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RESEARCH ARTICLE

CHEMICAL NATURE AND WATER QUALITY OF JAKEKUR RESERVOIR (PROJECT) IN CONTEXT WITH DRINKING WATER STANDARDS

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A B S T R A C T

The Jakekur Reservoir is one of the most important aquatic water bodies in Ta. Omerga Dist. Osmanabad (M.S). The reservoir is used for irrigation, Drinking purpose, as well as pisciculture by the local communities.

Limnological investigations of man-made lakes (reservoirs) are necessary to evaluate water quality is related to the health of people; developmental activities of this region, ecosystem, societies, and potential fish production. It provide information that could be useful in fisheries developmental planning and it is supply for Domestic, Industrial, Agriculture & aquaculture practices.

Reservoir has large and varied chemical contents. Innumerable materials enter the system from the atmosphere, catchments area and its own basin. The chemical properties of reservoir not only alter but also have significant bearing on the distribution and metabolic activities of the existing life.

During the study period samples were collected from the reservoir for a period of one year. From result it is concluded that sample result was within permissible limits in context with drinking water standards as described by Bureau of Indian Standard for Drinking Water for Water Quality Standards.

INTRODUCTION

The Jakekur Reservoir is one of the most important aquatic water bodies in Ta. Omerga Dist. Osmanabad (M.S). The reservoir is used for irrigation, Drinking purpose, as well as pisciculture by the local communities.

Limnological investigations of man-made lakes (reservoirs) are necessary to evaluate water quality is related to the health of people, ecosystem, societies, and potential fish production. It provides information that could be useful in fisheries developmental planning and it is supply for Domestic, Industrial, Agriculture & aquaculture practices.

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Review of work

Similar works and studies on reservoir water quality done by those of some of these are Sreenivasan (1965&1979), Dwivedi and Chondar (1980), Sugunan (1980&1990), Sharma and Sahai (1990), Kulshrestha *et al* (1992), Sugunan and Yadava (1991), Devi (1997), Pska and Chary (2000), Das *et al* (2001), Shastri and Pandse (2001).

The diverse chemical properties of reservoir such as dissolved carbon dioxide, dissolved oxygen, alkalinity, pH, chlorides etc. act as controlling factors for determining the presence and distribution of aquatic organism. Some of these chemicals are essential elements for metabolic processes of organisms while some are not. Recently much of supply of chemical compounds to aquatic systems by man has created acceleration of the eutrophication (Sakhare 2007).

Need of the present work

Considering the lack of knowledge of water quality, the study of the chemical characterization of Jakekur reservoir which includes the water parameter like, Dissolved Oxygen, Carbon

dioxide, Fluorides, Hardness(Calcium, Magnesium), Sodium, Alkalinity, Chlorides, Salinity and Sulphates.

Objective of the pape

The Jakekur Reservoir (project) is one of the most important aquatic water bodies in Tq. Omerga Dist. Osmanabad (M.S). The reservoir is used for irrigation. Drinking purpose, as well as pisciculture by the local communities.

The quality of water reservoir is usually described by its physical chemical and biological or bacteriological characteristics. Assessment of water quality is an important aspect for the developmental activities of this region, because of it is the sum of water supply of Domestic, Industrial, Agriculture & aquaculture practices (Jakher and Rawat 2003).

MATERIALS AND METHODS

The methods used for the analysis of various chemical parameters are as given in methodology for water analysis (Kodarker *et al*. 2006; Munshi, 2006; Salodia, P.K. 1996).

During the study period water samples were collected from the reservoir for a period of one year. Water sample was collected with the help of sampler in the morning hours. Water samples were brought in one-liter plastic containers to the laboratory for analysis. Parameters like Dissolved Oxygen, Carbon dioxide; Fluorides, Hardness (Calcium, Magnesium), Sodium, Alkalinity, Chlorides, Salinity and Sulphates were analysis in laboratory.

RESULTS AND DISCUSSION

Table 1 Result of Analysis of Jakekur Project Reservoir

Sr.No.	Parameter	Units	Summer	Monsoon	Winter	Min Max	BIS Max. Acceptable
1	Dissolved Oxygen	m/L	6.19	7.46	7.10	6.19-7.46	-
2	Free Co2	m/L	4.40	12.1	5.84	4.40-12.1	-
3	Fluoride	m/L	0.06	0.02	0.03	0.02-0.06	1.0 - 1.5
4	Hardness	ppm	125	130	153	125-153	300- 600
5	Calcium	ppm	27	28	33	27-33	75- 200
6	Magnesium	ppm	14	15	17	14-17	30 - 100
7	Sodium	ppm	42	27	39	27-42	-
8	Alkalinity	ppm	207	175	189	175-207	200- 600
9	Chloride	ppm	32	33	48	32-48	250 -1000
10	Salinity	ppm	57.63	59.43	86.43	57.63-86.43	-
11	Sulphates	ppm	18	15	10	10-18	200 - 400

The result of water analysis of Jekekur Reservoir is presented in Table 1. Water quality standards and guidelines corresponding to the Bureau of Indian Standard / Specification for Drinking Water (BIS: 105001991). Water Quality Standards of Requirement Desirable limit as well as Maximum Permissible limit has also been mentioned.

Dissolved oxygen: *In* the present investigation dissolved oxygen was found to range between 6.19 to 7.46 mg/L during the study period. The minimum concentration of dissolved oxygen recorded in summer and maximum concentration of dissolved oxygen recorded in monsoon.

The higher values of dissolved oxygen in monsoon season were due to the surface water of the lake was subjected to wind generated turbulence and resultant mixing of surface and subsurface water layers. Thus during monsoon months there establishes on oxygen equilibrium between the water and air.

Similar works done by Devi (1992) and Sakhare (2007) also gave similar explanation for the fluctuations of dissolved oxygen. Sugunan (1989) mentioned the dissolved oxygen below 5 ppm can be lethal to the biota. So high dissolved oxygen content of reservoir water is desirable and important factor in productivity. Rao and Khan (1982) recorded the dissolved oxygen range of Manjira reservoir at 2.45 to 18.59 mg/l.

The dissolved oxygen range of Jakekur reservoir water passes all these conditions indicating the good water quality with respect to oxygen content for fish survival. Many workers (Kulshrestha *et al* 1992, Rawat *et al* 1993, Mani and Gaikwad 1998, and Prakasam and Joseph 2000) have discussed the seasonal fluctuations in the dissolved oxygen content of various water bodies.

Carbon Dioxide

During study period carbon dioxide values ranges between 4.40 to 12.1 mg/L. In summer minimum value was found and maximum in monsoon. Lagler (1978) mentioned that the amount of carbon dioxide in water is important in fish management because it is perhaps the best single criterion of environmental suitability for fishes.

Carbon dioxide in excess of 20 ppm may be harmful to fishes, although lower values may be equally harmful in waters of low oxygen content (3 to 5 ppm). Carbon dioxide is directly proportional to bicarbonates and indirectly to the carbonates.

Similar works done by Shastri and Pendse (2001) and he find out that the maximum value of carbon dioxide recorded in monsoon.

According to Agrawal (1990) the carbon dioxide content of the water depends upon the temperature of water, depth of water, rate of respiration, decomposition of organic matter, chemical nature of the bottom and the geographical and physiological features of the terrain surrounding the water.

Fluoride

During study period fluoride values ranges between 0.02 to 0.06 mg/L. In monsoon minimum value was found and maximum in summer. Fluorine is widely distributed in nature and occurs in continental rocks of earth's crust. Fluoride is an

essential component in human diet that prevents skeletal and dental problems. Fluoride ions have dual significance in water supplies; high concentration of fluoride causes dental fluorosis, while at the same time concentrations less than 0.8 mg/L result in dental caries. Therefore, it is essential to maintain the fluoride concentration between 0.8 to 1.0 mg/L in drinking water (Bhalerao and Khan 2000). The prevalence of dental fluorosis increased proportionately with increase in fluoride concentration in the source water from different areas Choubisa *et al*., 1996).

Drinking water containing high concentration of fluoride (above 1.0-1.5 mg/L) is potentially harmful to bones or neural system of human beings which has been a global issue of drinking water safety for almost half a century (Nat. Acad. Press, 2006; WHO, 2004; Shi Rau and Wu Feng, 2010). India and China are two countries suffering several from the contamination and poisoning of fluoride at concentration level in the range of 1.5-10 mg/L in ground water (Zhang B *et al*, 2003; Meenakshi *et al*, 2006; Shi Rau and Wu Feng, 2010).

Hardness

During the study period hardness of water ranges in between 125 to 153 ppm. The higher values of hardness were recorded during winter and lower values were recorded during summer season. The hardness of water is mainly due to the presence of calcium and magnesium. Epizootic Ulcerative Syndrome (EUS) outbreak has been observed to be more frequent in waters with low hardness (Das and Das, 1995). Productive waters should have hardness value above 20 mg/l. Optimum hardness for fish culture has been observed to be around 75 to 150 mg/l (Das, 1996).

According to Jhingran (1988) and Sugunan (1990) the hardness above 70 ppm is an indicator of the better productivity. The desirable limit of total hardness for drinking water is specified by BIS (1991) as 300 mg/L and a maximum permissible limit of 600 mg/L. It is observed that sample were Permissible limit.

Calcium

Calcium content varied from 27-33 ppm. Maximum value of calcium content was recorded in winter season and minimum value recorded in summer season. The presence of calcium in drinking water is natural geological source, industrial waste, mining by products and agricultural wastes (Deshpande, 2011). The desirable limit of Calcium for drinking water is specified by BIS (1991) as 75 mg/L and a maximum permissible limit of 200 mg/L. It is observed that sample were permissible limit. Its concentration restricts water use, while it is an important component in the exoskeleton of Arthropods and shells in Molluscs (Kodarkar M.S., 2006).

Magnesium

Magnesium content varied between 27-42 ppm. Maximum value of Magnesium content was recorded in winter season and minimum value recorded in summer season. The principal sources of magnesium in the natural waters are various kinds of rocks, sewage and industrial wastes are also important contributors of magnesium (Deshpande 2011). It is the vital component of chlorophyll. Very high concentration of Mg imparts an unpleasant taste to the potable water. According to BIS (1991) the desirable values of Mg are 30 mg/L and a maximum permissible limit of 100 mg/L where 43 samples were permissible limit.

Sodium

Sodium content varied between 14-17 ppm. Maximum value of sodium content was recorded in winter summer and minimum value recorded in monsoon season.

Alkalinity

The Total alkalinity ranged from 175-207 mg/l. The maximum alkalinity observed in summer season and minimum during the monsoon season. Similar works done by Shastri and Pendse (2001) and he find out that the maximum value of carbon dioxide recorded in monsoon.

According to Bishop (1973), Blum (1957) and Salodia (1996) state that summer peak was due to partial stagnation of water. According to Lagler (1978) total alkalinity in water depends on the geology of the region.

Carbonates and bicarbonates thus formed are dissociated to yield hydroxyl ions. Carbonate salts produce double the hydroxyl ions than the bicarbonates. Water having 40 mg/L or more total alkalinities is considered to be more productive then water of lower alkalinities (Moyle 1945; Maris 1966). The low alkalinity is not conductive for good productivity since highly productive water has alkalinity over 100 mg/L caco3 (Jhingran, 1985). During present investigation the total alkalinity was more than 100 mg/L. Hence the reservoir water is highly productive.

Chloride

During the study periods chloride value ranges in between 27 to 33 ppm. Higher values of chlorides were recorded in winter and lower in summer.

Similar pattern of chlorides concentration reported and similar works done by Shastri and Pendse (2001) and he find out that the maximum value of carbon dioxide recorded in monsoon by Sakhare (2007). However, Mishra and Yadav (1978) could not find any definite pattern of fluctuation.

The high amount of chloride content has been co-related with high degree of organic pollution and eutrophication (Sinha 1986). In uncontaminated water which is not flowing from saline sediments, the quantity of chlorides present has been reported to be low (Hutchinson 1957). According to Johnson (1985), normal fresh inland surface water contains less than 50 mg/L of Chlorides.

Salinity

During the study periods salinity value ranges in between 57.63 to 86.43 ppm. Higher values of chlorides were recorded in winter and lower in summer season.

Sulphates

During the study periods Sulphates value ranges in between 10 to 18 ppm. Higher values of Sulphates were recorded in summer and lower in winter season. According to Johnson (1985), normal fresh inland surface water contains less than 50 mg/l of Sulphates. In addition to this, domestic sewage and industrial waste also contribute Sulphates to an aquatic ecosystem and hence high level of Sulphates is an indication of pollution from organic matter.

CONCLUSION

During the study period results of analysis of water sample were Dissolved Oxygen (6.19-7.46 mg/L), Carbon Dioxide (4.40-12.1 mg/L), Fluoride(0.02-0.06 mg/L), Hardness (125-153 ppm), Calcium (27-33 ppm), Magnesium (14-17 ppm), Sodium (27-42 ppm), Alkalinity (175-207 ppm), Chlorides (32-48 ppm), Salinity (57.63-86.43 ppm) and Sulphates (10-18 ppm). All the sample were within permissible limits as described by Bureau of Indian Standard / Specification for Drinking Water (BIS: 105001991) for Water Quality Standards.

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