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SCOPE FOR FURTHER STUDIES

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14.1 Scope of Current Study.

In the study carried out by the author, the scope was limited to the assessment of physico-chemical aspects of drinking water quality in Gujarat State. As such the assessment of drinking water quality includes some more considerations. They could be summarised as under:

- Bacteriological quality of water
- Biological quality of water
- Virological quality of water
- Toxicological quality of water

The above aspects are indicated in the guideline values or drinking water quality standards formulated by various agencies. However, it was not possible to cover all these aspects under one research study. So the author preferred to select one and formost aspect of physico-chemical quality which also included some specific trace elements such as Cyanide, Iron and Zinc.

In the routine assessment of water quality for drinking purpose, the controlling authorities usually resort to the physico-chemical analysis. The **No-Source criteria** of both Union and State Governments also stipulates the conditions regarding chemical quality of water. It mentions that if the water is containing any chemical substance which is likely to cause any physiological disorder or adverse health effect, than the water having such qualities, should be rejected.

This does not mean that the authorities accord low priority or less importance to other quality aspects. As such the main dependence for supply of drinking /domestic water currently is on ground water sources. And ground waters are usually found free from other impurities particularly that of bacteriological. However the water is vulnerable to all sorts of bacteriological contamination during its storage and handling also. By exercising due care, the extraneous contamination of water from bacteria could be avoided. Also such contamination if any could be easily removed by treatment like chlorination or even boiling at domestic level. Thus it is clear that physico-chemical quality is of paramount importance and should be ascertained on regular basis.

During the study it has been realised that some other issues are also important and they should be considered for further studies keeping the present work in mind. The areas of research for further studies could be enumerated as under:

14.2 Bacteriological quality of water

This aspect is also equally important. As seen in chapter-3 on Water & Health, we know that the bacterial quality of water is very much important from health point of view. There are large number of diseases which spread through bacterially contaminated water. It is therefore advisable that source-wise quality of water is evaluated for bacteriological parameters.

Also a study could be undertaken to check prevalence of water borne diseases among the communities, their relation with the available water quality of the area and socio-economical impacts.

A further study of assessing the effectiveness of water treatment provided to control bacteriological contamination of water,amount of residual chlorine at consumers end, factors leading to on-line contamination and development of simple methods for domestic water purification for use by people themselves could be taken up. Due to the use of chlorine compounds for disinfection of water, a new controversy has arisen, raising doubts that chlorine compounds reacts with organic impurities in water to form Trihalomethanes(THM) which are carcinogenic. A study could be undertaken to check the possibility of formation of THMs and their impacts.

14.3 Biological Quality of Water

In addition to bacteria, there are other forms of biological life in water which grow under various conditions and interfere with the beneficial uses of water. Mention could be made of algae which not only impair the quality of water by creating turbidity and increase in pH but are also causing many other nuisances. Their growth also causes clogging of filters in water treatment plant and reduce carrying capacity in pipelines. Similarly other forms of higher life like cyclopes causes guinea worm and some other diseases.

A study therefore could be undertaken to assess the biological quality of water, presence of various forms of higher life present in water and their impact on quality of water. Similarly factors promoting the presence and survival of such life like entry of **Nutrients** and their sources could be ascertained. Detergents are used abundantly in domestic washing and cleaning purposes. Detergents contain phosphates which contribute to increase in **eutrophication** of water bodies. Hence entry and factors responsible for such entries may be examined. Role of fertilizers used in agriculture for promoting the growth of biological life in water and its impacts could also be assessed separately.

14.4 Virological quality of water

Entry and survival of viruses in water can cause many diseases some of which are dreadful. Spread of infections hepatitis(Jaundice) in the recent years has created serious concern about the Virological quality of water. There are other host of diseases which are spread by viral contamination of drinking water. The domestic effluents which contain hospital wastes may also cause viral contamination of water. It is therefore pertinent that, a study is carried out

about the Virological aspects of drinking water quality. The study could include type of contaminants present, their concentration, diseases caused due to their presence and their health as well as socio-economical impacts.

14.5 Toxicological quality of water

Large number of chemical compounds are being invented every year and entry of such chemicals is increasing into water sources due to discharge of industrial effluents. Many chemical compounds are toxic or hazardous in nature and are creating potential health hazards on consuming such contaminated water. We have seen in chapter-3 that may heavy metals are toxic in nature and can prove fetal if found in water in excessive quantity. The incidence of **Minamata** in Japan due to mercury poisoning is an eye opener. Similarly many other metals including Lead and Arsenic can create health implications.

The presence of pesticides used in agricultural practices, can find their way into water bodies and result into serious health risks. It is therefore essential that the quality of water for presence of toxic/heavy metals is assessed and their impacts analysed.

14.6 Deficiency of essential elements

We have seen in chapter on Water and Health that certain elements like Iodine and Fluoride are very much essential in minute quantities as micro nutrients. Their deficiency can cause physiological disorder or other health problems. As seen deficiency of Iodine can cause **goitre** and deficiency of fluoride can cause **dental carries.** Similarly there are many other chemicals/elements which are very much essential for the body as nutrients. Many of them are listed in **Table No. 3.1** in chapter-3.

It would be appropriate if a separate study is undertaken to find out all essential elements for the life and assessment of their quantity present in water and adverse effects is carried out.

14.7 Studies on individual parameters

The quality of water is assessed by parameters set in by the authorities which have formulated guideline standards. We have seen in the **chapter No.10 on Significance of Parameters** that all parameters have their own importance and adverse impacts if are absent or present. In addition to essential elements and heavy metals/toxic chemicals there are certain parameters like **Hardness** and **pH** which have got sound bearing on the quality determination. Also the health effects and entry of certain parameters like Sodium etc. could be studied individually so as to reveal the detailed information about all important parameters. Thus all parameters which decide potability of water for drinking purpose and acceptability for other uses needs to be studied individually.

14.8 Studies on Pollution of Water

Due to indiscriminate discharge of industrial and domestic effluents into water sources, the water bodies are getting heavily polluted. These pollutants are having their own impacts/adverse effects on the environment. Although, the drinking water sources studied by the author are found protected from pollution, there are other sources which are not used for

public drinking water sources but are used for many other beneficial uses. It is therefore essential to check the entry of pollution in all such water sources and extent of pollution as well as adverse effects needs to be assessed. Such study could include surface and ground waters as well. This can also include studies on individual assessment of important parameters like BOD and COD also.

14.9 Studies on removal of impurities

We have seen in the preceding chapters that water is a Universal Solvent and many impurities get dissolved into it or carried along with it. This impurities could be natural or manmade. They also interfere with beneficial uses of water and are detrimental to the health as well as the environment. They also sometimes create nuisance and impair the development.

It is therefore essential to remove such impurities through suitable treatment methods. In the chapter on water pollution and treatment we have seen the types of impurities that could get access to water bodies and their impacts. The study on treatment methods for water was out of the scope of this research work. However in a separate study removal or treatment methods of undesirable or excessive impurities could be studied elaborately. such methods should be

- Economically viable
- Technically feasible
- Easy to operate and maintain
- Suitable to local conditions and
- Acceptable to people.

We have seen in the preceding chapters that there are three main water quality problems in Gujarat. And they are of Salinity, Fluoride and Nitrates. Suitables low cost treatment methods for these three impurities needs to be evolved. Particularly, methods to remove fluoride from water need immediate attention. Simple methods for disinfection of water in rural areas will also prove very beneficial.

It is felt that separate and elaborate studies on the topics mentioned here above can provide very useful information about the quality of water for various uses and also provide very useful reference for future use/comparison.