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*Research Paper*

# PATHOGENIC BACTERIA IN THE WATER OF DALVAYI LAKE, MYSORE

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Water is an important life source for all living organisms. Three fourth of the world is filled up of water. We, humans are using water for almost all the purpose and finally discharge the effluent to the water bodies. This polluted water is used by rural population for drinking and cooking purposes. In this study we have selected Dalvayi Lake on which four villages are dependent for drinking purpose. We have collected the water sample from different distance from the shore and also from different depths. Screening for pathogenic bacteria was done and various physical, morphological and biochemical tests were done to identify the organisms. Finally we came out with the result that the water is heavily contaminated with sewage water entering. Hence, the sewage treatment plant has to be upgraded timely and the treated water can be used for other agricultural purpose instead of letting it into the lake.

***Keywords:*** Pathogenic bacteria, Contamination, Effluents, Sewage.

## INTRODUCTION

Water is an inseparable component of life for all living organisms. The biological wealth of the lake is mainly dependent on its water quality and is the indication of its fitness for consumption. The chemical nature of pollutants and sediments that enter the aquatic system from various sources is a major problem of many water bodies in India (Yamuna and Balasubramaniana, 2000, Rao and Mamatha, 2004; Sharma *et al.*, 2010). Lake water is used for drinking, washing, other domestic and agricultural purposes in the surrounding villages (Mahesha and Balasubramaniana, 2008; Sharma *et al*., 2010). All the lakes and reservoirs of India were reported to be in various degrees of degradation due to encroachment, eutrophication (from domestic and industrial effluents) and slit. Untreated and adequately treated domestic and industrial effluents from point sources located all over the basins were stated to be an important cause of environmental impairment of urban lakes in India ( Reddy and Char, 2004). In Mysore city

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sewage water is treated and released into lakes (Sahana and Jagannatha,2006). The main source of pollution in lake water is the treated sewage entering into the lake (Anonymous, 2010).

Puttaswamaiah (2005) and Rao and Mamatha (2004) reported the causes of pollution and accumulation of chemical and biological pollutants and explained their impact on human health. Thus pollutants add up to the lake water being a source of major and minor health hazards. Prasad et al., (2005) reported the teratogenic effects of lake water pollutants on the morphology of edible fresh water fish. They attribute this mainly to the anthropogenic activities leading to lake water pollution resulting in disturbances of reproduction in vertebrate organisms by interfering with endocrine system. Puttaiah and Kiran (2008) recorded strong health implications of heavy metal contamination in lake water and its utilization in urban and periurban agriculture that finally leads them into food chains. They also suggested viable cleaner and acceptable alternatives.

Microbiological profiling of lakes is also an important indicator of the health of the lake and fitness of its water for consumption. Many recent studies on the lakes of Karnataka attempted to assess the bacterial flora that is an indicator of fecal contamination (Brick *et al*., 2004; Usha *et al*., 2008; Sharma *et al.,* 2010). These studies reported the increased presence of pathogenic coliforms in the lake waters.

In this paper we present a study on "Dalvayi Lake", which is one of the large lakes of Mysore city. The area of Dalvayi Lake is around 379 acres on which four villages depend for their daily water requirements. Present study records the presence of enteric bacteria in this lake water and suggests measures for rendering the water safe and drinkable.

# MATERIALS AND METHODS

## Collection of sample

The water sample was collected from Dalvayi lake at 5 and 7 meters distance from the shore and brought to the lab in a sterilized container.

## Plating

Serial dilution process is carried out under aseptic conditions using 0.9% physiological saline. Plating is done by taking 1ml of the sample from $10^{-5}$, $10^{-6}$ and $10^{-7}$ dilutions. Both spread and pore plate methods are used for plating and the plates were incubated at $37^0$C for 48 hrs. The colonies that developed were counted using a digital colony counter.

## Colony Morphology

Among the colonies that developed, six colonies were randomly selected for identification. The characteristics of the colonies are tabulated in the Table 2.

## Morphological Characteristics

The physical characteristics of bacterial colonies identified were studied by Gram's staining, capsular staining, Endospore staining and Flagellar staining. Results of these procedures are tabulated in Table 3.

## Biochemical Characteristics

Biochemical characteristics of identified bacterial colonies were studied by different biochemical tests viz. Indole production, Methyl red test, Voges proskauer, Citrate utilization, triple sugar Iron test, Urease test, lactose fermentation, Hydrogen sulfide test, Gelatin test, Casein utilization, carbohydrate utilization (Dubey and Maheshwari, 2006) and the results are tabulated in Table 4.

| Table 1: Colony Count | | |
|---|---|---|
| S. No. | Dilution | No. of Colonies |
| 1. | $10^{-5}$ | 24 |
| 2. | $10^{-6}$ | 22 |
| 3. | $10^{-7}$ | 18 |

# RESULTS AND DISCUSSION

Results presented in Tables 1 and 2 facilitated the identification of four genera and six species of enteric bacteria viz. *Klebsiella ozaenae, Serratia rubideae, Enterobacter agglomerans, Salmonella Arizona, Enterobacter sakazaki* and *Enterobacter cloaceae.*

| Table 2: Colony Characteristics | | | | | |
|---|---|---|---|---|---|
| S. No. | Color | Shape | Edge | Elevation | Name |
| 1. | Yellow | Circular | Edge | Pulvinate | DY |
| 2. | White | Filamentous | Curled | Flat | DWZ |
| 3. | White | Circular | Entire | Raised | DWS |
| 4. | White | Circular | Curled | Raised | DIZ |
| 5. | White | Irregular | Undulate | Flat | DIZ2 |
| 6. | White | Irregular | Lobate | Flat | DS |

| Table 3: Physcial Characteistics | | | | | |
|---|---|---|---|---|---|
| Sl.No. | Colony Name | Gram Staining | Capsular Staining | Endospore Staining | Flagellar Staining |
| 1. | DY | Negative | Positive | Negative | Negative |
| 2. | DWZ | Positive | Positive | Negative | Negative |
| 3. | DWS | Negative | Positive | Negative | Negative |
| 4. | DIZ | Negative | Positive | Negative | Negative |
| 5. | DIZ2 | Negative | Negative | Negative | Negative |
| 6. | DS | Negative | Positive | Negative | Negative |

| Table 4: Biochemical Characteristics | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| S. No. | Colony Name | In-dole | Methyl red | VP | Citrate | Gelatin | Case in | Carbo-hydrate | $H_2S$ | Urease | Lactose | | Sucore | | Glucose | |
| | | | | | | | | | | | A | G | A | G | A | G |
| 1. | DY | -ve | +ve | -ve | +ve | -ve | -ve | -ve | -ve | -ve | - | + | + | + | + | + |
| 2. | DWZ | -ve | -ve | +ve | -ve | -ve | +ve | -ve | -ve | -ve | - | + | + | + | + | + |
| 3. | DWS | -ve | +ve | -ve | -ve | -ve | +ve | -ve | -ve | +ve | - | + | + | + | + | + |
| 4. | DIZ | -ve | +ve | -ve | +ve | +ve | +ve | -ve | +ve | -ve | - | + | + | + | + | + |
| 5. | DIZ2 | +ve | -ve | +ve | +ve | -ve | +ve | -ve | +ve | -ve | - | + | + | + | + | + |
| 6. | DS | -ve | -ve | +ve | +ve | -ve | +ve | -ve | -ve | -ve | - | + | + | + | + | + |

Note: 1. DY: *Klebsiella ozaenae;* 2. DWZ: *Serratia rubideae;* 3. DWS: *Enterobacter agglomerans;* 4. DIZ: *Salmonella Arizona;* 5. DIZ2: *Enterobacter sakazaki;* and 6. DS: *Enterobacter cloaceae.*

*K.ozaenae* has yellow color colony with pulvinate elevation. It has shown positive result for methyl red and citrate utilization tests.

*Serratia rubideae* has a filamentous colony with flat elevation and it is Voges Proskauer positive and was the only gram positive bacteria among the isolated colonies.

*Salmonella Arizona* also rendered positive result for methyl red test and citrate utilization like *K.ozaenae* but it also hydrolyzed gelatin and showed H2S positive reaction whereas the former showed negative result.

Enterobacter species were distinguished between themselves by biochemical tests. *E.agglomerans* showed positive result for methyl red, Hydrolysed casein and produced urease whereas, *E.sakazaki* showed positive result for indole production and H2S production distinct from the other species. All the isolated colonies are non-capsulated, non-endospore forming and non- flagellated, irrespective to the genera they belong.

All the six organisms isolated from the lake water are capable of causing problems related to the health of human beings. Some of these cause secondary infections in human beings suffering from chronic diseases whereas some of them lead to chronic diseases

a) *Klebsialla ozaenae:* This bacterium is known to cause "Hansen's Disease" in chronic patients of rhinitis, cerebral abscess, sinusitis and nasal atrophy. Some strains of this bacterium are also resistant to ampicillin (Strampfer *et al.,* 1987).

b) *Serratia rubidae:* This is an opportunistic pathogen that colonizes the respiratory and urinary tracts of human beings and is also responsible for about 2% of nosocomial infections, lower respiratory tract, urinary tract, surgical wounds, skin and soft tissues (Ania, 2009).

c) *Salmonella Arizona:* Human infection with *S.arizona* has been well described from immuocompromised patients consuming contaminated water (Hoag and Nessler, 2005). This is a well known opportunistic pathogen. The main biochemical difference between *S.arizona* and other salmonella species include its ability to ferment lactose and liquefy gelatin.

d) *Enterobacter agglomerans;* Presently known as "*Pantoea agglomerans*". This makes humans to suffer from severe pain in soft tissue or bone joint infections (Wikipedia).

e) *E.sakazakii*: This causes infection in blood stream and central nervous system in infants. Reported outcomes are often severe brain abscess, development delay and death in as many as 80% of cases. Premature infants are at a greater risk that more mature i9nfants, other children or adults. Infections with *E.sakazakii* have been associated with contaminated water and food (Wikipedia).

f) *E.cloaceae*: This bacterium has been identified as the cause of neonatal necrotizing enterocolitis, neonatal meningitis and sepsis. Contaminated water is the main source of infections.

Recycled sewage water entering the lake appears to be the major source of contamination and serious health risk. All the isolated organisms are pathogenic and are known to cause serious health problems in humans. An earlier study of Yellamallappa Chetty Lake of Bangalore also revealed the presence of pathogenic coliforms in the water of that lake and attributed it to the flow of untreated sewage into the lake (Usha *et al*., 2008). Since this water is used by villagers for

household utility as well as drinking, proper action must be taken to render this water safe for consumption. Adequately strong sewage recycling methods must be adopted (Tijani *et al.*, 2005; Casteel *et al*., 2005) and if proper action is taken at this point of time, it any reduce the associated health risk.

Severe nature of microbial pollution in the lakes and the need to establish benchmarks for the restoration of lake water quality ti improve the ecological profile of the lake and enhancing health indices of local population was envisaged in the earlier studies (Usha *et al*., 2008) and should be undertaken on top priority for Dalvayi Lake and possibly other lakes of Mysore. Constant surveillance of water bodies with respect to true microbiological monitoring to suggest proper management actions that could be applied in order to improve the quality of lake water and reduce public health risk (Sharma *et al*., 2010).

From the aesthetic perspective also, it is important to render the lake sanitized as this is likely to form an attractive tourist destination in Mysore on account of its close proximity to the Airport and interstate highway. However, strict eco-tourist norms have to be adhered to.

Considering the ecological and eco-tourist importance of the lake and health hazards caused by the resident microbes, it is suggested that the sewage water should not be let into the lake even after the treatment. Instead, the treated sewage water can be diverted for use in agriculture in vicinal locations where water is scarce.

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