Research Paper

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An Investigation into the Drinking Water Problems in Kuttanad

Engineering

KEYWORDS : Kuttanad, remedial measures, solid waste, water pollution

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ABSTRACT

KUTTANAD in the district of Alappuzha of Kerala State in India is well known for its picturesque vast paddy fields and its geographical peculiarities. It is the region with the lowest altitude in India and one of the few places in the world where farming is carried out below sea level. The backwaters in Kuttanad get polluted due to the effects of 'Thanneermukkom Bund', improper solid waste disposal and other human activities. It causes various ill effects like colour, pH, acidity, turbidity, BOD, Iron etc. and results in depletion of oxygen in water. It creates other health hazards and decreases fisheries resources. This paper is a study about the water pollution at Kuttanad, analyzing its reason and suggesting remedial measures.

INTRODUCTION

Water covers almost three-quarters of the planet, and upon which all life depends and water sources have been the centres of life, providing habitat and sustenance for animals and plants alike. Clean water access is a basic human right. Kuttanad in Kerala is the region with the lowest altitude in India, with almost 500 square kilometres of the region below sea level. Its elevation ranges from 0.6 m above to 2.2 meters below sea level. Most of the area is covered with water throughout the year. It is one of the few places in the world where farming is carried out below sea level. Four major rivers Pampa, Meenachil, Achankovil and Manimala flow into Kuttanad. Most aggravating among the region's problems is the severe degradation of the aquatic environment mainly caused by human intervention leading to the depletion of fisheries resources and health hazards posed to the population. At the same time, other sources of fresh water are unreliable for drinking: ground water is acidic due to the soil conditions and iron leaching; fresh water from public tap is infrequent; and water supply from private vendors is extremely expensive.

In Kuttanad 'Kainakary Village' located at the lowest tip of Kuttanad taluk is one of the most affected areas and it is selected as the region for the study. The amount of waste deposition in this region is more because River Pamba joins Vembanad Lake at this point. When compared to the other villages in Kuttanad, public water supply is scarce, and insufficient to meet the need of its population. Since the agricultural activities are also more in Kainakary it has made the rivers toxic by the presence of pesticides. The number of medical cases reported including epidemic break outs and cancers are highest in Kainakary. A recent study conducted by Alappuzha medical college proved that 27% of deaths reported during 2005 -2009 in Kainakary were due to cancer.

This paper is a study about the water pollution at Kuttanad analysing the reasons and suggesting the remedial measures.

2. CAUSES OF POLLUTION

2.1 ACIDIC NATURE OF SOIL

It is found that the soil in the Kainakary region is acidic in nature. So the ground water is also acidic, which makes it unfit for drinking purpose. Thus the well water is also not reliable and ground water recharging is not possible in such soils.

2.2 EFFECT OF PESTICIDES AND FERTILIZERS

Kuttanad, known as the rice bowl of Kerala where paddy is cultivated in a large scale. About 2400 hectares of paddy is cultivated in two seasons. According to the reports from the Department of Agriculture Kerala, about 1750 hectares of land are cultivated in additional crop season and 1658 hectares in puncha season.

The chemical pesticides and fertilizers cause a serious threat to the environmental balance in Kainakary region. During the process of dewatering after harvesting of paddy, these chemical contaminants are washed away into the river Pampa. Recent studies by Rice research centre, Mancombu shows that only 30% of the total chemical fertilizers is absorbed by the rice plants. The rest of the chemicals which are retained in the soil itself cause an increase in the contaminant concentration in the dewatered water.

2.3 SOLID WASTE CARRIED BY THE RIVER

The river Pampa carries all the waste materials from Sabarimala and all other places in its course. Since Kainakary is the lowest tip of the river, all the contaminants carried by the river get accumulated here. The solid waste concentration increases during Sabarimala season.

2.4 WASTES FROM HOUSE BOATS

Hundreds of house boats are now in service in Kuttanad. Among these only few have onboard sewage treatment facilities or a bio-plant for the treatment of organic wastes. Sullage from kitchen and bathrooms and the oil and grease from engine causes severe contamination of the water.

2.5 IMPROPER SANITATION SYSTEM

There is a lack of properly designed sanitation system in Kuttanad. The number of household having proper sanitation facilities in this region is very few. This leads to the pollution of the water streams present in the area. Stagnation of water bodies is also another cause for the poor sanitary conditions in the region. This is mainly caused due to building up of new roads and land formations. The ground water level in this region is also high, facilitating easy interaction of the waste waters with the ground waters, thereby polluting the ground water. Such intrusions of waste waters into the river cause high bacteriological content resulting in high E-coli content in water. Therefore the improper sanitation system along with the stagnant waters and high ground water level has become a major source of pollution of water in the region, thereby making acute drinking water shortage even though it is in the midst of water bodies.

2.6 EFFECT OF THANNEERMUKKOM BUND

Thanneermukkom Bund was constructed so that seawater will not be allowed to come inside Kuttanad during summer, so that the farmers can cultivate an extra cycle per year. Even though the bund has improved the quality of life of the farmers, the bund is alleged to have caused severe environmental problems. The bund has caused deterioration of the catch of fish in the region. The bund has also disrupted the harmony of the sea with the backwaters and has caused problems not foreseen before the bund like the omnipresence of the water weeds like water hyacinth. Earlier the salt water tends to cleanse the backwaters but this does not happen anymore leading to the pollution of the backwaters and the entire land nearby.

3. WATER QUALITY ANALYSIS

To ascertain the treatment required for the water in the region samples were collected from Kainakary Main River, Pallithodu, and Poothodu. The sampling was done during the period De-

cember 2011 – January 2012. Samples were collected from center portion of river at a depth of about 40-50 cm below the surface in order to avoid impurities. They were tested for the following parameters such as turbidity, pH, Colour, total dissolved solids, total hardness, coliform, E-coli, Iron and BOD. The test results for different parameters form three regions along with their permissible limits are given in table 3.1.

Table 3.1 Water quality analysis

Sl. No.	Parameter	Pallithodu	Kainakiri main river	Poothodu	Permissible limits
1	Turbidity	1.8	0.7	6.2	5 NTU
2	Color	Colorless	Very faint yellow	Colorless	Colorless
3	Ph	6.7	6.8	6.5	6.5 - 8.5
4	T.D.S	110	56	120	500 mg/l
5	Total hardness	36	39	24	300 mg/l
6	Iron	0.1	0.35	0.3	0.3 mg/l
7	B.O.D	8	2	1	5 ppm
8	E - coli	15	Absent	10	0

Besides to these parameters the level of fluoride and pesticides are also high according to the reports of various central government organizations

4. CONTAMINANTS AND THEIR TREATMENT MEASURES REQUIRED

Based on the water quality analysis the treatment measures required are given in table 4.1

Table 4.1 Contaminants and their treatment measures

CONTAMINANTS	TREATMENT MEASURES
Color	Coagulation followed by filtration Chlorination Ozonation Treatment by activated carbon Use of CuSO4 Removal of iron and manganese
Ph	Treatment with lime.
Turbidity	Coagulation with filtration
Iron	Aeration Filtration
BOD	Sedimentation with coagulation filtration
Coli forms & E-coli	Disinfection Continuous chlorination Ultraviolet radiation Distillation
Fluorides	Nalgonda technique Reverse osmosis Ion exchange method
Pesticides	Ozonation, Nanofiltration

5. REMEDIAL MEASURES

5.1 PROMOTING THE USE OF ORGANIC MANURES

The ill-effects due to the excessive use of chemical fertilizers can be overcome by the use of organic manures. Farmers tend to use chemical fertilizers for higher productivity, but organic manures also gives good yield. The risk of biomagnifications is also eliminated. Commonly used organic manures are Bone meal (3.5% N2 & 21% P 2O5), Fish meal (3.5%N2) and poultry manure (1.2-1.5% N2, 1.4-1.8% P2O5 & 0.8-0.9% K2O). The only disadvantage of organic farming is that higher dosage is required so as to supply the required nutrients. But this is economical and beneficial than the chemical fertilizers. Government should provide subsidies for the organic manures and should also make people aware of its importance.

5.2 INTEGRATED PEST MANAGEMENT

IPM is not a single pest control method but, rather, a series of pest management evaluations, decisions and controls. In practicing IPM, growers who are aware of the potential for pest infestation follow a four-tiered approach. The four steps include:

Set Action Thresholds-Before taking any pest control action, IPM first sets an action threshold, a point at which pest populations or environmental conditions indicate that pest control action must be taken. Sighting a single pest does not always mean control is needed. The level at which pests will either become an economic threat is critical to guide future pest control decisions

Monitor and Identify Pests-Not all insects, weeds, and other living organisms require control. Many organisms are innocuous, and some are even beneficial. IPM programs work to monitor for pests and identify them accurately, so that appropriate control decisions can be made in conjunction with action thresholds. This monitoring and identification removes the possibility that pesticides will be used when they are not really needed or that the wrong kind of pesticide will be used.

Prevention-As a first line of pest control, IPM programs work to manage the crop, lawn, or indoor space to prevent pests from becoming a threat. In an agricultural crop, this may mean using cultural methods, such as rotating between different crops, selecting pest-resistant varieties, and planting pest-free rootstock. These control methods can be very effective and cost-efficient and present little to no risk to people or the environment.

Control-Once monitoring, identification, and action thresholds indicate that pest control is required, and preventive methods are no longer effective or available, IPM programs then evaluate the proper control method both for effectiveness and risk. Effective, less risky pest controls are chosen first, including highly targeted chemicals, such as pheromones to disrupt pest mating, or mechanical control, such as trapping or weeding. If further monitoring, identifications and action thresholds indicate that less risky controls are not working, then additional pest control methods would be employed, such as targeted spraying of pesticides. Broadcast spraying of non-specific pesticides is a last resort.

Stem baller and trycograma are the most common pests in rice cultivation. Jaggery traps, pheromone traps and light traps can be used effectively for these pests. Need based pesticide application in localized points is another control measure.

5.3 BIO TANKS FOR HOUSE BOATS

Bio tanks are treatment units in the house boats for the conversion of complex organic matters to stable harmless compounds, which can be safely disposed off. An oil separator can also be provided, which consist of a double chamber for the separation of oil from water. Strict laws should be enforced regarding the provision of license to the boat owners.

5.4 RAINWATER HARVESTING

In this method water treatment plants of smaller capacity can be built. In this plant only filtration takes place, which is not sufficient for the contaminated water and a large scale plant is highly uneconomical.

5.5 OPENING OF THANEERMUKKOM BUND

Thanneermukkom bund may be opened on an experimental basis, to counteract the effect of saline intrusion on the paddy fields and salt resistant paddy varieties may be developed. This reduces the concentration of contamination to a great extent.

6. CONCLUSION

Alappuzha backwaters one of the tourist attractions of Kerala is now extremely contaminated due to the effects of Thanneermukkom Bund, Improper solid waste disposal and other human activities. The causes of pollution are studied in detail and the possible remedial measures are also suggested.

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Among the villages in Kuttanad, Kainakary is found to be the most affected. Thus the water analysis is done on the water samples obtained from Kainakary.

The pH, Iron, Colour, Turbidity, BOD, Fluoride, Pesticides, etc. are found to exceed the permissible limits. Out of numerous treatment measures for the parameters, a Water treatment plant with Screening, Aeration, Sedimentation, Filtration, Nano filtration (for drinking water) and Disinfection are the effective solution for this problem. The Nano filtration plant can assure safe drinking water since it is an effective treatment for the removal of pescticides.

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