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Reconnaissance Comprehending Potable Competence of Lake Sambhaji at Solapur Dist. (MS), India

Shekhar Salunke and Balbhim Chavan

Department of Environmental Science, School of Earth Sceinces, Solapur University, Solapur, (MS), India.

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ABSTRACT

For the appraisal of contamination of lake waters coliform count is generally used to review the infectivity echelon of potable water. The usual sources of coliform contamination at lake Sambhaji include discharges due to domestic wastes, laundry activities related to hospitals, natural surface runoff, rivulets, swimming activities, anthropogenic activities urban run-off, animal and human wastes. Lake water for the reason it had objectionable odour, was suspected for being contaminated. An attempt was made to comprehend the potable competence lake waters of lake Sambhaji, at Solapur district (MS), India, by specifying total coliforms counts employing the method of Multiple Tube Test with double strength MacConkey Broth Medium (Himedia M539S), the traditional method for presumptive isolation of coliform bacteria by MPN, incubating at 37^0C for 24 hours, in addition to other tests. Most Probable Number (MPN) of total coliforms was determined by referring to standard probability table for estimation of total coliforms for the determination of MPN. The investigation of the cultural response revealed 480 cfu/ml at site 2 and 220 cfu/ml at site 1, exceeding limits for recreational water. The highest fraction of indicator coliforms was detected in the water sample at site 2, of lake Sambhaji which has truly objectionable odour as compared to site 1 of lake Sambhaji. Taking into consideration the observations of high coliform count at lake Sambhaji results portray a tragic testimony of the deterioration of the ecological health of the lake and advocates dismissal of the consideration of water for being thought for its potable potential, portraying human malady if exposed to such unsanitary lake. The results encompass imperative repercussion directing prioritization to design restoration strategies.

Introduction

Loss of biodiversity recorded is mostly due to destruction of habitats, over-harvesting. A decisive action is needed towards conservation of such valuable resources and ecosystems. This reinforces effective action through ex-situ conservation of resources and the in-situ protection of ecosystems enhancing the functionality of the ecosystems. Wetlands are unique resources under intimidation due to developmental activities and population pressure. Monitoring ecological health of lakes by all means proves decisive in restoring the lake water to acceptable standards. Pathogenic bacteria are considered as etiological agents of infectious diseases to human and marine animals (Baker-Austin et al., 2006; Pereira et al., 2007 [1]). Microbial indicators are used to determine whether or not water is safe for use. Recently, concerns have been raised about the appropriate use of microbial indicators to regulate recreational uses of water bodies (Solo-Gabriele, 2005 [2]). Microorganisms are widely distributed in nature, their diversity and density may be used as an indicator for the suitability of water (Okpokwasili and Akujobi, 1996 [3]). According to studies conducted by the EPA [4], enterococci have a greater correlation with swimming-associated gastrointestinal illness in both marine and fresh waters than other bacterial indicator organisms. Human feces are the biggest concern, because anything which infects one human could infect another. Ingesting human feces via contaminated water supply is a classic means for infections to spread rapidly. The primary risks to human health associated with the consumption of polluted water are microbiological in nature whereas the magnitude of chemical contagion cannot be underestimated. The more pathogens an individual carries, the more hazardous are their feces. As indicated in Chapter 18 of "Agenda 21" of UNSED [6], "An estimated 80% of all diseases and over one-third of deaths in developing countries are caused by the consumption of contaminated water and on average as much as one-tenth of each person's productive time is sacrificed to water-related diseases." Microbiological pollution is often through runoff from animal husbandries, human sewage streams into lakes along with wastes from wild animals, anthropogenic activities as hospital laundry washing. Variations in turbidity and algal blooms increase bacterial abundance in the water bodies (Geldreich et al., 1991 [5]). The risk of acquiring a waterborne infection increases with the level of contamination by pathogenic microorganisms. Drinking-water is the focal vehicle for disease transmission. Some agents may be transmitted primarily from person to person and, for bacteria capable of multiplication in food, food-borne transmission may be more important than transmission by drinking-water. Hence lake waters must be monitored to assure improved water supplies to communities and meet the water quality. Lake Sambhaji is polluted and was suspected to have been contaminated with faecal coliforms due to the objectionable odour. For the reason, an attempt was made to analyze the water quality in order to investigate the status of waters at lake Sambhaji to define remedial strategy. The complex interconnectedness of freshwater systems demands that freshwater management be holistic (taking a catchment management approach) and based

Tele:

E-mail addresses: spr_salunke@bsnl.in

on a balanced consideration of the needs of people and the environment (UNSED [6]).

Materials and method

Lake water samples were collected following the guidelines provided by WHO [7] from 20 cm depth at the selected sites of the lake. The samples collected were transported to the laboratory on ice with thiosulfate and processed within 24 hours for MPN or multiple tube analysis. Coliform organisms have long been recognized as a suitable microbial indicator of drinking-water quality, because they are easy to detect and specify in water. The term "coliform organisms" refers to Gram-negative, rod-shaped bacteria capable of growth in the presence of bile salts or other surface-active agents with similar growth-inhibiting properties and able to ferment lactose at 35–37°C with the production of acid, gas, and aldehyde within 24–48 hours. Cultural characteristics were observed after incubation at 37°C for 24-48 hours.

During the analysis, a series of tubes containing a Himedia (M539S) broth culture medium was inoculated with test portions of water sample. A suspension of 80.14 grams of Himedia (M539S; Ingredients in the volume of gm/L as - Peptic digest of animal tissue 40.00, Lactose 20.00, Bile salts 10.00, Sodium chloride 10.00, Neutral red 0.140, Final pH (at 25°C) was maintained to 7.5±0.2) medium was dissolved with exposure to low heat in 1000 ml of distilled water to dissolve the medium completely. The medium was distributed into test tubes with inverted Durham tubes and sterilized by autoclaving at 15 lbs pressure (121°C) for 15 minutes followed by cooling the tubes before inoculation. 10ml of sample to each of five tubes containing 10 ml of double-strength Medium, followed by 1.0 ml of sample to each of five tubes containing 10 ml of single-strength Medium & 1.0 ml of a 1 : 10 dilution of sample (i.e. 0.1 ml of sample) to each of five tubes containing 10 ml of single-strength medium. After incubation for time at a given 37^{0}C temperature, each tube showing gas formation was regarded as "presumptive positive" since the gas indicates the possible presence of coliforms. However, gas may also be produced by other organisms, and so a subsequent confirmatory test was treated essential, as the two tests are known respectively as the presumptive test and the confirmatory test. For the confirmatory test, a more selective culture medium is inoculated with material taken from the positive tubes. The confirmatory test was carried out at the end of incubation periods. Using a sterile loop, inoculums were transferred from each presumptive positive tube into two tubes containing respectively confirmatory broth. After an appropriate incubation time, the tubes are examined for gas formation as before. The most probable number (MPN) of bacteria present were then estimated from the number of tubes inoculated and the number of positive tubes obtained in the confirmatory test, using specially devised statistical tables. Further standard method for the examination of water and waste water was used (APHA [8]) to investigate the physicochemical parameters of lake Sambhaji.

Results and Discussion

Traditionally, coliform bacteria were regarded as belonging to the genera *Escherichia*, *Citrobacter*, *Enterobacter*, and *Klebsiella*. However, as defined by modern taxonomical methods, the group is heterogeneous. It includes lactose fermenting bacteria, such as *Enterobacter cloacae* and *Citrobacter freundii*, which can be found in both faeces and the environment (nutrient-rich waters, soil, decaying plant material) as well as in drinking-water containing relatively high concentrations of nutrients, as well as species that are rarely, if ever, found in faeces and may multiply in relatively good-quality drinking-water, e.g. *Serratia fonticola*, *Rabnella aquatilis*, and *Buttiauxella agrestis* (WHO [7]). The existence both of non-faecal bacteria that fit the definitions of coliform bacteria and of lactose-negative coliform bacteria limits the applicability of this group as an indicator of faecal pollution. The multiple-tube method is also referred to as the most probable number (MPN) method because it is based on an indirect assessment of microbial density in the water sample by reference to statistical tables to decide the most probable number of microorganisms present in the original sample.

During the investigation, the cultural response revealed MPN of 220 cfu/ml at site 1 of lake Sambhaji and MPN of 480 cfu/ml at site 2 of lake Sambhaji that exceeds the limit set for recreational water. The highest fraction of indicator coliforms was detected in the water sample at site 2 of lake Sambhaji which has truly objectionable odour as compared to site 1 of lake Sambhaji. The MPN index observed for the water samples revealed that maximum of samples were crossing the permissible limit of (WHO [7]) indicating gross pollution of the lake and its transition towards eutrophic state. Drinking-water should not contain any microorganisms known to be pathogenic or any bacteria indicative of faecal pollution. To ensure that a drinking-water supply satisfies these guidelines, samples were examined. The detection of coliforms provided definite evidence of faecal pollution at lake Sambhaji. Total coliform bacteria are not acceptable indicators of the sanitary quality of rural water supplies. Higher values of hardness, BOD, turbidity, are also the indicators of deterioration of the lake waters. Taking into consideration the observations of high coliform count at lake Sambhaji results portray tragic testimony of the deterioration of the ecological health of the lake and advocate dismissal of the consideration of water for being thought for its potable potential portray human malady if exposed to such unsanitary lake. This calls an immediate attention towards restoration.

Conclusion

Considering the observations of the investigation, high coliform count at lake Sambhaji portrays a tragic indication of deterioration of the ecological health of the lake. This advocates dismissal of the consideration of water for being thought for its potable potential, which in turn portrays human malady if exposed to such unsanitary lake waters. Huge quantity of detergents and chemical pollutants has caused the lake water to be unpleasant and unfit for supporting biological development. Evidently as the consequence of anthropogenic activities, the levels of total coliforms have been elevated. Poor sanitary system and land use pattern in the immediate catchment and discharge of domestic waste water continues to endanger the water quality of the lake for human use. The results encompass imperative repercussion directing prioritization for designing restoration strategies to meet the water quality standards and this provide insight towards the demand of progressive improvement of lake waters at lake Sambhaji.

Figure 1. Outline Map of Solapur district depicting location of lake Sambhaji

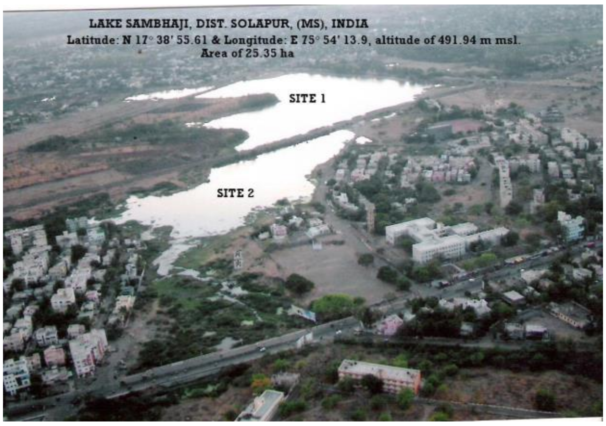

Figure 2. Lake Sambhaji Aerial Photograph

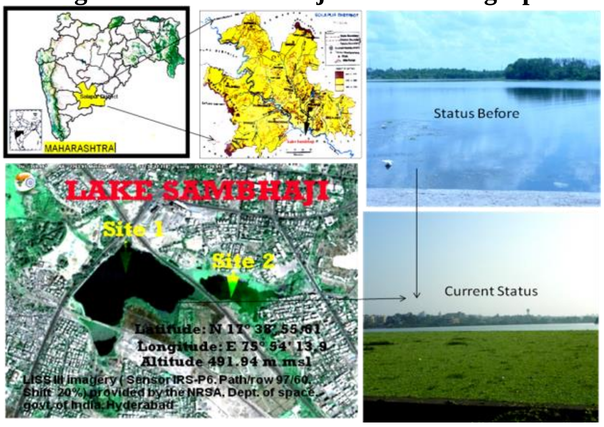

Figure 3. Lake Sambhaji Reconnaissance details

Figure 4. Eutrophication at Lake Sambhaji

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