Journal of Pharmacognosy and Phytochemistry

Available online at www.phytojournal.com

Asmat Rashid
Division of Environmental Science, Sher-e- Kashmir University of Agricultural Science and Technology, Shalimar campus, Srinagar, Jammu and Kashmir, India

Mohammad Aneesul Mehmood
Department of Environmental Science, Sri Pratap College campus, Cluster University Srinagar, Jammu and Kashmir, India

Humaira Qadri
Department of Environmental Science, Sri Pratap College campus, Cluster University Srinagar, Jammu and Kashmir, India

Rouf Ahmad Bhat
Department of Environmental Science, Sri Pratap College campus, Cluster University Srinagar, Jammu and Kashmir, India

Gowhar Hamid Dar
Department of Environmental Science, Sri Pratap College campus, Cluster University Srinagar, Jammu and Kashmir, India

Comparative water quality assessment of a tropical and a temperate lake of India

Asmat Rashid, Mohammad Aneesul Mehmood, Humaira Qadri, Rouf Ahmad Bhat and Gowhar Hamid Dar

Abstract
Two urban lakes were selected for this investigation, Dal lake Srinagar Kashmir and Bellunder lake Bangalore. The two lakes are having a greater importance in their respective cities or we can say that they are the main water bodies in these cities providing water for irrigation, recreation, sports events, domestic use, commercial use, and tourism also. The study is based on physico chemical parameters of both lakes and then comparison of both lakes and intend outcome. The Dal lake is a Himalayan urban lake which is mostly used for tourism, it is India's most beautiful and second largest lake in state of Jammu and Kashmir. Secondly the Bellunder lake providing water for irrigation, recreation, sports events, domestic use, commercial use, also situated on the extreme eastern part of Bangalore city located in Deccan plateau of south Indian peninsula, the terrain of region is relatively flat and sloping towards south of Bangalore city. Three water samples were collected at three locations from the three basins of the Dal Lake and Bellunder Lake respectively. An water quality analysis was carried out according by adopting universally accepted standards. The present investigation of both lakes reveals that the both lakes are under extreme environmental stress, the main stress is due to the unplanned developmental activities in the catchment area which directly have negative affect on the respective lakes because both lakes are urban and have greater importance in their respective cities he Dal lake Kashmir and Bellunder Lake Bangalore, The lakes need proper planning for rejunavation and for the survival of ecosystem and ecological balance. The study reveals that sewage is the main source of pollution of this water body.

Keywords: Dal lake, bellunder lake, water qualuty, sewage, irrigation

Introduction
A lake derived (from Latin *lacus*) is physical feature, a body of liquid on the surface of a world that is localized to the bottom of basin (another type of landform or terrain feature; that is, it is not global) and moves slowly if it moves at all. Another definition is a body of fresh or salt water of considerable size that is surrounded by land. On Earth a body of water is considered a lake when it is inland, not part of the ocean, is larger and deeper than a pond, and is fed by a river. The only world other than Earth known to harbor lakes is Titan, Saturn's largest moon, which has lakes of ethane, most likely mixed with methane. It is not known if Titan's lakes are fed by rivers; Titan's surface is carved by numerous river beds. Natural lakes on Earth are generally found in mountainous areas, rift zones, and areas with ongoing or recent glaciation. Other lakes are found in endorheic basins or along the courses of mature rivers. In some parts of the world there are many lakes because of chaotic drainage patterns left over from the last Ice Age. All lakes are temporary over geologic time scales, as they will slowly fill in with sediments or spill out of the basin containing them. The environmental condition of Dal Lake and Bellandur lake water and sediment is a cumulative reflection of catchment point source an non point sources pollution presence; the chemical processes are mainly chemical degradation of silicate and carbonate minerals by various processes, The concentration of the chemical constituents in water depends on the availability of the parent mineral for a particular constituent and its dissolving capacity. The concentration and abundance of the chemical constituents in lake sediments reflect the occurrence and abundance of these metals in rocks of their catchment areas and anthropogenic sources. Since both lakes are sinks of agricultural runoff and municipal and industrial-waste water discharges, they become enriched with nutrients, sediments and associated heavy metals. Due to drastic rise in developments in the lake surroundings and very low dispersion and high mobilization rates, the lake water quality is decreasing day by day. Being urban type lakes, municipal and domestic effluents have altered the surface-water composition of the Dal Lake and Bellandur Lake respectively, leading to increased eutrophication.

Correspondence
Asmat Rashid
Division of Environmental Science, Sher-e- Kashmir University of Agricultural Science and Technology, Shalimar campus, Srinagar, Jammu and Kashmir, India

Moreover, excessive sedimentation rates, enhanced by extensive soil erosion due to deforestation, and an encroachment by surrounding population have dramatically reduced the lake volume. These lakes serve as a resource for drinking water, irrigation, fisheries, recreation, tourism, etc. A comprehensive study of water quality and has been lacking to date. This research has been taken in consideration keeping in view both the lakes and there geographical setting also here we have to examine the influences on water and sediment chemistry of the lake exclusively based on physico chemical parameters, and to establish a baseline for future assessment.

Study area description
Dal Lake
Location
- Jammu and Kashmir, India.
- 34:18N, 74:91E; 1,583 *m above sea level*.

Description: Dal is a Himalayan urban lake which is mainly used for tourism. Fishery is of secondary importance. The lake comprises five basins and a myriad of inter- connecting channels. It is one of the most beautiful lakes of India and the second largest lake in the State of Jammu and Kashmir. The lake is surrounded by mountains on its three sides. A large number of gardens and orchards have been laid along the shores. Dal Lake is unique in having hundreds of house boats which afford an opportunity to tourists to reside on the lake in an atmosphere of peace and tranquility. The boats are served by Shikaras which more or less resemble the gondolas of Venice but are smaller in size and are tastefully decorated. Besides the Moghul monuments the campus of the University of Kashmir is also located along the shores of the lake. Overlooking the lake are two hillocks which house the famous temples of Shankaracharya and Hari Parbat. A perennial inflow channel enters the lake from the north and supplies about 80% of the water. Towards the southwest side an outflow channel drains the lake water into a tributary of the River Jehlum. Parallel to this exit is a stone-lined canal which connects the lake with the tributary. This channel is used for movement of boats in and out of the lake and prevents inundation of floating gardens during high floods. The famous Moghul gardens around the lake have been laid during 16-17th century and their number was about five hundred but now only a few of these have survived. The origin of the lake has remained unresolved. It is believed by some geologists that the Dal Lake is the remnant of a Pleistocene oligotrophic lake which once covered the entire valley of Kashmir. There are other geologists who believe Dal to be a flood plain lake. The lake water is being used for irrigation of vegetable fields which have grown in number and extent during recent years. The present maximum depth of the lake is 6 m (Nagin basin). Many aquatic plants growing in the lake are used as food, fodder and compost. The water quality of Dal Lake has deteriorated considerably in the last two decades. Large peripheral areas have been reclaimed and converted into floating gardens. With the increase in the tourist influx a large number of residential buildings, restaurants and hotels have come up along the lake front. The number of house boats has also been increasing at an alarming rate. As a result of rapid and unplanned urbanization, large quantities of raw sewage are discharged in the lake water, which might pose health problems in the near future. The main environmental issues are excessive weed growth, reduction in water clarity, enrichment of waters and high microbial activity. A Dal Development Project was formulated in 1978 and the State Government of Jammu and Kashmir adopted it with some modification.

Table 1: Description of Study Area

Location	Srinagar**,** Jammu and Kashmir
Coordinates	34:18N, 74:91E; 1,583 *m above sea level*
Lake type	Warm monomictic
Primary inflows	Inflow Channel Telbal from Jehlum River - 291.9 MCM
Primary outflows	Regulated, two channels (Dal Gate and Nallah Amir)- 275.6 MCM
Catchment area	316 square kilometers (122 sq mi)
Basin countries	India occupied Kashmir
Max. length	7.44 km (4.62 mi)
Max. width	3.5 km (2.2 mi)
Surface area	18–22 square kilometers (6.9–8.5 sq mi)
Average depth	1.42 meters (4.7 ft)
Max. depth	6 m (20 ft)
Water volume	983 MCM
Residence time	22.16 days
Shore length[1]	15.5 km (9.6 mi)
Surface elevation	1,583 m (5,194 ft)
Frozen	During severe winter
Islands	Two (Sona Lank and Rupa Lank (or Char Chinari)
Settlements	Hazratbal, Srinagar

Bellandur Lake
Geographically, the study area is located between 77° 35´ west and 77° 45´ east and latitude 12° 50´ south and 13° 00´ north (toposheet 57 H/9, scale: 1:50,000). The over all catchment areas is about 287.33 sq. km with water spread area of 361 ha (Water Resources Department, 2003). The terrain of the region is relatively flat and sloping towards south of Bangalore city. Relative Slope of the region is found to be very gentle to gentle slope. The relative contour height is 930 m above mean sea level and the lowest is 880 m. The height is found to be 870 m above mean sea Level near the tank. The drainage pattern is dendrite type and is characterized by gneiss and gneiss granite rocks. Three main streams join the tank, which form the entire watershed. One of the Streams originates at the northern part of the region, Jayamahal and covers the eastern portion and are referred to as the eastern stream. Another stream originates from the central part of the city; Krishna Raja Market covers the central part of the region before joining the tank and is called the central stream. Another stream commands southwestern part of the region called the Western stream. Further, before the confluence with Bellandur Tank, all the streams come across two to three tanks (Sreekantha and Narayana, 2000). The rainfall data is available for the last 100 To 110 years. Rainfall varies from 725.5 mm to 844.8 mm. The district receives 51 % of the total annual rainfall in the southwest monsoon period, i.e. June to September. The average annual Rainfall in the catchment was 859 mm in 1999. April is usually the hottest month with the mean daily maximum and minimum temperature of 33.4° C and 21.2° C respectively. December is generally the coolest month with the mean daily maximum and minimum temperature of 25° C and 15.3° C respectively. The temperature drops down to 8° C during January nights. Relative Humidity is high from June to October (80 to 85 %). Thereafter, it decreases and from February to April becomes 25 to 35%. The relative humidity in the morning is higher than in the evening, giving rise to the formation of fog.

Methodology

The methodologies for study are almost done in laboratory but for the collection of literature of lake background and other related aspects, to collect authentic literature I have to go through various departments and agencies government as well as Non-Government. The studies are mostly conducted on the basis of primary survey supported by ground survey marking point source and non-point source of pollution by visiting all corners of the lake were it was assessable and have taken snapshots/photographs also. secondaly the laboratory tests were done and analyzed in university of Kashmir laboratory and for Bellandur lake from Bangalore university laboratories respectively, by using standard methods for testing purposes. Thirdly interviews with Dal dwellers and Bellandur lake catchment area residents and other people within the catchment area, the interviews were almost related to domestic water discharge and the problems they are facing from the present polluted lakes fourthlly, secondary data were collected from newspapers, websites, journals, magazines, published by LAWDA Kashmir and LDA Bangalore.

Three water samples were collected at three locations from the three basins of the Dal Lake and Bellandur Lake respectively. An analysis was carried out according to standard methods (APHA 1992 *American public health association*) pH and conductivity (EC) of water samples were determined by portable digital pH meter and conductivity meter, respectively. DO, CO2, chloride, and phosphate have been estimated by WINKLER method, TITRATION method (sodium carbonate), TITRATION method (AgNO3) and STANNOUS CHLORIDE method respectively.
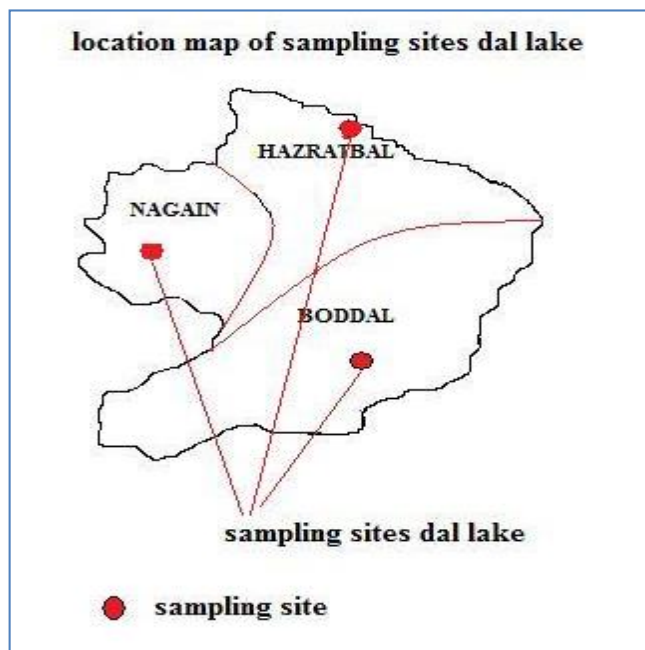

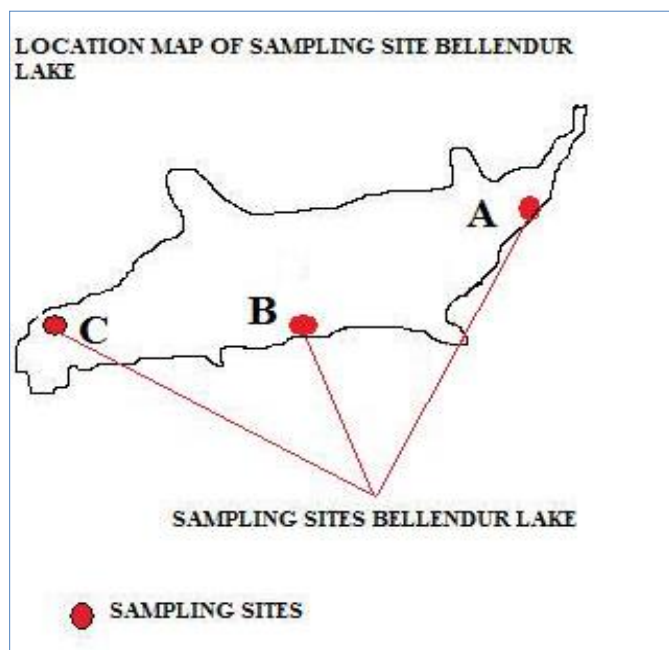**Fig 1:** Map of sampling sites in Dal Lake

Fig 2: Map of sampling sites in Bellandur Lake

Table 2: Water quality of dal lake

Sampling sites	pH	water temp (°C)	Ec (µs/cm)	DO (mg/l)	CO₂ (mg/l)	Chloride (mg/l)	Phosphate mg/l
Site A	8.1	8.1	250	5.4	**1.8**	**9.9**	**0.16**
Site B	7.6	8.0	247	6.3	**2.3**	**1.4**	**0.15**
Site C	7.4	8.2	243	6.2	**2.1**	**15.2**	**0.16**

Table 3: Water quality of bellandur lake

Sampling sites	pH	water temp (°C)	Ec (µs/cm)	DO (mg/l)	CO₂ (mg/l)	Chloride (mg/l)	Phosphate mg/l
Site A	7.76	28.4	950.00	1.91	14. 3	115.33	0.41
Site B	8	28.4	956.00	1.48	8.88	115.73	0.37
Site C	6.14	29.8	934.00	6.43	10.6	112.92	0.46

Result and Discussion

The lake water is slightly acidic for Dal Lake and for Bellandur Lake it is slightly alkaline. There is high amount of dissolved solids, which includes Phytoplankton (*Euglenophyceae members*), chlorides, Phosphate, and, other ions resulting in Turbidity in water body. For both the lakes the water has very less Dissolved Oxygen. This may be attributed due to high organic waste from Sewage and high algal growth. Chloride concentration in the Bellunder Lake is comparatively very high due to the faecal contamination and effluent/ sewage discharge into the lake. High phosphates in both the lakes may be due to agricultural activities in the catchment area and also sewage (detergents). This enhances the rate of Eutrophication in both the lakes.

The present investigation of both lakes reveals that the both lakes are under extreme environmental stress. the main stress is due to the unplanned developmental activities in the catchment area which directly have negative affect on the respective lakes because both lakes are urban and have greater importance in their respective cities i.e Dal lake Kashmir and Bellandur lake Bangalore, by our investigations I have seen and analyzed that the lakes need proper planning for rejunavation and for the survival of ecosystem and ecological balance.

The study reveals that sewage is the main source of pollution of this water body and irrigation with sewage-contaminated water containing variable amounts of heavy metals leads to increase in concentration of metals in the soil and vegetation. Concentrations of metals in vegetation will provide baseline data and there is a need for intensive sampling of the same for quantification of the results. Soil, plant and water quality monitoring, together with the prevention of metals entering the plant, is a prerequisite in order to prevent potential health hazards of irrigation with sewage fed water. The lake water is slightly acidic for Dal Lake and for Bellandur Lake it is slightly alkaline. There is high amount of dissolved solids, which includes Phytoplankton (*Euglenophyceae members*), chlorides, Phosphate, and, other ions resulting in Turbidity in water body. For both the lakes the water has very less Dissolved Oxygen. This may be attributed due to high organic waste from Sewage and high algal growth. Chloride concentration in the Bellunder Lake is comparatively very high due to the faecal contamination and effluent/sewage discharge into the lake. High phosphates in both the lakes may be due to agricultural activities in the catchment area and also sewage (detergents). This enhances the rate of Eutrophication in both the lakes.

At this juncture of progress, it seems very essential that a thorough introspection on the direction of development be made. This call for such introspection stems out of the fact due to the current Status of Bellandur Lake catchment, which is succumbing to the Urbanisation defined by the unplanned developmental activities devoid of ecosystem approaches in regional planning. While predevelopment Community may argue that the development has to be towards Urbanisation, the indicators of Urbanisation especially in terms of ecology are not favourable. On the one hand Ecologists would feel imperative that the entire catchment be protected, while, developers might want to exploit the region for the simple fact that it is closer to the larger city and also enjoys Proximity to key growth centers of Electronic City and Whitefield. It is not that development per se is itself questioned. But, the suggestion that development has to be based on proper integrated Planning in a holistic manner acknowledging the feedbacks that might occur due to any intervention in the natural system is stressed here.

The Bangalore Development Authority (BDA) has recently prepared the draft master plan of Bangalore city for 2015. A preliminary review of the draft master plan suggests that the BDA has Earmarked some of these localities as green spaces (as is situation) while some of these are also earmarked for further development. It is noted here that any further development can lead to Ecological imbalance in the system, which can be disastrous. Such indications of development depicting the lack of any holistic approaches would be largely "unplanned" and a futile attempt.

Conclusion
The proposed Environmental Management Plan (EMP) will try to achieve certain benefits like augmentation of vegetation, wild life and fisheries. The measures will also help in controlling floods occurring in the surrounding areas. The water body will generate conducive and cleaner climate and promote better environment with the mitigation of the pollution problems. Underground water will become safe for human consumption. There will be optimum utilization of land resources on the adoption of soil conservation programs. Also the diversification of the economic activities will lead to better living standards for the local people and the wetlands will present a picturesque view and promote tourism.

References
1. ILEC. (International lake environment committee), 2009.
2. Other published data sources
3. Zutshi DP. Impact of human activities on the evolution of Dal lake environment, 1978.
4. Zutshi DP, Vass KK. Limnological studies on Dal lake, Srinagar III. Biological features. Proc. Indian Natn. sci. acad. 1982 B; 48(2).
5. Google Earth
6. Department of Geoinformatics Bangalore University Bangalore
7. BBMP Bangalore
8. Meteorological Department of Srinagar and Bangalore