IJCRT.ORG ISSN : 2320-2882

INTERNATIONAL JOURNAL OF CREATIVE RESEARCH THOUGHTS (IJCRT)

An International Open Access, Peer-reviewed, Refereed Journal

Innovative Approach Of Liquid Waste Management In Indore: A Review

[1]Ms. Shraddha Tomar, [2] Dr. Sanjay Verma

[1]M.Tech. Scholar, Environmental Management, [2]Professor, Department of Chemical Engineering
[1]Department of Chemical Engineering,
[1]Ujjain Engineering College, Ujjain (M.P.), India

Abstract: With a population of 2.96 million people spread over 276 sq. km, Indore generates about 367.8 MLD of wastewater daily. This includes wastewater generated from 5.77 lakh units comprised of residential, industrial, and commercial establishments, etc (IMC's DPR V-1, 2017). The different types of liquid waste generated include wastewater, fats, oil or grease, sewage sludge, hazardous household liquids, organic wastewater, inorganic wastewater, storm water, and other liquid waste. Handling wastewater was a challenge, and the wastewater found its way into the Kanh and Saraswati Rivers and at the end of Kshipra River, affecting water quality. There was a need for technological interventions to deal with the wastewater by treating the water, promoting its reuse, and releasing the treated water into rivers. It undertook INNOVATE processes for strengthening the technological aspects of treatment technologies.

Keywords: Indore Municipal Corporation (IMC), Sustainable Development Goal (SDG), Open Defecation Free (ODF), Urban Local Body (ULB), Sewerage Treatment Plant (STP), Effluent Treatment Plant (ETP).

Introduction

Insights from a century-old Indore plan – Patrick Geddes, a well-known urban planner from Edinburgh in the early twentieth century, focused his careful and compassionate attention on this city's center of a royal kingdom. Due to his Scottish anti-colonial heritage, he was a harsh opponent of the then-dominant English tendency to look down on local civic practices and blame things on native habits. The royal rulers of Indore, like many others around the world at the time, asked Geddes to assist in removing the plague and other diseases negative effects from the city in the early twentieth century. Authorities, as was their wont, mostly blamed it on the alleged bad habits of the residents, something Geddes strongly opposed—geddes' deep engagement with the civic consciousness of the city by recounting an unusual incident. To rally the entire city in response to the plague's dangers, he organized a massive carnival sequel procession during Diwali. According to reports, 6,000 truckloads of garbage were removed, and thousands of rats were trapped. Temple priests took the initiative to clean up their precincts. Geddes' 1918 plan for Indore (Geddes, 1918) seems so avant-garde and progressive even now because it was infused with his intense interest in the city's people and his strong conviction that a city's plan for the future can only emerge from an appreciation of its past.https://www.thehindu.com/society/history-and-culture/planning-without colonizing/article19474786.ece Adopting the strategy, the present Vision Document (Ganga and Indore Municipal Corporation, 2020) for River Kanh lays down the restoration needs and strategy for the river given its socio-cultural and ecological status – the current socioeconomic demands of both urban and rural areas, both historical and contemporary. It is a first step that takes cognizance of the physical, social, and management status of the Kanh River.

It is pertinent to mention here by the order of the Hon'ble National Green Tribunal, Central Zonal Bench Bhopal the Municipal Corporation had carried out various works related to the abatement of pollution and up-gradation of water quality of Kanh and Saraswati Rivers of Indore. For the same, a Proposed Action Plan for Rejuvenation of River Kanh was formulated by the ULB in 2017, as the works for pollution abatement were already underway. The plan talks of solid waste management practices, diversion of sewage outfalls, cleaning and dredging of rivers, bin-free city initiative, construction of STPs and ETPs, and various other regulatory measures like plantation along riverbanks, the ban on single-use plastic, and removal of encroachment along water bodies.

To further all efforts, a comprehensive strategy of the actions were taken to rejuvenate rivers Kanh and Saraswati by the Municipal Corporation.

I. LIQUID WASTE MANAGEMENT IN INDIA

Urban India faces the challenge of liquid waste management. About 72,368 million liters per day (MLD) of wastewater is generated in Urban India which finds its way into rivers, lakes, and groundwater aquifers. Wastewater affects river and marine life, pollutes soil, and has adverse effects on groundwater. It directly impacts the human health of those residing beside the polluted water bodies. It leads to diseases such as cholera, diarrhea, dysentery, hepatitis A, typhoid, and polio. Various occupational groups such as farmers, farm workers, and the residents beside the drains and rivers which are usually slum dwellers and poor consumers are affected by wastewater. Unless treated, unsafe disposal of wastewater could be problematic and counterproductive to human well-being. (NeetiAyog waste-water-ver2, 2022) Providing safe sanitation is thus a global and national development goal. Sanitation and clean water for all people are demands of Sustainable Development Goal (SDG) 6. By 2030, it aims to achieve access to adequate and equitable sanitation and hygiene for all end open defecation, particularly for women and girls, and improve water quality by reducing pollution, eliminating dumping, and minimizing the release of hazardous chemicals and materials, halving the proportion of untreated wastewater, and substantially increasing recycling and safe reuse. While India has effectively moved towards coverage of individual toilets, this has not been accompanied by further management of liquid waste. Though, 60 % of households, in cities with a population of more than one lakh (as per the 2011 Census), are targeted to be covered with sewerage facilities under AMRUT by 2022, still, as of now, only 40% are serviced with sewerage system and remaining 60% of the urban population is dependent on On-site Sanitation systems. Therefore, the Government of India as well as State Governments hitherto had been encouraging cities to prepare conventional sewage management plans comprising sewer networks and sewage treatment plants, on a whole city basis. This process although tested and robust is cost time and water-intensive.

To strengthen liquid waste management, the Government of India as well as State Governments hitherto had been encouraging cities to prepare conventional sewage management plans comprising sewer networks and sewage treatment plants, on a whole city basis. The various acts have provided a positive environment to undertake wastewater management. These include the Prevention and Control of Pollution Act of 1974, the Water Prevention and Control of Pollution Cess Act, of 1977, the Environment (Protection) Act, of 1986, the National Environmental Policy 2006, the National Urban Sanitation Policy 2008, Prohibition of Employment as Manual Scavengers and their Rehabilitation Act, National Policy on Faecal Sludge and Septage Management (FSSM).

SBM-U 2.0 envisions making all cities 'Garbage free' and ensuring grey and black water management in all cities, making all urban local bodies ODF+ thereby achieving the vision of safe sanitation in urban areas. Various protocols have been released from time to time for strengthening sanitation in urban areas. These include ones related to ODF in 2016, ODF+ and ODF++ in 2018, and Water + in 2019. Indore Municipal Corporation (IMC) has tried to follow the SBM protocols on SBM ODF, SBM ODF+, SBM ODF++, and SBM Water+. The focus is on promoting the use of individual household toilets, promoting connection with sewerage networks, promoting the treatment of sludge, and promoting the reuse of treated wastewater. Different institutions have been created to deal with urban wastewater such as pollution control boards at Central-State and District levels, public health and environment engineering organizations, water supply and sanitation boards, and urban local bodies.

II. THE CHALLENGE OF URBAN WASTEWATER

It is estimated that with a population of 1.38 billion people, India generated about 39,604 million Litres per Day (MLD) of wastewater in rural regions and about 72,368 MLD in urban areas during 2020-21. The installed capacity for treating wastewater is 31,841 MLD, the operational capacity is 26,869 MLD, and urban sewerage treated was 20,236 MLD. There is a large volume of untreated water. The untreated water finds its way into nearby rivers, lakes, and groundwater aquifers. With increasing urbanization, the volume of wastewater generation would only increase and with depletion of freshwater sources is only going to worsen the situation. (Neeti Ayog waste-water-ver2, 2022)

Wastewater affects river and marine life, pollutes soil, and has adverse effects on groundwater. It directly impacts the human health of those residing beside the polluted water bodies. Available evidence of wastewater indicates that it leads to health risks such as diarrhea, skin infection, parasitic infection, bacterial infection, and epilepsy. Community health risks also increase when one consumes contaminated fish, vegetables, and fruits from wastewater. Occupational groups who are exposed to wastewater include farm workers, their families, consumers, and the residents beside the drains and rivers which are usually slum dwellers and poor. According to the World Health Organization (WHO), exposure to poor sanitation is related to cholera, diarrhea, dysentery, hepatitis A, typhoid, and polio. Unless treated, unsafe disposal of wastewater could be problematic and counterproductive to human well-being. Wastewater has negative outcomes on the quality of soil and human health. Providing safe sanitation is also a global and national development goal.

There were some challenges witnessed in Indore. These were related to initial community resistance, the prevalence of untouched and unreached areas, social inclusion, and the need to address gaps in liquid waste management infrastructure.

Initial community resistance: There was initial resistance faced towards sharing costs when communities were asked to share the costs for closing pipes behind their residence and connecting them to the sewerage system. However, this was addressed through the involvement of IMC and the associated NGOs who convinced the people to share the costs as it was in the interest of long-term outcomes for the community. Similarly, when slum locations beside the river were planned to be rehabilitated to a different location, there was resistance from the community. However, this was later agreed upon and the community agreed to the same.

Unreached areas and groups: Some of the far-off locations in the city such as the rehabilitated locations can be improved further on the liquid waste management front.

Social inclusion: The social inclusion of sanitation workers has been achieved by ensuring them on the regular payroll of employment. However, this could be improved further through linkage with social security schemes concerning occupational safety and health hazards particularly for those involved as sewerage workers.

Liquid waste management infrastructure: Liquid waste management infrastructure could be improved further to comply with the City's rainfall patterns. Sometimes the lower side of the pipes results in flooding. There could be a separation of grey and black water.

III. AN OVERVIEW OF LIQUID WASTE MANAGEMENT IN INDORE

Before the initiation of interventions, Indore City faced the challenge of liquid waste management. It generated about 367.8 MLD of wastewater per day by households, commercial units, mixed units, urinals, and community toilet systems besides industries. It resulted in contamination of land and soil, contamination of surface water bodies due to untapped outfalls, contamination of underground water table and aquifer due to percolation of wastewater, and finally contamination of air due to foul odor. There were issues related to people's awareness and willingness of the community to connect with sewerage networks etc. Swachh Bharat – Urban provided the right policy direction to address the challenge of liquid waste management in the city.

The success of Indore was a success of techno-managerial and social intervention. The documentation is an attempt at capturing these three processes.

Social intervention process: - The EMPOWER process was adopted to achieve the desired results in liquid waste management. The six steps include Educating, Mobilizing, Preparing, Organizing, working in collaboration, Executing and Monitoring, Rule formation, and compliance. In undertaking the EMPOWER process through social interventions, NGOs played a key role. They not only educated communities, but mobilized them, prepared them through linking with sewerage networks, organized into Samiti's, worked in collaboration with communities, and supported in execution, monitoring, and creating norms through rule formation and compliance.

LIFE outcomes: - LIFE outcomes were achieved as a result of the intervention. The outcomes achieved included livelihood improvement, integrative social life, financial outcomes, fit livable conditions, and empowered communities.

Empowered communities: - The communities have become empowered to take care of their cleanliness. Through the residential welfare societies, nallah Samiti's, the communities monitor, oversee, and fine in case of deviant waste disposal behavior. In residential societies, as per the regulations, special treatment plants (STPs) have been set up to treat wastewater. These STPs make wastewater into usable water for gardening plants and reuse in toilets.

Technical intervention process

The INNOVATE process was adopted to strengthen technical interventions in the city. The INNOVATE steps include the following: -

- Identifying the routes of wastewater flow: - The flow of wastewater from the source (residential areas, commercial locations, industrial locations, schools, hospitals, etc.,) to the drains or rivers or through existing sewerage networks was identified.
- Networking the sources of origin of wastewater with sewerage flow: - In slums, along rivers, and next to drains, IMC found units or gates that were not securely connected to the sewerage system, allowing waste water to flow into rivers and drains.
- New infrastructure development for the treatment of wastewater (STPs and ETPs): - New infrastructure development in the form of STPs and ETPs was added to the existing ones (IMC's sewerage network plan, 2020). A sewerage treatment capacity of 412.5 MLD was created through 10 STPs and 1 common effluent treatment plant. This tapped 1,746 nos. major outfalls and 5,624 minor outfalls into Kanh/ Saraswati River and six nallahs.
- Observe the quality of water on a day-to-day basis: - The treated water to be released daily had to be monitored for its chemical composition before and after release. Its compliance with central pollution control board norms had to be monitored. A similar process is undertaken on a day-to-day basis. The various parameters that were to be captured included ones related to PH, COD, BOD, TSS, TKN, NH3-N, TP, etc.
- Vying to bridge the gap between requirement and installed capacity: - IMC went about to increase the installed treatment capacity to meet the city's requirements. While the wastewater generated in Indore is 367.8 MLD per day, the actual installed capacity is 412.5 per MLD. Hence the current infrastructure is sufficient to take care of the current capacities. Since urbanization and the growth of the population, wastewater generation is going to increase; new STPs are also being developed to address the growing treatment requirements. To deal with increased requirements additional STPs are being set up.
- Aligning with the standards of the latest technologies: - Sewerage treatment plants and effluent treatment plants were equipped with the newest and most advanced technologies. The technology that is used in STPs is UASB, AGBRR, and SBR-based. Most of the STPs are based on the SBR which is used in the technical concept of treatment technology in cyclic activated sludge process (C-Tech). The activated sludge process (ASP) is being used in common effluent treatment plants. Effluent treatment involves the process of removing solid, chemical, and organic substances from wastewater produced by industries as an outcome of the production process and recycling the water for industrial use to discharge it into the environment safely. The ETP involves process stages such as screening, coagulation and flocculation, clarifier, aeration, flirtation, and reverse osmosis.

- Technology for sewerage treatment in residential areas: - Micro STPs were installed in the residential locations so that wastewater generated at the source is reused by the households. About 80-85% of the wastewater is reused either as a flush for toilets or gardening plants. There are about 15 STP service providers in the city such as Eco Water Solutions, Vinaka Forbes, TATA, Wipro, etc.
- Educate the citizens on the importance of reusing treated water: - There is a continuous awareness created of the need for reusing treated water. A regular education process is undertaken, which has resulted in the uptake and reuse of treated water. The treated water is used in residential areas for flushing and watering plants, in zoos for gardening, and in agricultural farms for cultivating crops.

Managerial processes

The challenges of wastewater management in Indore were dilapidated sewage infrastructure, lack of monitoring and availability of civic facilities, and polluted water bodies. A three-stage management process was adopted. These included the planning stage, execution stage, and operations and maintenance stage.

- **Planning stage**: - The planning stage involved the assessment of primary lines, identification of decentralization infrastructure to be created, and planning for a gravity-based conveyance system which is more cost-intensive.
- **Execution stage**: - The execution stage involved repairing primary lines, laying new sewerage lines (Network covering 100% entities), segregation of sewage from storm water, segregation of industrial wastewater from sewage, sewerage connection to the last mile, removing encroachments through slum rehabilitation, Primary treatment by institutions and industries, riverfront development, reuse of treated water, and capacity building of the team for operating and cleaning the sewage lines, etc.
- **Operations and maintenance stage**: -The sewerage infrastructure requires scheduled maintenance and repair work to ensure its functionality. Sewerage lines are cleaned with adequate machinery whenever the complaint is registered by the residents via the helpline number or 311 applications within 24 hours to 7 days depending on the nature of maintenance work required. The overall maintenance work at the zone level is monitored by the drainage supervisor at the zone level through drainage daroga and drainage workers at the ward level with a strong grievance redressal and feedback mechanism.

IV. CONCLUSION

It can be concluded by saying there was an eight-step INNOVATE process for introducing wastewater treatment technologies in Indore city. These include Identifying the routes of wastewater flow, Networking with the sources of origin of wastewater with sewerage flow, New infrastructure development for the treatment of wastewater (STPs and ETPs), Observing the quality of water on a day-to-day basis, Vying to bridge the gap between requirement and installed capacity, Aligning with the standards of latest technologies, Technologies for sewerage treatment in residential areas and Educate the citizens on the importance of reusing treated water. Technical interventions strengthened the liquid waste infrastructure in the city and enabled it to achieve the cleanest city. Underwater Plus, the city has achieved 100% sanitation coverage, rejuvenated the river, treated and reused water, and a water reuse network has been laid.

REFERENCES

[1] How Effluent Treatment Plant (ETP) works? (daacoworks.com)
[2] SDG Target 6.2 | Sanitation and hygiene: By 2030, achieve access to adequate and equitable sanitation and hygiene for all and end open defecation, paying special attention to the needs of women and girls and those in vulnerable situations (who.int)
[3] https://scbp.niua.org/sites/default/files/MoHUA_Consultative_Document_for_Land%20_pplication. Pdf
[4] Urban Wastewater scenario in India, September 2022, NeetiAyogWaste-Water-ver2_18102022.pdf (niti.gov.in)
[5] c.tech process in municipal sewage treatment plant a case study (envirobiotechjournals.com)
[6] https://www.thehindu.com/society/history-and-culture/planning-without colonising/article19474786.ece
[7] Detailed Project Report on Indore Sewerage System - Vol.-1, Indore Municipal Corporation, Indore, Madhya Pradesh
[8] Sewer network plan and FSSM Plan, Indore Municipal Corporation, Indore, Madhya Pradesh.
[9] City Development Plan (CDP), Indore Municipal Corporation, Indore, Madhya Pradesh.

[10] 07_Vision-Indore_English Version_February-2020.pdf (3dcaddrawing.com)
[11] Manual on Sewerage and Sewage Treatment Systems - 2013:Central Public Health and Environmental Engineering Organisation (CPHEEO), Govt of India
[12] Manual on Storm Water Drainage Systems - 2019:Central Public Health and Environmental Engineering Organisation (CPHEEO), Govt of India
[13] Central and State schemes such as Swachh Bharat Mission, JnNURM, Simhastha, AMRUT and SMARTCITY etc.
[14] Prevention and Control of Pollution Act 1974 which led to the setting up of Central and State Pollution Control Boards (CPCBs and SPCBs)
[15] The Water Prevention and Control of Pollution Cess Act, 1977 which tried to encourage treatment of wastewater in industries
[16] The Environment (Protection) Act, 1986 which promoted 'Polluter pays principle'
[17] The National Environmental policy 2006 which calls for reusing wastewater prior to disposal and calling for technologies for treating, repurposing, and recycling urban wastewater prior to final discharge into water bodies
[18] National Urban Sanitation Policy 2008 calls for recycling and reusing while focusing on hygienic and secure disposal of human waste
[19] Prohibition of Employment as Manual Scavengers and their Rehabilitation Act sought to eradicate unhygienic latrines manually and rehabilitate manual scavengers into alternative jobs
[20] National Policy on Faecal Sludge and Septage Management (FSSM), 2017 which emphasizes focus on integrated urban sanitation, safe faecal waste disposal and strict environmental discharge restrictions.
[21] Standard operating procedure (SOP) for cleaning Sewers and Septic Tanks,2018
[22] Advisory on Emergency Response Sanitation Unit (ERSU), 2019
[23] Advisory on on-site and off-site Sewage Management practices, 2020
[24] SBM protocols on SBM ODF, SBM ODF+, SBM ODF++, SBM Water+