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Fold scope As a Tool for Microbial Investigation of Community Pond Water

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ABSTRACT:

The present study has been conducted on four different ponds in the campus of Modern College, Imphal. The campus is characterized by high biodiversity, water ways, vast plains, wetland and characteristic swamps. The Fold scope microbial investigation found more microorganisms in the water sample nearer to the local drain surrounding the campus. The study revealed that the ponds were contaminated with potential pathogenic microorganisms by unplanned drainage system and the water is unsuitable for consumption and domestic use, unless treated properly. This paper focuses on the overall situation of the drainage system, environmental impact and health hazard of urban people by unplanned drainage system of Imphal city.

KEYWORDS: Fold scope, Pond, Microorganism, Environmental impact, Drainage system.

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INTRODUCTION:

The Fold scope is an origami based optical microscope that can be assembled from a flat sheet of paper and lens. The fold scope was invented by Manu Prakash at Stanford University for viewing the microscopic world around us and use as a significant microscopy tools for medical and other scientific research^{1,2}. Merging principles of optical design with origami enables high volume of fabrication of microscopes from 2D media¹. The Fold scope has micro-lens with capability of 140X magnification and 1.9 microns resolution, would be useful for viewing and video recording microscopic data with a smart phone in bright field, dark field and oblique phase illumination^{3,4}. Virtual image formed via direct observation with the eye and real image formed via projection of the fold scope. Fold scope brings hands on microscopy to new place. Fold scope can be used in three different modes with similar performance such as eye view, coupled to any smart phone and projection microscopy with external flash light¹. Fold scope is a disposable microscope where the entire microscope can be incinerated which may benefit in the application of highly infectious diseases.

Water is important for living organism and essential to life. People used water for drinking and other domestic purposes in local communities. Water is obtained from natural sources such as rivers, lakes, ponds and wells. Quality of the water supplied is important in determining the health of an individual and the whole communities. Good quality of water is prerequisite for the survival of living organisms. It is needed to check the quality of drinking water at regular interval of time as the prolonged use of contaminated drinking water leads the human population to suffer from various water borne diseases⁵. An adequate, safe and accessible water supply must be available to all human population. Safe water quality is a major concern with reference to public health and well being of the human population⁶. Improving access to safe drinking-water can result in significant benefits to health. Every effort should be made to achieve a drinking water quality as safe as possible.

Pollution of water is due to the discharge of effluent, remnant of hospital, sewage, garbage, insoluble solid particle and industrial waste. The major components of municipal solid waste comprises includes vegetables waste, food waste, clothes, metals, animal dung and stagnant water^{7,8}. These solid wastes filled and blocked the drainage. Sewage contains organic compounds which act as food for bacteria in ponds, lakes and rivers water thus increase the population of bacteria. These bacteria oxidize nitrogen and phosphorus present in organic compounds of the sewage to nitrates and phosphates. This oxidation process consumes a large quantity of oxygen gas dissolved in water which causes the death fish and other aquatic animals⁹.

The greatest microbial risks are associated with ingestion of water that is contaminated with human or animal faeces. Wastewater discharges in fresh waters is the major source of

faecal microorganisms, including pathogens^{10,11,12,13,14}. Acute microbial diarrheal diseases are a major public health problem in every community. People affected by diarrheal diseases are those with the lowest financial resources and poorest hygienic facilities. Biological contamination of drinking water supply combined with scanty quantity has been a major cause of most of the ill health¹⁵.

The role of a pond is manifold and makes an absolute contribution to daily life of all communities. Presently, ponds are used mainly for domestic, irrigation water supply, fish production and ritual activities. The rapid urbanization, massive increase in population and shrinkage of wetlands cause reduction in the number of pre-existing ponds¹⁶. Mismanagement and negligence on the treatment of domestic solid waste further deteriorate the quality of pond water.

DESCRIPTION OF THE STUDIED AREA:

Imphal is the capital of Manipur bounded by Myanmar in the East, Assam in the west, Nagaland in the North, Mizoram in the South. Imphal lies between 24.82°N latitude 93.95°E longitude in extreme north eastern India and located at an altitude of 786 meters above sea level¹⁷. It has a humid subtropical climate to temperate climate with mild, dry winters, hot monsoon season and their temperature varies from 0° to 40°C. The drainage pattern is from north to south. Manipur River is the main drainage, which ultimately flows to the south towards Myanmar and falls into Chindwin River¹⁸. The present microbial study of different pond water was from the Modern College campus. The modern college is situated at Porompat, Imphal East district of Manipur close to the District Police Head Quarter, Deputy Commissioner Complex and Jawaharlal Nehru Institute of Medical Science (JNIMS) hospitals.

MATERIALS AND METHODS:

The study was conducted in campus of Modern College, Imphal. The campus region is characterized by high biodiversity, water ways, vast plains, wetland and characteristic swamp. Four ponds from the campus were selected for the investigation purposes. Fresh water samples were collected from four ponds of different site of campus. The four ponds were designated as pond A, pond B, pond C and pond D respectively. Water samples were collected once monthly for four months covering both rainy (July and August. 2018) and dry (November and December. 2018) seasons, aseptically from the surface to about depth of 10-15cm by using sterile plastic bottles. A fold scope was used to observe all samples in the field. The fold scope was synced to a smartphone to photograph and videos recorded for all samples. The fold scope was focusing the water sample by pulling and pushing on the focusing tabs. Taking a picture with the water sample was more difficult due to the unsteady movement of the organism in the field and taking videos were easier to

check the water sample and made it allowed to focus the sample. The videos as well as pictures were taken from such four different ponds of the water sample. All the sample pond A, pond B, pond C and pond D were observed a wide variety of microorganism including pathogens but the difference was the microbial quantity present in the water sample.

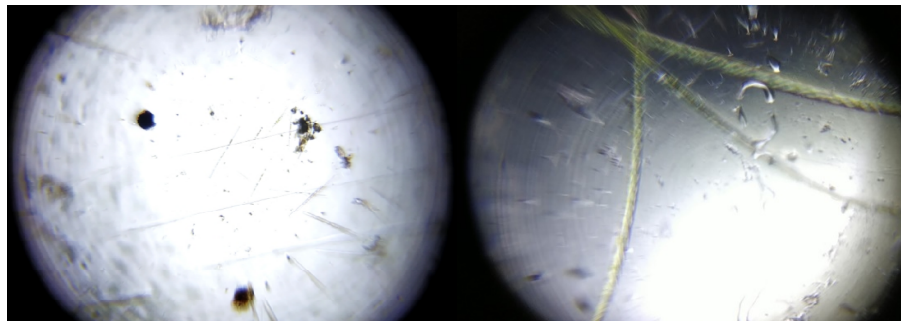


Fig: Observation of water sample through foldscope.

RESULTS AND DISCUSSION:

The Fold scope microbial observation was found to be more microorganisms in the water sample of pond B. Pond B water sample is nearer to the local drain surrounded to the college campus. The people of the community disposed their waste into low-lying lands, road sides, drains or local drains or channels. At present, some people in Imphal areas collect solid wastes from households and hospitals which are disposed it indiscriminately into local drains. Clinical wastes carry pathogens, sharp and toxic substance endangering the lives of the dwellers. Discharges of effluent, clinical wastes, sewage, garbage, solid particles and industrial waste made the water polluted. Sewage is the dirty which contains human and animal excretion (urine and faeces) that disposed to the drains and pond by the local people made harmful and hazardous. This is produced everyday by human activities like bathing, washing of clothes, excreting urine and faeces. Solid waste comprises all the waste arising from human and animal activities. Reckless disposal of human and animal wastes contributes to surface water pollution leading to the spread of water borne diseases. Waste collection are becoming insufficient and ineffective, causing major portion of the generated waste to remain uncollected and disposed off locally. The solid waste dumps at Imphal area is unregulated and unsanitary, resulting in adverse impact like degradation of water quality, attraction of diseases carrying insects and rodents and overall degradation of the environment. Water are polluted as it is mix with solid waste, clinical waste, silt, contaminants, domestic waste water and other human activities, which contaminated ground water as well as the receiving water bodies.

Biological contamination of water was occurred due to the flooded over the campus in the rainy season. The campus of the Modern College, Imphal is low lying area and characterized by

wetland and swampy. The ponds located in the college campus are contaminated from the local drain. These ponds were used for domestic purposes by local community but when the shortages of safe drinking water many people used the available surface water for drinking. These ponds water were polluted and highly microbial ricks.

The development of infrastructures cannot cope with the faster rate of population. Urbanisation is on the rise. While over-congestion is on the rise, drainage system remains fairly outdated and is unorganized. During rainy season most of the latrines both sanitary and non-sanitary are over flooded contaminating pond water with biological agents. Unplanned urbanization of Imphal area is one the complex problems. Many streets have narrow lanes and roads. So there is no easy accessibility for the waste collectors. Dwellers of these congested areas disposed off their wastes into local drains, low-lying lands and ponds.

As the growth of urban population taking place at an exceptionally rapid rate, the city is unable to cope with changing situations due to their internal resource constraints and management limitations. In recent years, Imphal City is facing extensive drainage problems during the monsoon as a common and regular problem like water pollution, traffic congestion, air and noise pollution, solid waste disposal etc. This paper focuses on the overall situation of the drainage system, environmental impact and health hazard of urban people by unplanned drainage system of Imphal city. Inadequate drainage sections, conventional drainage system with low capacity and gravity, natural siltation, absence of inlets and outlets, lack of proper maintenance are the prime causes of blockage in drainage system. Management of drainage system of Imphal area is presently a challenge for the urban authorities. Therefore, a close coordination among urban authorities and agencies and collaboration between public and private sectors is needed for effective management and sustainable operation of urban drainage system. Rapid population growth and its growing demand for housing in Imphal area are encouraging the real estate business and private developers to grab and encroach of wetlands, low lands, water bodies and natural drainage system for housing, roads and commercial activities. Due to such activities, the natural drainage pattern and flood retention areas are destructed and creating the unprecedented water logging. Therefore, the concerned authorities need to take appropriate measures immediately to overcome the situation.

In urban areas, the most adverse impact of water logging created by drainage blockage is incidents and prevalence of various diseases. In poorly drained areas, urban runoff mixes with sewage from overflowing latrines and sewers, causing pollution and a wide range of problems associated with waterborne diseases. Sometimes, the poor people had to rely on surface or shallow groundwater sources that are polluted, as they don't have access to portable water during the period of monsoon. Poor drainage of rainwater leads to the creation of breeding sites for disease vectors.

Solid waste blocks the drainage system and creates flooding in the streets resulting. Due to inadequate drainage facilities, storm water cannot convey properly, as a result water logging is created in low-laying and flood prone areas.

CONCLUSION:

The paper discusses about the overall situation of drainage system of Imphal city and how adverse effect is created to the pond water by unplanned drainage system. Planning, design, operation and maintenance of urban drainage systems is a challenge for urban authorities because of unplanned development activities, and the effectiveness of storm water management systems can be directly linked to the efficacy of urban management. Imphal city is the populated area in Manipur so it is important to create a planned city. For this reason proper drainage system should be established and proper management should be provided. This paper will be helpful for showing possible ways for finding the best solution.

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