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# A REVIEW ON THE POLLUTION PROBLEM OF THE MAJOR WATER SOURCES IN HYDERABAD CITY

**K. Sri Lakshmi[1], *V. Hema Sailaja[2] and Dr. M. Anji Reddy[3]**

*[1]Research Scholar, *[2]Lecturer, [3]Professor,*
*Centre for Environment, JNTUH, Kukatpally, Hyderabad, Telangana, India.*
* corresponding author

**Abstract**

***Due to rapid growth of population, industrialization, urbanization and various developments in agricultural practices since 1970's the quality of water resources has been deteriorating drastically. The aquatic ecosystem is being polluted to an extent which is irreparable which is a problem of concern. The discharge of sewage and industrial waste waters into water bodies is leading to deposition of various pollutants/contaminants into aquatic ecosystem which may become accumulated, persistent and toxic. These contaminants may make water unsuitable for various purposes and cause threat to human health through bioaccumulation. This Article reviews the degree of contamination of major inland water bodies of city of Hyderabad, Telangana. It also focuses on sources of contamination. It shows that various anthropogenic activities, apart from natural sources are causing the environmental degradation. The treatment of waste waters from various sources is a major societal problem not only in Hyderabad, but across the world. Development of Advanced waste water treatment technologies and improvisation of existing treatment facilities to improve the quality of water is essential.However it is required to bring awareness among the public about these problems. Apart from advanced technological remedial measures, prevention of pollution aiming at sustainable development has to be emphasized.***

***Keywords- Water resources, aquatic ecosystem, Pollution, environmental degradation, sustainable development***.

## I. INTRODUCTION

Many Rivers across the world are being polluted by domestic and industrial effluents due to wide range of pollutants. Some of the pollutants are persistent and stable environmental contaminants (Karadede-Akin and Unlu, 2007). Domestic sewage poses health related issues while industrial effluents carry along them a vide variety of toxic elements like Cd, Cr, Pb, Hg and Zn which cause significant toxicity even in trace amounts. The pollutants enter various segments of environment by anthropogenic activities as well as natural cause and degrade the surface and ground water quality and make them unfit for drinking, industrial, agricultural, recreation or other purposes (Carpenter et al., 1998; Howarth et al., 1996).

Hyderabad is the capital city of Telangana situated on the Deccan Plateau, consisting of a number of lakes and bunds which were constructed by the rulers of Qutubshahi dynasty, the metro citylocated at 17° 22' of northern latitude and 78° 29' of the eastern longitude with an area of 7,100 sq km.The city is drained by river Musiwhich was earlier a principal drinking water source. Later in 1920's two reservoirs Osman sagar and Himayatsagar were constructed upstream of Musi to meet the drinking water requirement of city dwellers. Hussainsagar and Mir Alam tanks were also drinking water resources before 1900's. However because of uncontrolled and untreated discharge of various pollutants into these water

 

bodies, 3245 ha. area of its drinking water resources were drastically effected. Hyderabad is one among the fastest growing Indian megacities.As per the census data, 2011 (Census of India, 2011), the population of Hyderabad is estimated to be 9.5 million by 2015 but it has crossed 10 million mark by end of 2015 (Table 1). To supply this population with drinking water is the greatest challenge for the government of Telangana. The demand for water is an ever increasing and theper capita consumption of water in many Indian cities depends upon the amount supplied and not by the demand (Hemanthwakode, 2011).The demand of water could not be met because of Urban Sprawl and pollution of its own resources.Hence water is being imported from sources out side the local catchment area, example Singur (Medak dist) or the NagarjunaSagar reservoir (Krishna River) which is being pumped from 120 Km(Rooijen*et al.*, 2005).And further Godavari water is also being drawn into the city.

***Table 1: Hyderabad Population 2015***

| | |
|---|---|
| Total Metropolitan Area Population of Hyderabad in 2015 | 11,458,741 (11.4 million) |
| Hyderabad city Population in 2015 | 9,507,434 (9.5 million) |
| Population in 2014 | 87,46,490 |
| Population of Hyderabad in 2013 | 80,46,449 |
| Population of Hyderabad city 2012 | 74,02,437 (7.4 million) |
| Literacy Rate in Hyderabad | 82.96% |
| Sex Ratio | 945 |

Source: India Guide Population of India Population of Hyderabad 2015.

**Figure 1 gives details of water demand of city and urban growth provided by Hyderabad Metropolitan Water Supplyand Sewerage Board (HMWSSB, 1995; Rooijen*et al.*,2005).**

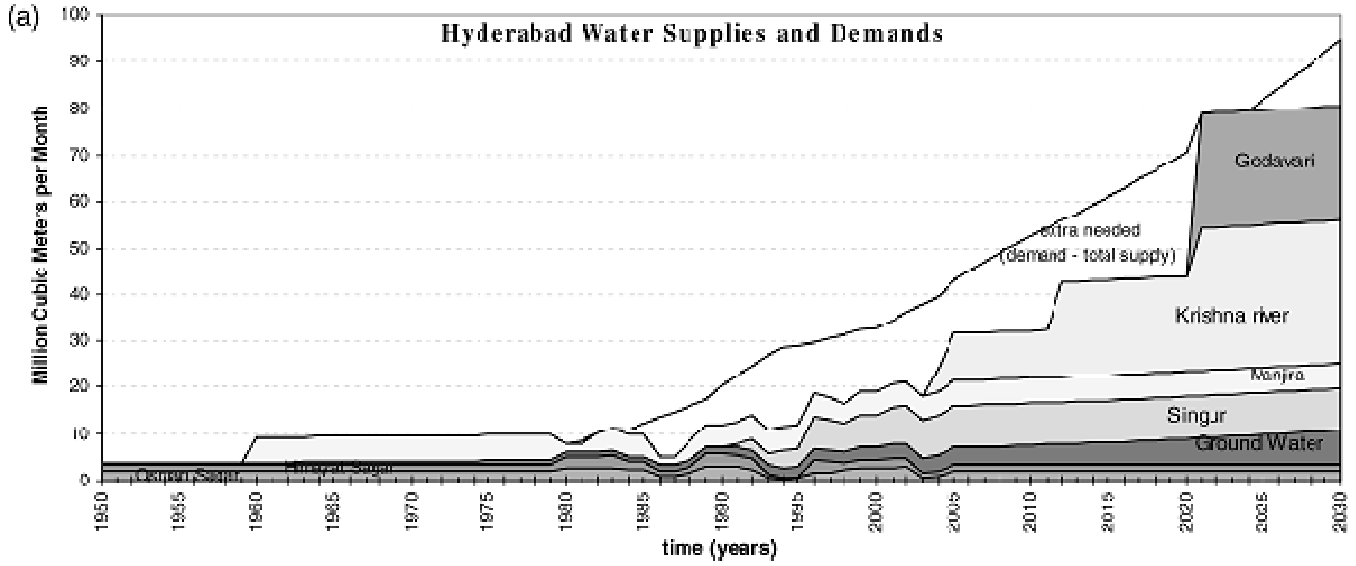


*Fig 1: Water delivery rates from the different water sources for urban water supply in Hyderabad in the period1950–2030.For the period of 1980–2003 more detailed water delivery data were used*
*(HMWSSB, 1995; Rooijenet al., 2005)*

 

Environment of the city is becoming fragile due to ignorance about the environmental degradation and lack of stringent legal action against environmental pollution activities. Although industrialization and technological advancement is essential but sustainability is of utmost importance, which is presently at stake. The life supporting aquatic environment is devastated by domestic as well as industrial sources and irresponsible human actions. The wastes have both biodegradable as well as non-biodegradable matter including heavy metals. According to Hydrological cycle, the water around us is absorbed to land/soil and as rivers flow and reach the sea, the self-purification capacity of rivers and streams degrade the organic content. But at present the rate of pollution of aquatic resources is far beyond the carrying capacity of lakes and streams. However, heavy metals are a threat to living beings (Rashmi et al., 2013 ) as they are persistant, toxic, enter the food chain(Sahar Mohammadnabizadehetal., 2014, (Karadede-Akin and Unlu, 2007)and may cause bioaccumulation and biomagnificationand finally absorbed by humans (H. Agah et al., 2009, Y. Kamaruzzaman et al, 2010 ).

The city is at threat of fresh drinking water resource. By the end of last century many industries/ boom of IT/ real estate developments / construction in catchment areas / fields converted to plots & other anthropogenic activities led to massive migration of population into the city which affected the water resources sustenance by their ignorance and negligence. Many water bodies had and have been diminishing in size due to eutrophication or being polluted by industrial/ sewage effluent from various sources. The water quality shows extreme variation from the standards. Studies have shown a direct negative impact of urbanization on quality of water bodies (Sangodoyin, A.Y, 1991), showed reduction in water bodies both in the area as well as in number. Not only the reduction in size and number, many lakes are getting dried up, or else converted into parks (Ramachandraiah 2004,*P.Rama Chandra Prasad*etal, 2009). Due to unplanned urbanization and industrialization many of our waterbodies have reached a point of crisis (Singh et al.2002). At least now, mitigation measures need to be taken up by the authorities concern to safe guard and protect life from the damages of the aquatic pollution since it challenges the sustenance of survival of the ecosystem.

## II. SOURCES OF POLLUTION

Aquatic pollution arises fromnatural as well as anthropogenicsources. Natural sources include seepage fromrocksintowater, volcanic activity, forest fires, etc which account to less pollution. Anthropogenicsourcesmainly include domestic and industrial wastes which contribute to enormous amount of pollutants.

### 2.1.Domestic sources

Many of the water resources of Hyderabad are polluted by discharge of untreated domestic and industrial waste water.IndianPlanning Commission in its Tenth Plan Document reportedsewage as a highly polluting source contributing to about80% of the total water pollution. Out of about 38000 millionlitre per day of sewage generated, treatment capacityexists for only about 12000 million litre per day. Thus, the amount of waste water generated is much more than the amount treated. Many of the available treatment facilities are not effectively utilised because of operation and maintenance problems.Operation and maintenance of existing plants and sewagepumping stations is not satisfactory, as they are not conforming to the general standards prescribed underthe Environmental (Protection) Rules for discharge intostreams.

 

### 2.2. Industrial source

Under Hyderabad city corporation limits (Azamabad, Musheerabad, Sanathnagar, Kavadiguda, New Bhoiguda, and Lalaguda), totally 18 industrial estates are established which are in the catchment areas of the various lakes that are potential sources of drinking water earlier. But now they are highly polluted by the untreated industrial effluents and sustain no life. Almost all the lakes are facing the pollution problem to mention few with major threat are: Kazipallicheruvu, Gandigudemcheruvu, Nagulalcheruvu, Kistareddypetcheruvu, Muktakantacheruvu, Aminpurcheruvu, Bollaramcheruvu, Saki cheruvu, Muthangicheruvu, Isnapurcheruvu, Chitkulcheruvu, Lakadaramcheruvu, Peddacheruvu, Yerdanurcheruvu, Gummadidala tank, Bonthapalli tank, Jinnaramcheruvu, Kalatelealcheruvu, and Digwalcheruvu etc. And the industrial estates that account for pollution are 1. Jeedimetla, 2.Balanagar, 3.ChandulalBardari, 4. Medchal, 5.Moulali, 6.Nacharam, 7.Cherlapalli, 8.Uppal, 9.Katedan, 10.Autonagar, and 11. GaganPahad industrial development area (Ramachandraiah, 2004).

Some of the major polluting industries in and around Hyderabad city include cement mills, sugar, thermal power plants, distilleries, fertilizers, oil refineries, caustic soda production, petrochemicals, zinc smelting, copper smelting, aluminium smelting, sulphuric acid, integrated iron and steel, pulp and paper, tanneries, pharmaceuticals, dye and dye intermediates and pesticides industries. In these, distilleries, textile, engineering and pulp and paper industries are added impetus effects on aquatic water bodies than others. Hyderabad city has many small-scale industries out of which many are highly polluting, and the wastewater generation from these small-scale industries also contributes to major pollution of aquatic systems. The discharge of effluents into aquatic ecosystem is a major environmental problem of concern and poses potential health hazards (Abbas Alkarkhi et al., 2008) and pollutes the surface water resulting in pollution of irrigation and drinking water. Although, the government of India's policy statement on abatement of pollution at source (GoI, 1992) is formulated but the strict enforcement is a point of concern. The use of polluted water for irrigation in many developing countries like China, Mexico, Peru, Egypt, Lebanon, Morocco, India and Vietnam, is reported earlier in a new review by Jiménez and Asano (2008)Butcertain toxic elements enter the human body mostly through food and water and to a lesser extent through inhalation of polluted air is an established fact. It has been found in many research articles that the polluted water from city used to cultivation is leading to accumulation of toxic chemicals thereby threaten the food chain.

Even though the government is making huge efforts to meet the demand of drinking water of the city, apart from vivid awareness among the public, the main emphasis should be on restoration, preservation, prevention and protection of water sources in the city with strict penalizationupon violation would bring a drastic change in the reclamation of the waters since only 1% of the water on earth is fresh water. Prohibition on industries to dump their untreated waste into surrounding lakes and bunds has to be very stringent. Certain measures, laws and policies will help to protect the existing water bodies and reduce stress on water availability and water demand-supply (ShikharKumar, 2011).

## III. FATE OF MAJOR WATER BODIES IN HYDERABAD

The pollution of water bodies has become a cause of serious concern throughout the world. The pollutants or chemicals are entering the ecosystem through geoaccumulation, bioaccumulation and biomagnification process. The discharge of domestic sewage and industrial effluents into the lakes lead to deposition of organic matter, nitrogen and phosphorous causing eutrophication. These effluents alter various physico-chemical parameters like colour, odour, alkalinity, chloride, hardness, total dissolved solids, total suspended solid, pH, electrical conductivity, biochemical oxygen demand (BOD), chemical oxygen demand (COD), dis-solved oxygen (DO) total dissolved solid (TDS), total suspended solid (TSS)

 

anions and trace element. Deposition of heavy metals like Fe, Mn, Cu, Cd, Pb, Ni and Co in the water samples of various rivers was reported earlier (NeetuMaliketal., 2013).Consequently, studies on the major river and lake ecosystems indicate that they are grossly polluted, especially beside the cities (Upadhyaya et al., 1982;). The lake sediment acts as both carrier and sink for contaminants including heavy metals in aquatic environment and their occurrence inwater bodies indicate the presence of natural and anthropogenic sources.

### 3.1.Aquatic ecosystems

Since last 5 decades the quality of the lakes/rivers has deterioratedeverywhere due to the exponential growth of humanpopulation and discharging of waste products into the aquatic bodies. Various factors like geology change in land usepattern, agricultural activity, industrialization and biologicalproductivity controlled the metal load in the river sediment.Pollution of many lakes due to domestic and industrial sources has been reported earlier (Joseph Clement Akan etal., 2012, NeetuMalik 2013).

### 3.1.1.River Musi

Hyderabad is founded on the bank of Musi River which is located on the Deccan Plateau in the State of Telangana. The river originates 60KM upstream of the city and joins with Krishna River 200 KM downstream. It was a source of drinking water to the city till early 20$^{th}$ century, but due to frequent floods of river water two dams were constructed in 1920 to meet the water supply of city. The untreated domestic as well as industrial waste water as runoff water, treated and untreated waste water from various STPS enter into the river. The Hyderabad city discharges about 600 million liters per day untreated sewerage water into Musi River. The pollution of surface water bodies in various regions in Hyderabad due to release of industrial effluent has been earlier identified (Subrahmanyam .K et al., 2001).This surface pollution of the water bodies also led to ground water pollution in the city at an alarming stage.The water from the Musi River is used by down stream for irrigation which can lead to bio accumulation of trace elements and thus effect the future generations.High levels of nitrogen in wastewater resulted in nitrate pollution of groundwater sources used for drinking, which lead to adverse health effects. Accumulation of heavy metals in soils and its uptake by plants is another risk associated with wastewater irrigation (Khouri et al.,1994). The ground water around Musi has also been reported to contain heavy metals(Wakode, 2014). The large incidence of diseases like arthritis, diarrheic, skin allergies, stomach pain, malaria, food poison, eye diseases, pediatric problems and jaundices diseases suffered by the people, impact on the live stock and cropping pattern in sample villages (Dr.PullaiahCheepi (2012).However recently the survey performed by Ensink et al., 2009 has shown that the river water quality dramatically improved from sewage water in city to irrigation water 40KM down stream of city due to placement of irrigation weirs on river which could be promising.

### 3.1.2.Hussain Sagar Lake

The Hussainsagar lake is one of the largest man made lake with5.7 sq.km water spread area and with 5.02 m. average depth.The lake has 270 sq.km catchment area is 1788 feet above the sea level nd is located at 17° 22’ of northern latitude and 78° 29’ of the eastern longitude. The lake was solely constructed to fulfill the water requirement of the city. Major runoff water enters the lake from 4 streams ie, kukatpally, Bowenpally& picket, Banjara&Balkapur. Out of the total 90-100MLD of effluent entering the lake, 70- 80 MLD of waste water enter from the kukatpallynalla. The Kukatpally catchment area has

 

Kukatpally, balanagar, sanathnagar and jeedimetlaindustrial areas.Out of 4 IDAs in kukatpally and dullapally watershed areas which underwent rapid industrialization & urbanization have got 3 IDAs along with 400 and odd industries which manufacture many products like chemical reagents, organics, pharmaceuticals, drugs, detergents, batteries, rubber products, food & beverages, milk products, dyes , tanneries cause severe pollution of Hussainsagar via various point and non-point sources.

The lake gradually became receptacle of sewage and industrial effluents from catchment area. Due to eutrophication, algal bloom and growth of water weeds and bad odour the water body became redundant for recreation.

The immersion of ganeshidols in the lake every year has made it worse. It was reported that the water quality of hussainsagar lake is deteriorated with many heavy metals concentration in elevated levels than the ICMR standards(M. Vikram Reddy, et al., 2012). It has also been reported that the kukatpallynallah carries the major quantity of pollutantswhich was determined by the sediment analysis at kukatpallynallah being heavily polluted by potentially toxic elements (PETs) (V.V.S. Gurunadha Rao, 2004). The sediment and pore water analysis has shown elevated concentration of Cr &Pb indicating settlement of various pollutants at bottom of lake(S. UmamaheswaraReddy, 2013). All lakes serve to recharge water table. But because of heavy pollution of Hussainsagar Lake many of pollutants get carried into underground water bodies. Though percolation filters many pollutants, open wells or bore wells receive certain pollutants causing ground water pollution. Elevated levels of certain chemicals like Hg, (Srikanth et al., 1993) Cd, Pb&Ni(R. Srikanth et al., 1993) have been reported around Hussain sagar lake.

The Hyderabad Urban Development Authority (HUDA) is making efforts to restore Hussain sagarLake in all respects.The project entitled “HussainsagarLake and catchment area improvement project” aims at improving lake water quality by preventing entry of pollutants into lake both point and non-point sources of pollution, besides removal of nutrient rich sediment. Interception and diversion of dry weatherflows, improvement of nallas in catchment area(Jayeshranjan and K. N. Reddy, 2007). Similarly many more projects are running today with aim of cleaning the lake.

### 3.1.3.HimayatSagarand Osman Sagar Lakes

Osman Sagar and HimayatSagar were constructed by damming the Musi River in 1920, to provide an additional source of drinking water for Hyderabad and to protect the city after the Great Musi Flood of 1908.The lake HimayatSagar is located in Hyderabad, at17°18’28”N latitude and 78°20’47”E.longitude with catchment area spread to 1340 sq km. While Osmansagar popularly known as Gandipet, is a reservoir in Hyderabad which lies between 17°23′N 78°18′E. Both reservoirs have a storage capacity of 4TMC. These two lakes had been serving drinking water for Hyderabad city. But, due to increase in population and demand for water has lead to pump water from other sources away from city as well.
A total of 84 villages fall within 10 km catchment area of Osmansagar and Himayatsagar in the mandals of Moinabad, Shamshabad, Shabad, Kothur, Rajendranar, Shankerpally and Chevella. The Himayatsagar spread over 500 sq. miles covers Pargi, Venkatapuram, Shamshabad and other areas. In the catchment area of the lakes upto 10km from full tank level (FTL), polluting industries, major hotels, residential colonies and other establishments are banned, but in residential use zone development is allowed subject to certain conditions (The times of India, 2014).However in the city of Hyderabad due to exponential population growth, industrialization, use of fertilizers in the agricultural and various anthropogenic activities the catchment areas are receiving pollutants which are entering the major drinking water sources himayatsagar lake and osmansagar lake, deteriorating the water quality (The Hindu, 2012).The authorities admit to pollution of the two lakes through sewage from the surrounding villages. The waste generated by the poultry farms and resorts and the pesticides used by farmers for cultivation all join the water body

 

during the rainy season (The Hindu,2012). Though Osman Sagar and HimayatSagar receive copious inflows, structures coming up in the catchment areas like farm houses, resorts, habitats are leading to contamination of the reservoirs as well as acting as stumbling blocks in free flow of water (The Hindu, 2012).

The quality of lake water depends upon its surrounding ecosystem and its components. Topography of the surrounding area, soil, geology and vegetation determines the kind of materials entering into lake which indicates the water quality (Dong et al., 2010). And also any structures which capture the runoff within a catchment reduce the volume of water reaching the water course due to reduced surface runoff (van Dijk et al, 2006). Further studies forecasting the streamflow by using advanced technological models i.e, SWAT has predicted that the average annual streamflows were reduced by 1.37 % due to increases in hydrological structures (Nune, R et al., 2011). It is clear that the trend in streamflow is due to anthropogenic changes, particularly increasing irrigation and groundwater extractions, as well as certain streamflow interceptions due to changes in landuse/landcover during last two decades in the HSC. Water usage in this catchment now exceeds total sustainable resource availability, which suggests water shortages will continue to increase into the future unless water management practices change (RajeshNune et al., 2012).However analytical assessments carried out to monitor the drinking water quality of HimayatSagar lake have shown that lake waters are slightly alkaline in nature and found that the physicochemical parameters of lake waters are within the acceptable limits for drinking purposes (BIS 10500: 2012) except TDS (*GhassanHadiKttafah et. al, 2015.*). However, water colour was slightly greenish with 40 Hazen units of max.value, average pH ranged between 8 to 8.5 indicating alkalinity and DO value varied between 3.2 mg/l and 8.0 mg/l with corresponding BOD values of 3.8 mg/l and 2.0 mg/l indicating contamination by high organic load into the lake (V. Hemasailaja and M.Anji Reddy, 2013).The Osmansagar catchment comprising Vikarabad, Shankerpally, Appajiguda, Mahajanpet, Chandangar, Khanapur, Janwada, Reddypally, Kollur. The catchment of Osman Sagar is also facing treat due to constructions, real estate boom and illegal contructions.The Osman Sagar catchment constitutes the upper part of the Musi sub-basin and the total geographical area of the catchment is spread to 736 $km^2$. This reservoir also has an important role in protecting Hyderabad city from flood during the monsoon period. Due to construction activities in the upstream and other anthropogenic activities has lead to soil erosion. Soil erosion poses land degradation issues upstream and increases sediment loads in downstream water bodies (Yang *et al*., 2003). Agricultural water management (AWM) practices, i.e, construction of percolation ponds, check dams and contour trenches etc using the catchment area of Osman Sagar aiming at the development of watershed has resulted in higher crop production and hence larger incomes. Moreover, lower flow intensities and sediment losses reduced by 30–50%, reducing the risk of flooding and sediment accumulation in the Osman Sagar drinking water reservoir. However, AWM interventions are predicted to result in reduced total water inflows to the Osman Sagar reservoir from 11% of the total annual rainfall (754 mm) recorded at present, to 8% if AWM interventions were implemented at large scale throughout the catchment (Kaushal K. Garg et al., 2013).And also according to sixth annual report, The Hyderabad Metropolitan Water Supply and Sewerage Board (HMWSSB, 1995) shows that capacity of the Osman Sagar reservoir was reduced by 12% of its total storage capacity between the years 1973 and 1988 because of sediment loading.The surface waters and ground water quality studies around Osmansagarlake are slightly hard to alkaline in nature. Where as all other parameters of water samples fall within the permissible levels as compared to WHO: 2006 drinking water standards except for few samples. Osmanasagar lake waters and ground waters in and around Osmansagar are well suitable for drinking and irrigation purpose exceptionally for few samples (*LaithHemed. et. al 2015).*Various constructions on first and second order streams under various government schemes during the last few years lead to decrease in base flow component, where as

 

significant reduction in surface run off of the streams draining into the lakes has been observed. Indiscriminate constructions have resulted in reduction of storage in the lakes. Comprehensive water-shed development programmes has to be planned without endangering existing water supply to urban areas in future (V. V. S. Gurunadha Rao et al., 2007). At the same time essentiality of regular monitoring of the surface and ground water quality may prevent contaminated water supply, proper suggestion of treatment techniques, suitable planning and management strategies and policies execution.(V.HemaSailaja et.al.,2013).

## IV. CONCLUSION

The review reveals that the pollution problem prevailing in the city water bodies is due to the rapid population and urbanization and industrialization without proper planning and improper law enforcement towards sustenance of the crucial life saving resource. So it is therefore recommended that the concern authorities must constantly scrutinize for the analysis of quality parameters seasonally and prevent point and non point source pollution around the water bodies and check for eutrophication.Ecological, hydrological and socio-economic aspects of the surrounding environ must be ethically and legally be executed by the people and the authorities to safe guard the aquatic sustainability. Advanced waste water treatment technologies should be implemented at the discharge points into the water bodies. Finally, it is suggested that, although many policies/ laws have been formulated the enforcement is incompetent so, necessary action must be taken by the concern bodies.

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