.3: Magnesium and overaall results of muncipality water

6.1.2 Results of different company water bottles at Nandayal location

As we see the results of different company water bottles even one company water bottles also should not maintained parameters in limits. Those parameters are (pH, TDS(PPM), TH(mg/l), ca(ppm), mg(ppm), F(ppm)).So, as we can say that when you drink Ro water you may affect longterm effects. So as we can possible to avoid drinking of RO water.

Table 6.3: Different company water bottlels at Nandayal

sno.	type of water	pH	TDS(PPM)	TH(mg/l)	ca(ppm)	mg(ppm)	F(ppm)
1	Kinley	7.07	44.58	0	56	0	0.6
2	Bisleri	7.6	62.03	0	80	0	0.7
3	Mega	8.08	75.28	0	34	0	0.2
4	Aqufina	7.42	16.64	0	34	0	0.8
5	Muncipal water	6.52	219.8	0	22	0	1.6
6	RGMCET	7.77	65.55	66	14	52	0.821

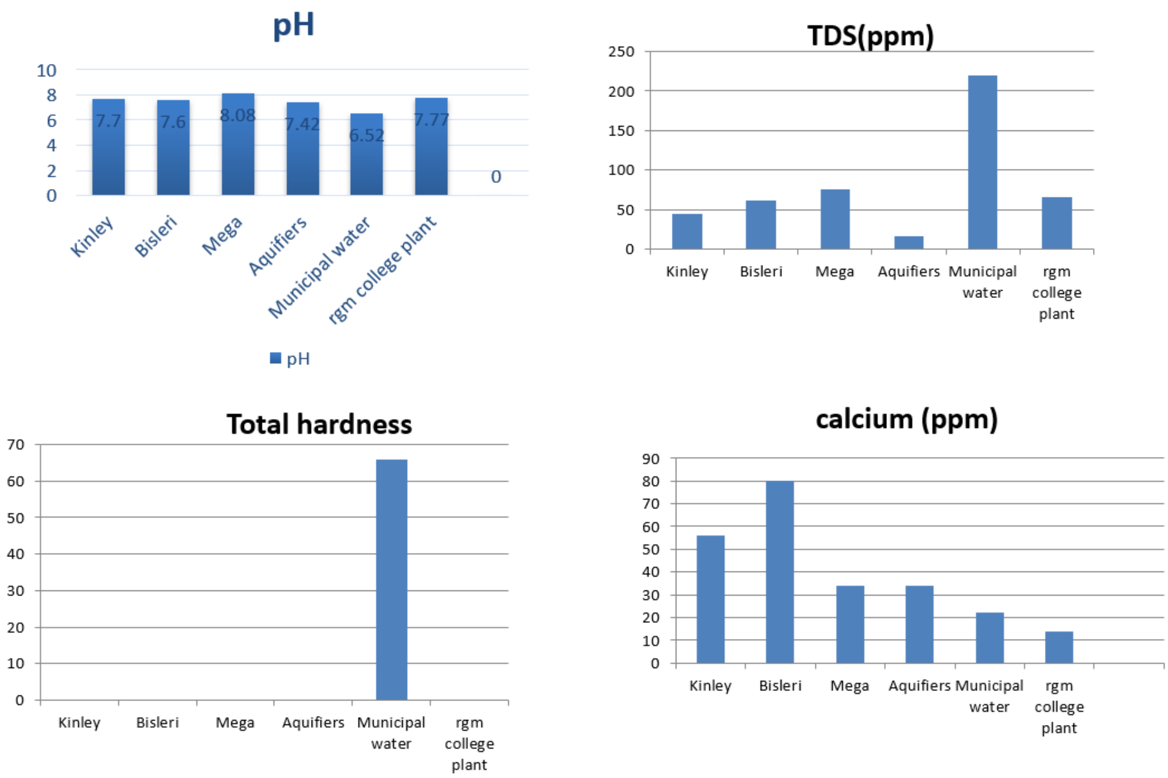

Figure 6.4: pH and TDS and TH and Calcium graphs

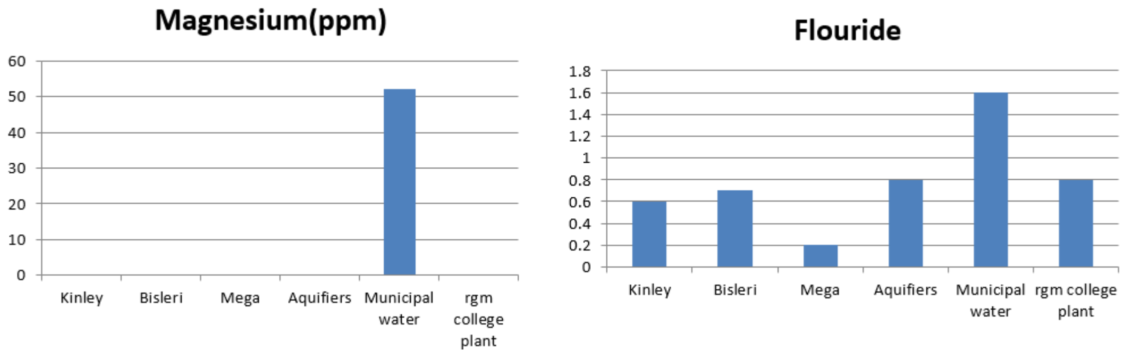

Figure 6.5: Magnesium and Flouride graphs

6.1.3 The results of Ph, TDS, TH CA, MG, K, NA, F of RO water are shown in below

In this project we take different location of RO plants at Nandayal area and we conducted tests are (pH, TDS, TH, CA, MG, K, NA, F. But we can see the results even any one mineral plant also doesn't maintained standard parameters.what we conclude that you may drink but you can affect health issuses but not in short term effects but compulsary you may effect longterm effects.We can take perfect diet ok we can prefer RO water to drink but we can't take perfect diet. So our main goal is should maintain mineral content in RO water. But no one can should maintain there parameters. finally what we say that as possible avoid RO water.

Table 6.4: RO plant results at Nandayal Area

sno.	Sample location	pH	TDS	TH	ca	k	Na	mg	F
1	Sai jyothi mineral palnt	6.5	32	0	68	0.2	34.8	0	0.1
2	Ruchi plant	6.3	51.2	0	59	0.5	52.2	0	0.3
3	Cool drink purified water	6.2	12.8	0	61	0.1	17.4	0	0.2
4	Ayyapa minera plant	6.4	19.2	0	55	1.2	19.14	0 7	0.2
5	Nagamani minera plant	6.2	25.6	0	39	0.3	17.4	0	0.2
6	Vijaya purified water	6.3	25.6	0	65	0.8	17.4	0	0.3
7	Srisaipurified water	6.5	57.6	0	49	1.3	34.8	0	0.4
8	chandra minera plant	6.3	25.6	0	48	0.4	69.6	0	0.3
9	Shilpa mineral plant	7.1	57.6	0	52	0.2	52.2	0	0.3
10	Chinamani mineral plant	6.2	25.6	0	46	0.5	52.2	0	0.3
11	Bhaskar mineral plant	6.5	44.8	0	58	0.5	34.8	0	0.4
12	Muncipal office inside	6.4	12.8	0	36	0.2	17.4	0 7	0.3
13	Free shipla water plant	6.2	25.6	0	32	0.3	17.4	0	0.2
14	Sri tirumala plant	7.2	51.2	0	58	0.1	69.6	0	0.2
15	A1 minera plant	6	19.2	0	61	1	17.4	0	0.2
16	Free mineral plant	7.1	32	0	58	0.5	52.2	0	0.2
17	Spy reddy mineral plant	6.5	25.6	0	48	0.8	34.8	0	0.2
18	Vasavi mineral plant	6.7	44.8	0	64	0.9	52.2	0	0.3
19	Shiva ganga mineral plant	6.3	19.2	0	45	0.7	34.8	0	0.2
20	Raj gopal reddy plant	6.4	12.8	0	51	0.5	34.8	0	0.3
21	Sri sai ram mineral plant	6.9	57.6	0	45	1.4	52.2	0	0.3
22	Ganga mineral plant	7.1	64	0	48	1.2	14.4	0	0.4
23	Thikkaswamy mineral plant	7	12.8	0	42	0.9	11.74	0	0.1
24	Spy reddy mineral plant(KN)	7	61.8	0	35	0.8	12.5	0	0.2
25	Shilpaplant(moolasangaram)	6.5	52.7	0	41	0.7	32.1	0	0.1
26	Moolasangaram plant	7.2	59	0	58	0.5	11.8	0	0.3
27	Muncipal office	6.2	62.1	0	67	1.2	31.8	0	0.4
28	Kundu river	6.8	368.5	167.5	129	5	52.2	71	0.4

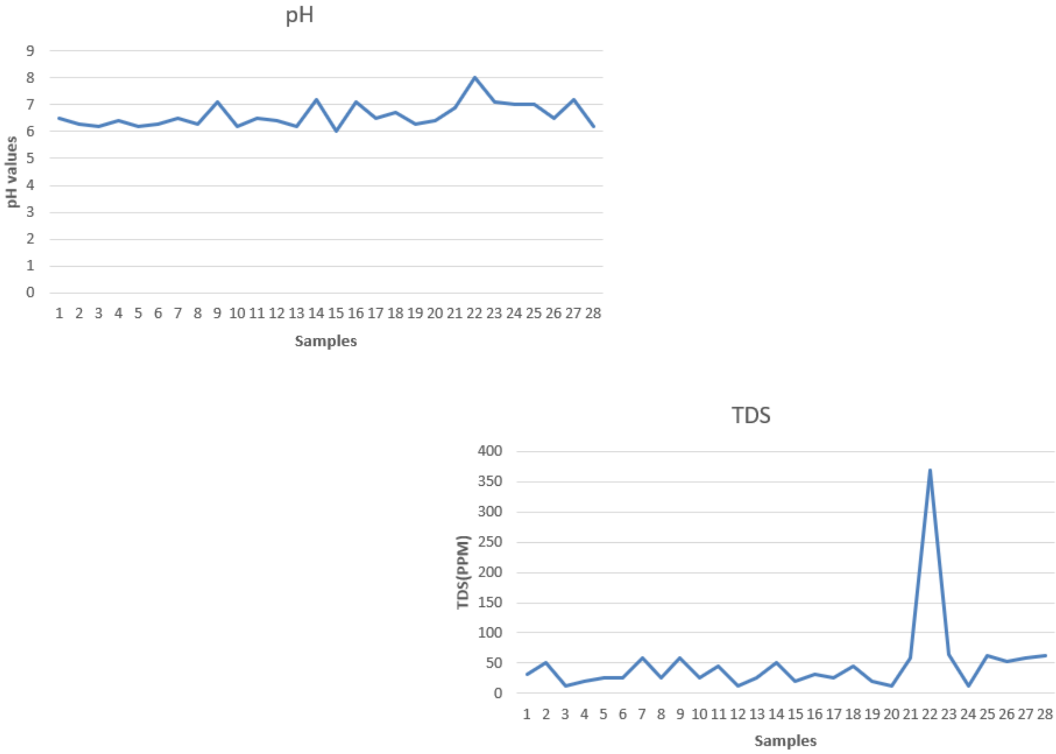

Figure 6.6: pH and TDS results

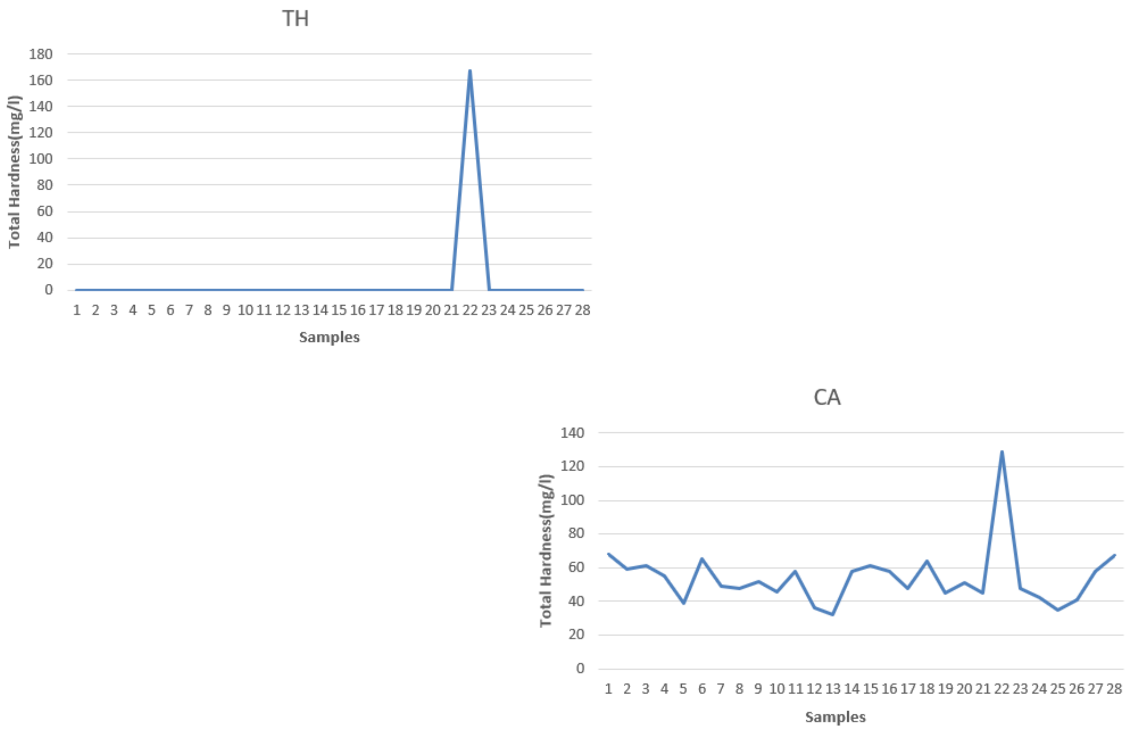

Figure 6.7: TH and Calcium results

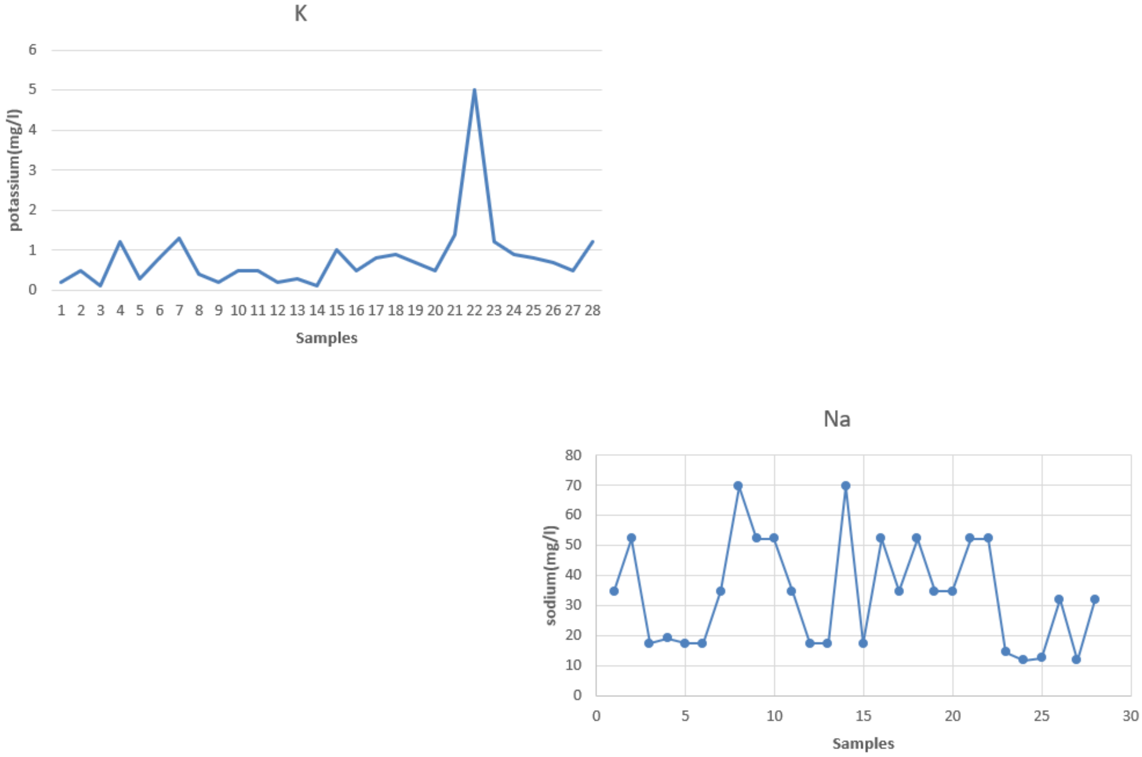

Figure 6.8: potassium and sodium results

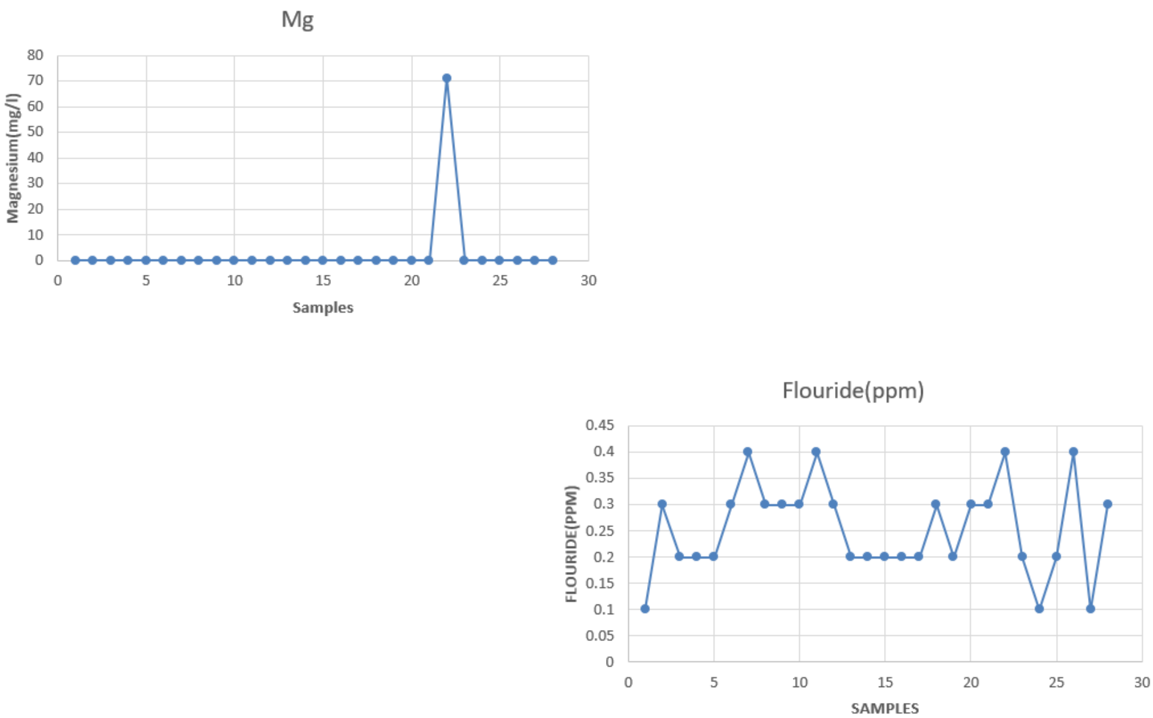

Figure 6.9: Magnesium and flouride results

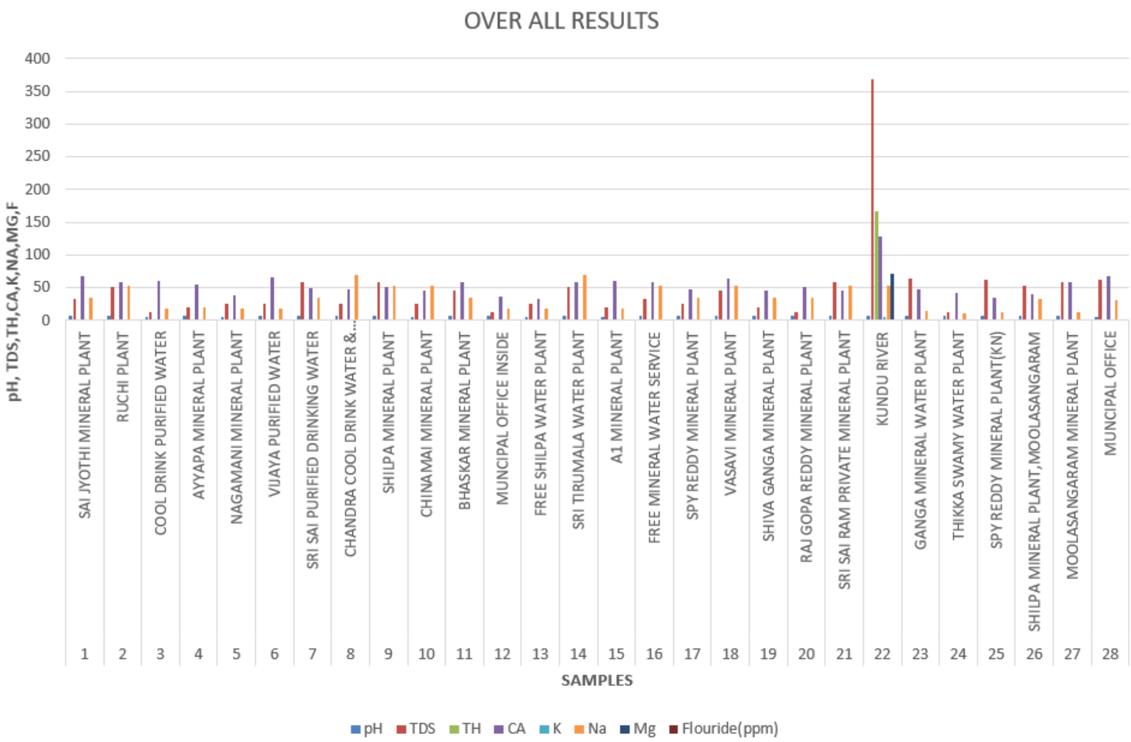

Figure 6.10: Over all results of RO plants at Nandayal Region

Chapter 7

CONCLUSION

Drinking water(RO water)should contain minimum level of certain essential minerals. Unfortunately, over the two past decades, little reasearch attention has been given to benificial or protective effects of RO water on humans.
Based on the analysis of different parameters conducted on RO water collected at Nandayal area. The parameters are not within(WHO)standards.So, these RO water is not suggested for drinking purpose. Humans required certain minerals which are present in water. But the RO water doesn't contain sufficient minerals in it.

The reasons behind that may be due to (RO plant membrane, filter media, maintainence problem, adding of chemicals for providing taste to the water)etc..The usuage of RO water may not effect initially.It may have long term effects on the health of humans. Such as(Osteoporosis, Arthritis, Depression, Mood Swings, Irritability, Bone Loss, Hair Loss).

By the chemical ananlysis it is observed that the most of the water parameters are not in limits.From this results the tested of RO water are not satisfying the drinking purpose.
So avoid consumption of RO water.

Chapter 8

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Chapter 9

APPENDIX

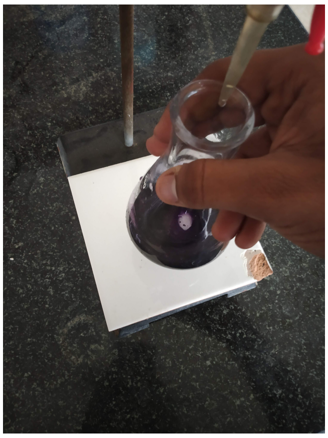

Figure 9.1: During expeiment

Figure 9.2: While during survey