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ENVIRONMENTAL HEALTH HAZARDS DUE TO WASTE WATER FARMING IN BANGALORE CITY, INDIA**D. Rajasekaran**

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Abstract: *Bangalore is the capital of Karnataka and is the primate city of South India - one of the largest growing metropolitan regions of the world. With the Information Technology (IT) and Bio-Technology (BT) boom, Bangalore is one of the fastest growing cities in India and Asia. Bangalore serves as the global example of the potentials and problems facing mega-cities in the developing nations. Rapid urbanization, mindless development, erratic industrialization coupled with chemicals, poor sewage and solid waste management and heavy metal content in the water bodies has contaminated the water and land farming. Normally urbanized city face the environmental problems such as water quality, air and noise pollution, waste disposal and wastewater, loss of green cover, sewerage and sanitation, hazardous and e-waste disposal, traffic congestion etc., are only growing, thus seriously affecting the quality of life and the health of the people in Bangalore City. Bangalore's urban future is grave - because of heavy mineral/metals found in rivers and sewage water. The water in and around Bangalore are toxic in nature, mineral/metals found in water bodies are fluoride, zinc copper, lead, manganese, chromium, iron, nitrate and aluminum which are hazards to health. Along with the above mentioned problems, farming with toxic lakes and wastewater farming are poisoned veg. farms leads to health hazard in and around Bangalore City. The paper covers aspects like growth of city, polluted industrial effluent, untreated domestic sewage water and Toxic lakes, Life around the Lake, a trail of health hazards, Farming with wastewater, Customers unawareness, Fish kill, plastic-eating cows and various health hazards are analyzed and suggestions are dealt in it.*

Key words: Industrial Effluents, Domestic Sewage Water, Toxic Lakes, Water Contamination

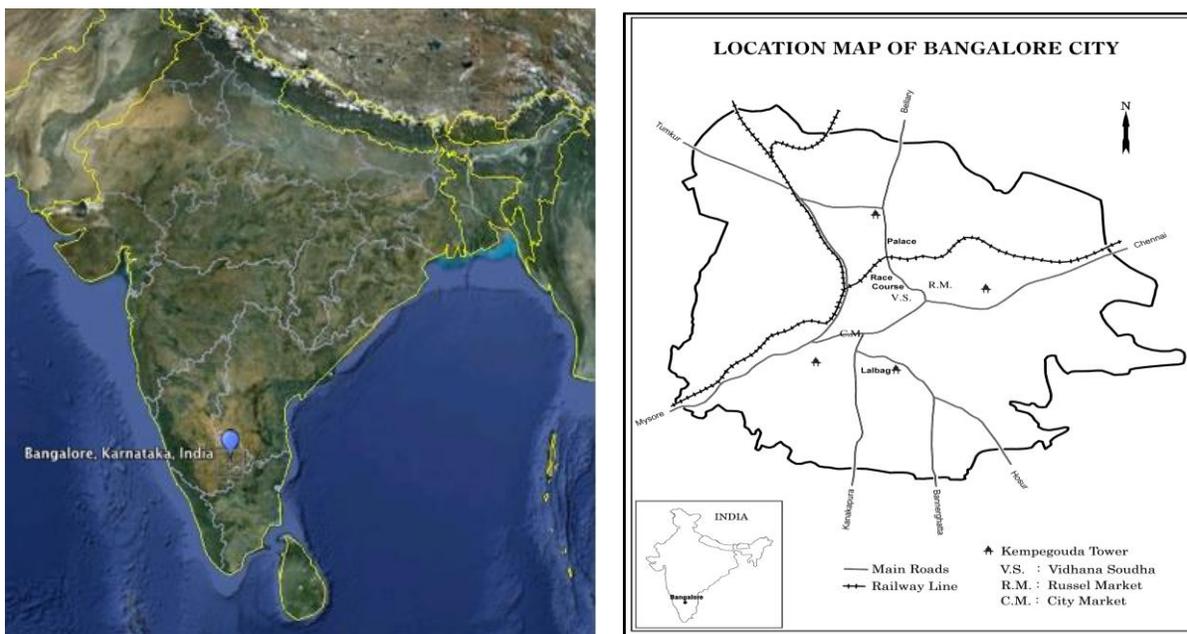
Introduction

Environmental issues are of utmost concern to the citizens those who are living in urban centers. Bangalore has the distinction of being the Silicon Valley of India as it is a hub for major IT and other hi-tech companies. The salubrious climate, quality education and livelihood opportunities, health care facilities etc., have favored and attracted people and investors from across the world. This has led to an unprecedented urban growth causing environmental threats. The environmental problems such as water quality, air and noise pollution, waste and wastewater disposal, loss of green cover, sewerage and sanitation, hazardous and e-waste disposal, traffic congestion etc., are only growing thus seriously affecting the quality of life and the health of the people. Along with the above mentioned environmental problems, farming with toxic lakes and wastewater are poisoned veg. farms leads to health hazard in and around Bangalore City. Polluted air and water might be Bangalore's bane, but vegetables grown on farms irrigated with contaminated water have given it a hazardous twist. Interactions with farmers, retailers and consumers indicate that a big chunk of vegetables arriving in markets across the City might show chemical contamination if tested. Most of

the vegetables are grown near in and around surrounding areas of Bangalore city are contaminated. The farmers grow greens, tomato, cabbage and other vegetables using water from a sewage treatment plant. Such vegetables could be as high as 75% of chemical content. “Today, everything from water to air to soil is contaminated. We are trying to washing fruits and vegetables with running water as many times as possible and boil them properly before consuming them. We cannot avoid consuming the vegetables with heavy metal contamination. Taking precautionary measures is the best available option.”

Study Area

Bangalore City is located in Bangalore District of south east of Karnataka State. It is located in the heart of the Deccan Plateau. The area lies between 12° 58^l to 13° 0^l North Latitude and 77° 37^l to 78° 18^l East Longitude and at an average elevation of 949 meters (3,113 feet) above mean sea level. It covers an area of about 2190 sq. kms. It has a maximum temperature of 33° C to lowest minimum of 14 ° C. Climatic conditions are March to May warmest, June to September rainy and December to January cold. It has a moderate and pleasant climate. Summers are mild and winters are cool. Bangalore is accessible by air, road, and rail.



Images & Map shows the Location of Bangalore in Karnataka, India

Objectives

The main objectives are as follows:

- Urban growth of Bangalore City.
- Industrial effluent and toxic lakes and wastewater contamination in Bangalore City.
- Chemicals, which makes water contamination in Bangalore.
- Veg. Farming with wastewater and its Health Hazards.
- Fish kill and plastic-eating cows.
- Adopt some of the precautionary measures to control it for future of the Bangalore City.

Methodology

In the present study of Environmental Health Hazard due to Toxic Lakes with Wastewater Farming Poisoned Veg. Farms in Bangalore City, data's are collected from secondary as well as primary sources like Bangalore District Census Hand Book, data from Bangalore Water Supply and Sewerage Board, Reports from Karnataka State Pollution Control Board (KSPCB), Bangalore, Karnataka Pollution Central Board (KPCB), Bangalore. And data of Bangalore Metropolitan Area (BMA) covered area has been collected and analyzed. As the study is qualitative in nature simple tables and suitable maps have been generated. Since Bangalore City is a dynamic metropolis there are a series of popular articles published in leading dailies from which information has been elicited.

Urban Growth of Bangalore City

The population of Bangalore city stands at 6.5 million in 2001 and 9.6 million as per 2011 census records, and continuing with this growth rate, the city's population is expected to reach around 11 and 22 million in 2021 and 2041 respectively. With the Information Technology (IT) boom, Bangalore is one of the fastest growing cities in India and Asia. With the emerging Bio-Technology (BT) boom, Bangalore's population growth may be even faster in the forth-coming decades. Bangalore is booming with other growth which is evident from its nicknames viz. "India's Silicon Valley", "Fashion Capital of India", "The Pub City of India", and so on. All these factors contribute to the growth of population of city. The table 1 below shows the growth trends.

Table 1: Population Growth of Bangalore City 1901-2011

Year	Area (in km2)	Population	Sex Ratio	Density	Decadal Variation in %
1901	NA	163,091	982	NA	--
1911	60.35	189,485	958	NA	8.47
1921	NA	240,054	931	NA	12.25
1931	NA	309,785	928	NA	22.79
1941	NA	410,967	922	NA	25.11
1951	NA	786,343	895	NA	69.77
1961	501.21	1,206,961	890	2,408	19.61
1971	177.30	1,664,208	886	9,386	46.55
1981	365.65	2,921,751	900	7,991	59.08
1991	445.91	4,130,288	903	9,263	38.44
2001	531.00	6,537,124	908	2,985	35.09
2011	800.00	9,588,910	908	4,378	46.68

Source: Census of India, District Census Handbook -2001 & 2011.

Toxic lakes, poisoned veg. farms in Bangalore City

Irrigated by sewage-fed lake water, vegetable farms on the city's out skirts are contaminating the food chain with chemicals hazardous to human health. There is no system in place to regulate this dangerous trend in markets across Bangalore. Fresh green vegetables were neatly decked up installs lined up to beckon the weekend customers. But before those greens reached the markets, farmers had to grow them with all the attendant problems. Did that complex process involve irrigation with highly polluted water sourced from the city's lakes and river streams; it is a tough, but heavily loaded question. Loaded, because repeated studies by city based universities and scientific institutions have clearly indicated heavy metal contamination in vegetables sold in big markets across Bangalore. Irrigated by sewage-fed lake water on agricultural land, contamination of the

greens has been proved beyond doubt. Analyzing samples of water, soil and crop plants, the tests have shown significant traces of zinc, copper, lead and cadmium in the greens that directly influence our food chain.

Heavy metal contamination in vegetables grown in Bellandur Lake Area

Twelve years ago, when the Bellandur Lake's pollution levels were high but not at today's alarming levels, a study had shown high heavy metal contamination in vegetables grown in the vicinity. The impact of the lake's polluted water on vegetation was found to be much more than soil. In its wide expanse of 397 hectares of the lake, under Kormangala-Challaghatta Valley, receives over 40% of the city's mostly untreated sewage water. Incessant flow of untreated sewage from multiple inlets, encroachment and wide-spread development has effectively killed vegetable farming in Bellandur Lake. Cultivation has gradually shifted to Varthur and Hoodi Lake beds on the downstream. But here it lays the big problem: Highly polluted water from Bellandur flows into the downstream lakes, contaminating the ground water as well. It is mostly this water that is being drilled out through bore wells by the farmers. As if this is not hazardous enough, the vegetables are also washed with the lake water before they are loaded onto distribution trucks. Their produce is supplied to vegetable markets in Marathahalli, KR Puram, Whitefield, HAL and other areas within a 20 km radius of Bangalore City. At the HAL market, for instance, supplies start at around 3 am. Enquiries reveal that most vegetables are sourced from farms in Hoodi, Kadugodi, Varthur and other areas.

Water Contamination and its Health Hazards

Chemical	Origin	Health Hazards
Nitrate	Discharge of untreated sewage into the ground	Causes infant methaemoglobinemia (Blue Babies); at very high concentration causes gastric cancer and adversely affects central nervous system and cardiovascular system
Fluoride	Fluoride rock in the ground gets dissolved in groundwater	Reduces dental caries; in very high concentration causes skeletal fluorosis.
Chromium	Present in industrial effluents discharged into natural drain without treating	May be carcinogenic causes rashes and skin eruption
Total Dissolved Solids	Leaching of soil contamination, discharge from industrial or sewage treatment plants	Palatability decreases and may cause gastrointestinal irritation in humans and have laxative transits.
Total Hardness	Hardness in water is mainly due to dissolved calcium and magnesium salts in the ground rock-water interaction	Affects water supply system (scaling), excessive soap consumption, calcification of arteries, may cause primary concretions, diseases of kidney or bladder and stomach disorder.

Life around the Bellandur Lake, a trail of health hazards

Bellandur Lake, the city's largest, has become a symbol for what ails Bangalore: Unplanned development and official apathy. The toxic foam and fires at the lake have become so commonplace that hardly any attention is paid to the woes of the local residents and commuters. However, the worsening condition of the lake has served to make life miserable for those who live

in its surroundings. Neighboring villages surrounding Bellandur Lake use the same water for irrigation and agriculture. Therefore the vegetables we eat are metal-laden and poisonous.



Apartments around Bellandur Lake in Bangalore

A high concentration of effluent in the lake water causes it to foam often, with the froth spilling out on to the streets and causing inconvenience to commuters. When exposed to the foam, the toxic chemicals make his eyes water and skin itch. "It is an unpleasant sight to encounter regularly. The residence who resides in an apartment close to the lake, the pollution is causing serious health problems. Even on an ordinary day, the stench from the lake is unbearable. Now, due to the fires, the toxic fumes are causing severe respiratory problems of asthmatic. The lake area has shrunk considerably due to encroachment. Unregulated and rampant dumping of garbage is slowly choking the lake. The vacant private plots along the lake boundary serve as perfect dumping sites. Many of them are not fenced and people unscrupulously dump alba (construction debris) and garbage in these plots in the night. Caretakers of the plots then set fire to the piles of garbage, instead of disposing it properly.

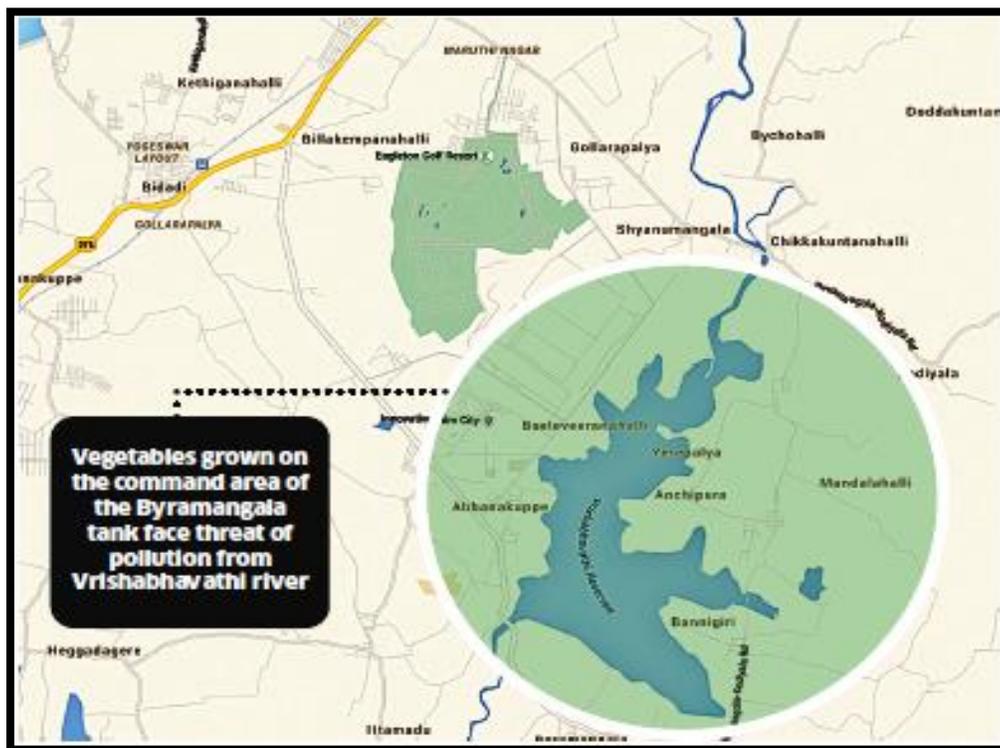
Fires in the lake area regular occurrence and have not subsided after the major one. They may spiral out of control and cause damage to life and property. What action are the authorities taking to control illegal dumping of garbage on the lake bed? The problem shunting Bellandur Lake is not new. It is no win the limelight after the issue has received a lot of publicity in the media. The fires would not harm anybody earlier. Now, with all the garbage and sewage being dumped into the lake, the plastic catches fire along with the grass, releasing toxic fumes. The problem is compounded by the untreated sewage let into the lake from localities nearby. Not only industrial effluents, but also partially treated sewage from homes enters the lake. The BWSSB regulations mandate apartment complexes with more than 20 flats to set up sewage treatment plants (STPs) on their premises. While many high-rise apartments have complied with the rules, and there are others who are yet to follow. The Bangalore Development Authority (BDA) has given permission to build many high rise buildings despite paucity of space for STPs. On the other hand the builders should ensure that they do not encroach the lake and its surroundings.

Health hazards on the rise in Bangalore City

The hazards linked to the pollution in Bellandur Lake are mounting. Studies also says spike in neurology-related cases such as epilepsy in the last four months. Pediatric consultant at a private clinic in Bellandur believes that the foam and froth raked up by the lake have had a felling effect on people living around the area. She says, "Parents have been bringing their children with complaints of respiratory diseases which they now believe are becoming prolonged and chronic. Parents feel the ailments are a result of the rising smog in the lakes." The allergies have had a domino effect on people in the area, most of whom are working parents who find it tough to attend to their kids when they fall ill. Many people are even ready to relocate so as to get some respite from the increasing problems of the area.

Vrishabhavathi the polluted River flowing in Bangalore City

Over the last three years, tests on water and soil samples collected from the area growing baby corn have shown accumulation of heavy metals - as Atree researcher informs. Heavily polluted with industrial effluents and untreated domestic sewage, the Vrishabhavathi River feeds this water directly into the Byramangala tank. Heavy metal contamination of water can be effectively tracked only with 24-hour sampling. For the study on Vrishabhavathi, the water was measured day and night. Heavy metal traces were found to peak during the night. This is a clear indication that industrial effluents are being discharged after dusk to hoodwink the agencies.



Vrishabhavathi River in Bangalore City

Baby corn cultivation has graduated to tomatoes and other vegetables in recent months. These greens make their way to the KR Market and Kalasipalyam outlets, eventually heading to other vegetable bazaars in the city interior.

Customers unaware of chemical contamination

Not many customers are aware of this supply chain, although most retailers feign ignorance about the irrigation methods for fear of losing clients. A customer, say she has been buying vegetables from the HAL market for nearly a decade. But he admits he had never asked where the greens

came from. In recent years, say there trailers; supplies from Varthur side have been declining as farms are being traded for real estate. Huge apartment blocks and malls have come upon once fertile lands. To compensate the shortfall, supplies often come from KR Market. Yet, that is not a safe bet. An ongoing study by the Ashoka Trust for Research in Ecology and the Environment (Atree) has already indicated contamination in vegetables grown in the command area of the Byramangala tank on the Vrushabhavathi River. The water quality monitoring is only a part of the mechanism to prevent health hazards of irrigation with sewage-fed water. Soil and plant quality are equally critical. The University study showed that the presence of cadmium in spinach (4 mgg-1) and radish (2.5 mg g-1) is way beyond the acceptable standards. Not many customers are aware of this supply chain, although most of the retailers are ignorance about the irrigation methods for fear of losing clients.

Farming with wastewater a health hazard in Bangalore City

Today, everything from water to air to soil is contaminated. Despite knowing the harmful effects of chemical contamination, they have no choice but to buy the fruits and vegetables from the markets. However, the President of Wholesale Vegetables and Fruits Traders Merchant Association does not agree. According to him, drainage water was earlier being used by vegetable growers in Kengeri, Gollahalli and Varthur. But now he says that most of the farmers have stopped vegetable farming there due to encroachment of lakes and rapid urbanization. Sellers and middlemen at Agricultural Produce Marketing Committee (APMC) Yard, Yeshwantpur admit that the quality of fruits and vegetables has come down because of bad water quality and pollution. Yet, there are many others who deny using dirty water to grow greens. A wholesale onion and potato merchant from APMC contends that most of his produce comes from Maharashtra and Chitradurga region. He says the farmers there depend on bore well (tube well) water and tap water to grow vegetables and not drainage.

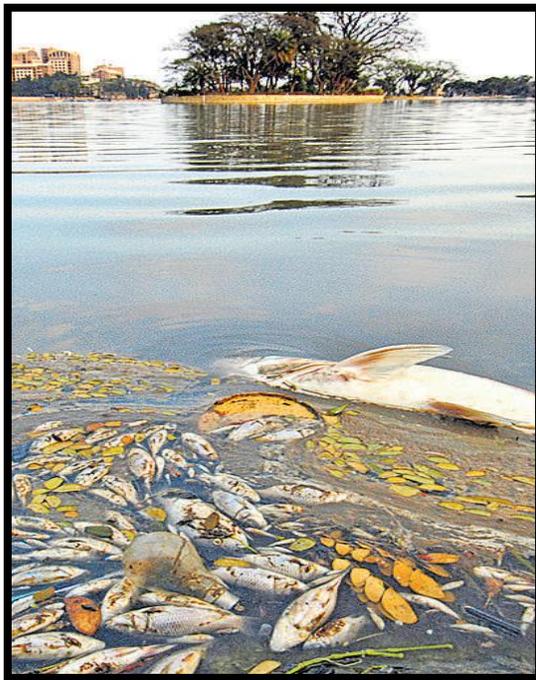
Hoskote-based farmer claims that he uses bore well water for vegetable farming. But there some of a few farmers using water from polluted lakes in his locality. Environmentalists suggest that reducing pollution at water source points and increasing awareness among public on the dangers of consuming food with high heavy metal Contamination could be helpful. But consumer's opinion say that they are harmful effects of chemical contamination, they have no choice but to buy the fruits and vegetables from the markets. One of the residents of Hennur says "Today, everything from water to air to soil is contaminated. I try washing fruits and vegetables with running water as many times as possible and boil them properly before consuming them. We cannot avoid consuming them. Taking precautionary measures is the best available option."

A resident of Bellandur and an active member of Kasa Muktha Bellandur, informs that BBMP had conducted a drive in her locality to seize plastics. The Palike personnel confiscated boxes filled with artificial coloring content from vegetable farmers. These were used to add color to peas. Parmar sees a way out in using organic vegetables. She explains, "The best way to avoid consumption of harmful produce is by buying organic produce. Though it is expensive, it is worth as it keeps me and my family healthy. Apart from sewage effluents inside the lake, garbage is also being burnt and dumped there. I see ashes floating a top Bellandur lake due to burning of waste." Malleswaram resident Sampath Kumar agrees that organic vegetables could be an option only if people can afford them. "Not everyone can buy organic stuff," he points out.

Fish kill and plastic-eating cows

Pollution enters the food chain in multiple ways. If untreated sewage in lakes and river streams contaminates the water that irrigates vegetable farms, poorly managed solid waste could be equally dangerous. Cattle feeding on plastic bags and frequent fish kill in the city lakes are tell-tale signs of an eco-system gone horribly wrong. Veterinarians are on record citing operations on cows that revealed upwards of 50kg of plastic bags in their stomachs. The more plastic in their stomach, the less food it consumes. This directly reduces the milk production. Scurrying for food in roadside garbage bins, the cows find it tough to tear the plastic bags. Eventually, the entire bag gets in.

Instances of fish kill, the death of native fish in thousands, are getting more frequent than before in the city lakes. This trend, last seen in Halasuru Lake, has serious consequences for the fish-eating public. From the Centre for Ecological Sciences, Indian Institute of Science attributes this to bioaccumulation, accumulation of chemicals in the algae. Fish eats the algae, transferring the toxic substances. Simply put, bioaccumulation occurs when an organism absorbs a - possibly toxic -substance at a rate faster than that at which the substance is lost by catabolism and excretion. "This happens when the fish feeds on the algae and zooplankton (organisms drifting in the water bodies).The trend is very worrying. It could lead to severe health complications". Fish farmers introduced the African cat fish in lakes galore since their survival rate is much better than the native fish. This has, however, complicated matters since the exotic variety even feed son the native fish.



Fish kill and plastic-eating cows

A study finding showed that fruits collected from KR Market and Yeshwantpur market had variable concentrations of pesticides. Heavy metal contamination in green leafy vegetables, especially Palak (pinches leaf) and Coriander. Green leafy vegetable samples were collected from the sampling stations– Byramangala and Bellandur are lead concentration was exceedingly high in Palak (28.43ppm to 149.50ppm) and coriander (54.69ppm to 75.50ppm). In coriander leaves, copper, zinc and manganese were found. Here the farmers were using water from polluted lakes

located at the stations. The pollution was due to the direct flow of effluents to lakes from industries and households.

Suggestion & Conclusion

- Reviving Bellandur Lake is clearly a complex task and requires both the government agencies and citizens to work together. Citizens' groups and volunteers could keep a tab on those who dump garbage or set fires and promptly alert the authorities. State should be more proactive and transparent in its rejuvenation effort.
- To made mandate to the apartment complexes with more than 20 flats to set up sewage treatment plants (STPs) on their premises.
- It is unfortunate that vegetables are grown using contaminated water from the lakes. Besides the chemicals in the pesticides, the farmers wash the vegetables with the same polluted water. This is double the poisoning. It is a dangerous practice that needs to be stopped.
- People should stress on hygienic conditions. Water treatment plants should be set up at various places and only the treated water should be used for vegetable farming. Organic vegetables should be promoted. Awareness should be created about the ill-effects of consuming farm products grown using contaminated water.
- The only way to be healthy is to consume organic produce as much as possible. Vegetables or fruits laced with chemicals should be avoided. There should be more awareness among the public about organic vegetables and how safe it is to consume them.
- Prefer vegetables from the departmental stores that are will do divulge information about the source of their produced.
- Prefer to get Vegetables are from Hopcoms, which are sources it from Lalbag and organic produce from stipulated farms either in Mysore or Ooty.
- Stringent quality tests -the message is clear: The Karnataka State Pollution Control Board (KSPCB) needs to change its water quality monitoring protocol. The testing should have more scientific and stringent on Vrishabhavathi and Byramangala tank.

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