Characterization of Wastewater of a Covid-19 Dedicated Hospital (SARI-ITC), Teknaf, Cox's Bazar And It's Impact on Ecosystem

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ABSTRACT

Hospitals produce a huge quantity of wastewater every day. Activated sludge process is generally used for treatment of hospital wastewater in Bangladesh. Wastewater effluent from the hospitals has been gradually increasing during the recent years due to developments in medical services and products in Bangladesh. This study aimed to assess the COVID-19 dedicated hospital called Severe Acute Respiratory Infection -isolation and treatment center (SARI-ITC), Teknaf, Cox's bazar, wastewater treatment practices, targeted to identify the flaws of existing waste management, and figure out the ecosystemic impacts. Wastewater samples were collected from three different places. Raw wastewater sample collected from the settler tank of the treatment plant (ABR). Treated wastewater sample was collected from the holding tank of ABR, and Disposal wastewater sample was collected from the disposal pond and has been sent to the laboratory for determining the physical and chemical parameters. The questionnaire survey was conducted at the local community level. The survey questions were mainly concerned with the Environmental impacts on natural resources and public health issues, as well as on the nearby community. After the lab test on the disposal area sample pH is within acceptable limits. Other parameters, such as Turbidity, BOD, COD, EC, DO, TDS, and Fecal Coliform, of wastewater samples from the SARI-ITC disposal area were not within the acceptable limits. The overall Environmental Impact Value indicates a negative result (-) 67, which clearly if the environmental degradation by wastewater disposal from SARI-ITC. A well-organized treatment plant should be designed, and an Effective Environmental Management Plan should be introduced for minimizing the pollution on local environment.

Keywords: Wastewater; Hospital; Covid-19; Environment; Pollution

INTRODUCTION

All medical and non-medical activities in hospitals, including emergency services, operations, laboratories, radiology, diagnostics, laundry, and kitchens, generate wastewater. If not managed properly, this wastewater poses significant environmental and public health risks. Hospital effluents typically contain microorganisms, heavy metals, pharmaceuticals, detergents, disinfectants, and toxic chemicals that can threaten ecological balance and human health [1]. Untreated infectious and pathological wastes may trigger outbreaks of communicable diseases. The World Health Organization (WHO, 2018) has reported that about 85% of hospital wastes are non-hazardous, 10% are infectious, and 5% are hazardous but non-infectious [2]

Hospital wastewater often carries pathogenic microorganisms, antibiotic-resistant bacteria, and pharmaceutically active compounds that persist through treatment plants, causing biological imbalances in the environment [3-4]. Although hospital effluents are sometimes considered like municipal wastewater, their unique composition—including hazardous chemicals, pathogens, and pharmaceuticals—makes them more dangerous [5]. In Bangladesh, many health facilities, especially in rural areas such as Teknaf Upazila, lack adequate sewage treatment systems. Activated sludge processes are the most common treatment methods worldwide, used in about 78% of hospitals, but they face challenges due to the inhibitory effects of toxic substances on microbial populations, leading to reduced efficiency and difficulties in meeting discharge standards [6].

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The Teknaf SARI-ITC, which was located in Teknaf Upazila for forcibly displaced Myanmar nationals, received a high volume of patients from both camps and surrounding communities. This results in increased wastewater generation with significant variations in quantity and quality. The hospital discharges effluents into a nearby pond, which connects to canals, causing irrigation water shortages, declining fisheries, and surface water pollution. physico-chemical analyses show that water quality is deteriorating, posing growing risks to human health. Although an effluent treatment plant exists, it fails to meet discharge standards.

Globally and locally, studies have highlighted the hazards of untreated hospital wastewater [7], showing that pharmaceutical residues from hospitals enter aquatic ecosystems, threatening biodiversity. The study emphasized the occurrence of pharmaceutically active compounds, resistant microorganisms, and SARS-CoV-2 RNA in hospital effluents, underscoring their role in disease transmission [8]. Research on related polluting industries provides further evidence and documented severe environmental degradation from the ship-breaking industry in Sitakunda [9], with water quality parameters exceeding permissible limits and an overall environmental impact value of –93. Similarly, one of the research projects reported negative environmental effects from the Boga Bridge project in Patuakhali, though they noted that mitigation measures such as reforestation, dredging, and safe water provision could reduce impacts [10]. Another study reinforces that without proper treatment, hospital wastewater contributes to the spread of resistant pathogens, pollution of natural water bodies, and long-term ecological harm [11].

METHODS

Collection of wastewater samples

To assess the liquid effluents, samples were collected using a purposive convenience sampling method from the discharge points. Water samples were collected from three different locations: raw wastewater was collected from the settler tank of the treatment plant (ABR), treated wastewater from the holding tank of the ABR, and disposal wastewater from the disposal pond (Figure 1). Samples were transported to the laboratory as soon as possible for experimental analysis. To prevent contamination and changes in the parameters, all samples were collected in airtight plastic bottles and carried in an insulated box. The bottles were carefully cleaned before use and properly labeled. Adequate precautions were taken during sample collection and handling, including the use of protective apparel, gloves, and safety glasses. All samples were delivered to the laboratory within three hours of collection and preserved in refrigerators. Samples were tested within 24 hours of collection to ensure accuracy and reliability of the results.

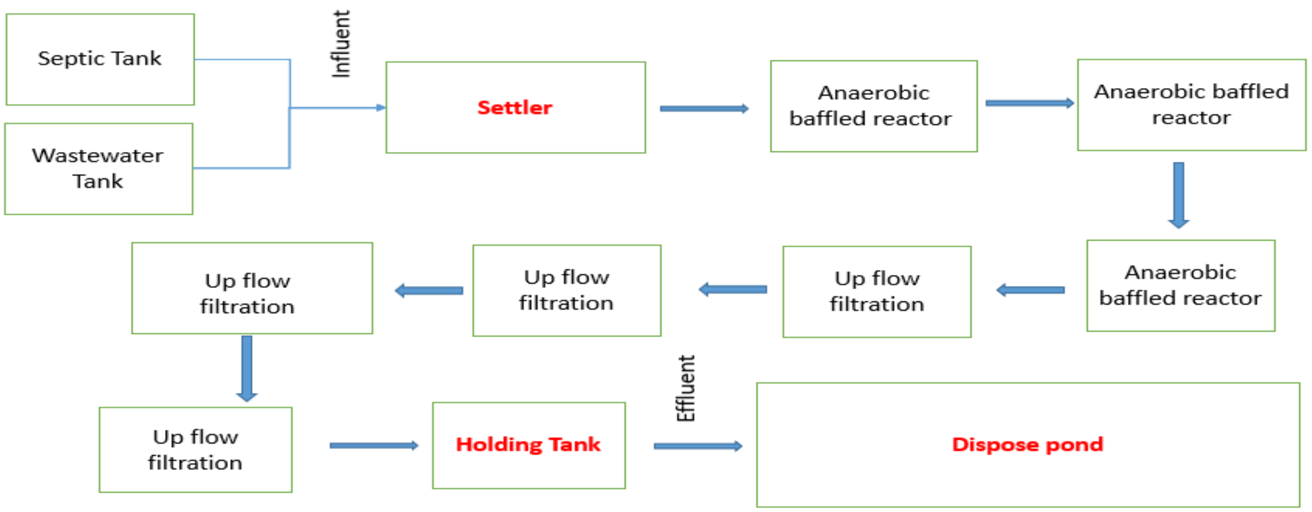

Figure 1: Wastewater treatment plant at the facility.

Determination of turbidity

The turbidity was measured by using Apera portable turbidity meter (Model LLC-A1481 TN400). The test kit comes with 4 vials of high-molecular polymer turbidity standard solutions (0.02 NTU, 20.0 NTU, 100 NTU, 800 NTU), an EPA approved primary standard for calibration of turbidity sensors that is safe, non-toxic and disposable. First it needs to calibrate the device from the vials then taken the reading of the wastewater samples.

Determination of dissolved oxygen (DO)

Dissolve oxygen was measured using Portable dissolve oxygen meter (Hanna Instrument HI19146). Before using, I made sure that the instrument is calibrated, and the protective cap is being removed. After immersing the tip of the probe in the sample to be examined I waited for approximately one minute for the reading to stabilize. I found out that the Dissolved Oxygen value (in ppm) is shown on the primary LCD and the temperature on the secondary LCD. We know that for accurate Dissolved Oxygen measurements, a water movement of 0.3 m/s is required. This is to confirm that the oxygen-depleted membrane surface is constantly restocked. A moving stream will provide adequate circulation.

Determination of pH and electric conductivity

The conductivity of water is a measure of the capability of water to pass electrical flow, and the acidic or alkaline condition of the water is expressed by pH. The pH and electric conductivity of the water sample were determined by using a HACH portable Multi-parameter Meter (Model HQ40d). First, needs to calibrate with different solutions, then take the reading of wastewater samples.

Determination of total dissolved solids (TDS)

The conductivity of water is a measure of the capability of water to pass electrical flow, and the acidic or alkaline condition of the water is expressed by pH. The pH and electric conductivity of the water sample were determined by using a HACH portable Multi-parameter Meter (Model HQ40d). First, needs to calibrate with different solutions, then take the reading of wastewater samples.

Determination of biochemical oxygen demand (BOD)

One of the most important characteristics of wastewater is the amount of oxygen required to stabilize it, known as biochemical oxygen demand (BOD). BOD represents the quantity of oxygen needed by bacteria to break down organic contaminants in the wastewater. In this study, BOD was measured using the Manometric Method [12], which requires five days of incubation at 20°C. The unit of measurement is mg/L. The procedure followed was as follows: an estimated range of BOD was first determined. A 250 mL wastewater sample was placed into an amber bottle containing a magnetic stirrer to ensure agitation during measurement. BOD nutrients were added using a HACH BOD nutrient buffer pillow. Sodium hydroxide (NaOH) was placed in the manometric cap to absorb carbon dioxide produced during microbial activity. The manometric cap was then securely fitted onto the bottle, and the system was reset. The bottle was placed in a magnetic tray inside an incubator maintained at 20°C for five days. After incubation, the oxygen consumption was read from the manometric cap and multiplied by a factor obtained from the reference chart [13] to calculate the BOD.

Determination of chemical oxygen demand (COD)

Chemical oxygen demand (COD) represents the amount of dissolved oxygen required to oxidize chemical organic materials, such as petroleum, in water. COD is commonly used to assess the short-term impact of wastewater effluents on the oxygen levels of receiving water bodies. In this study, COD was determined using the Dichromate Mercury-Free Method with a spectrophotometer (Hanna Instruments: MR Reagent Vial-HI93754E, COD Reactor-HI839800, Spectrophotometer-HI801) following the procedure described in [14]. The procedure involved three main steps: sample and blank preparation, digestion, and measurement. A medium-range COD vial (0–1500 mg/L) was selected for each test. Samples were shaken thoroughly before collection. Two milliliters of the wastewater sample were transferred to the reagent vial, and two milliliters of deionized water were used for the blank. Both vials were placed in the COD reactor and digested at 150°C for two hours. After cooling for 20 minutes, the spectrophotometer was powered on, and the factory method for COD MR Mercury-Free (option 13) was selected. The blank vial was first inserted to calibrate the device to zero, followed by the sample vial to obtain the COD reading.

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Determination of fecal coliform

Fecal coliform bacteria indicate sewage pollution and the potential presence of pathogens in water. Elevated levels may reflect failures in treatment or contamination, increasing the risk of waterborne gastroenteritis. Fecal coliforms were measured using the membrane filtration method with Oxfam-DelAgua water testing kits [15]. Petri dishes were prepared with culture pads using forceps. Ten milliliters of the water sample were filtered through a sterile membrane, which was then placed onto the pad. The dishes were left for 30 minutes and incubated at the recommended temperature for 16–18 hours. Culture media was prepared by dissolving 38.1 g of membrane lauryl sulfate powder in 500 mL of clean water and distributing 50 mL into each of 10 bottles for use in the tests.

Determination of environmental impact value

The environmental impact of wastewater disposal from SARI-ITC was assessed through site visits, observation of environmental, occupational, and cultural conditions, collection and analysis of water samples from disposal canals and surrounding areas, and interviews with residents, farmers, and other stakeholders. Key environmental parameters affected by the wastewater were identified, and the Environmental Impact Value (EIV) was quantified using the Environmental Evaluation System (EES) [16] and in the Environmental and Social Management Framework (ESMF) for the Western Economic Corridor & Regional Enhancement Program (WeCARE) [17].

In this method, the reference level was defined as the background environmental condition, and positive or negative changes in environmental parameters caused by wastewater were evaluated using the equation:

$$EIV=\sum_{i=1}^{n}(V_i \times W_i)$$

Where:

- V_i represents the relative change in the value of environmental quality for parameter iii compared to the present situation. It reflects the magnitude of variation in the environmental parameter.
- W_i denotes the relative importance or weight of parameter iii, indicating its significance within the project context.
- N is the total number of environmental parameters considered.

Changes in environmental parameters were scored as 0 for no change, –1 to –5 for very low to severe negative impacts, and +1 to +5 for very low to very high positive impacts. The relative importance of each parameter was rated on a scale of 1 to 5, depending on its significance in the project setting. Parameters were multiplied by their respective weights to calculate individual impacts, and the total EIV was obtained by summing these values.

Data analysis

Data were entered and analyzed in an Excel spreadsheet. One table for each question was made. Tables and figures are presented in the latter part with results. As the survey design did not involve extensive statistical analysis, data collection and analysis were mostly done by using a Microsoft Excel spreadsheet. During the interpretation of information in addition to the graphics, the statements and comments provided through the questionnaire by the respondents were used.

RESULTS

Physico-chemical parameters of water samples

Physico-chemical parameters of water samples that were collected from the holding tank, settler, and disposal pond of the wastewater treatment plant are presented in Table 1.

Table 1: Physicochemical Parameters of Water Sample Collected from Treatment Plant.

Parameters	**Before treatment value**		**After treatment value**		**Dispose area value**			**Standard value (as per ECR,1997) [18]**
	Sample 1	Sample 2	Sample 1	Sample 2	Sample 1	Sample 2	Sample 3	
Turbidity (NTU)	12.95	12.95	10.30	10.30	9.10	9.15	8.80	5
BOD (mg/l)	290	290	200	200	180	178	177	150
COD (mg/l)	775	775	331	331	320	320	310	200
EC (µs/cm)	804	804	820	820	829	829	810	400
DO (mg/l)	2.54	2.45	3.05	3.06	3.75	3.77	3.50	6.5-8
pH	8.74	8.74	8.13	8.13	7.23	7.23	7.20	6.5-8.5
TDS (mg/l)	3945	3952	3580	3585	2480	2485	2480	< 2100
Fecal coli (CFU/100ml)	3171	3100	2790	2750	2100	2150	2100	1000

Questionnaire survey status for environmental impact assessment

The Preliminary Perception Survey was administered at local level. The local level survey was carried out by me. The survey questions were mainly concerned with the Environmental impacts on natural resources and public health issues as well as on nearby community from the disposal wastewater of SARI-ITC, Teknaf, Cox's Bazar. The questionnaire has been set up on Ecological Impact, Physio-chemical impact, and Human interests. Distribution of the 100 survey participants indicated almost 4:1 ratio between men and women with 79% men and 21% women. As the survey design did not involve extensive statistical analysis, Data compilation and analysis was mostly done by using a Microsoft Excel spreadsheet. During the interpretation of information in addition to the graphics, the statements and comments provided through the questionnaire by the respondents were used. Environmental Impact Value of Wastewater disposal of SARI-ITC is described in the table. The beneficial and adverse changes in environmental parameters resulting from the establishment of SARI-ITC are expressed in qualitative terms plotted in a scale of +5 to -5 to quantifying the environmental alteration.

Participants gender

The survey was conducted between both male and female group. As mentioned earlier, the ratio of participants' age is almost 4:1, with 79 male and 21 female. This gender diversity has been kept in mind in every single identification from this survey including age, education, marital status, occupation, monthly income, number of family members, purpose of using canal water etc.

Participants age

Among the 100 participants who volunteered in the survey, there were 4 different categories based on their ages. We have categorized every group within the range of 10 to 12 years. For example, 18 to 30 years old participants were grouped together, which has 46 people in total. 35 people were from age group of 31 to 40. Next age group was 41 to 50 years, 13 participants belong to this group. 6 people were aged more than 50 years.

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Participants marital status

One of the key results that came out from the survey is the marital status of the participants. We asked the participants to tick the best suitable one from the 4 options we gave (single, married. separated and widowed) through the questionnaire, it was identified that 6 of the total participants were widowed, among which 4 were female and 2 were male. Surprisingly, none of the participants were separated from their partners. All of them were either married or widowed or single. 71 people from those who volunteered are married and 23 of total sample are single.

Participants occupation

Among the 100 participants, there were also 4 different categories for occupations including Business, Farmer, Job Holder and other. As the target location is not that much poor or rich and is quite self-sufficient in nature, the result was not surprising at all. Most of the people (75) of the surveyed area are working as farmers, 14 people are working as entrepreneurs and they run their own business. Rest 11 people were engaged in jobs.

Participants education level

From 100 samples, it was found that very few were educated and proceed further to HSC. Maximum of them have primary or above level education. It was identified that 29 of them have no education at all. 43 people have education till primary level. 28 people has completed SSC among which only 12 have completed HSC and went further.

Participants monthly income

This was obvious that the monthly income of the participants who took part in the survey will not be much high. Less than 10% earn twenty thousand or more in Bangladeshi currency. Only 9 people fell on this income group. 27 people earns 10000 to 20000 in a month. 23 participants income monthly income is in between 5 thousand to 10 thousand. Maximum of the participants (41) either do not income or income equal or less than 5 thousand.

Participants family member

Number of family members impacts any project's impact on that area. Because the cost of living and earnings are dependent on number of family members. from our survey, I got to know that most of the participants (62) has 6 to 10 family members. 27 participants have 3 to 5 family members, and 2 participants have 0 to 2 family members. Among all the participants, 9 people have 10 or more number of family numbers.

Participants living in the area since

From the survey, the participants were categorized into 4 groups based on the duration they are living in that place. It was identified among all participants, 79 were born in here and rest 21 participants came to this place in different times. 5 people are living here since last 10 years and 6 are living from 10 to 20 years, rest are living here for more than 20 years.

Purpose of using canal water

The survey indicates that 83 percent of the participants use canal water for irrigation. 14 from total participants use the water for washing clothes and only 3 use them for cooking. It was identified that none of them use this canal water for drinking.

Checklists of environmental impact assessment

While conducting the Environmental impacts assessment, the present environmental setting of the project area, and nature and extent of the proposed activities were considered carefully. Possible impacts on various environmental elements because of different project activities during operation and preservation stages have

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identified and prioritized through collaboration matrix. It has been identified that the project activities will trigger out both positive and negative impacts. In accordance with their spatial context, magnitude, stability and durability, the impacts have prioritized as high, medium and low both for positive and negative impacts. High and medium positive and negative impacts have considered as potentially significant (Table 2).

Table 2: Checklist of environmental impact assessment of the facility wastewater.

Impacts on the Environment											
Parameters	Positive Impacts					Negative Impacts					No Impact
	Very Low	Low	Moderate	High	Very High	Very Low	Low	Moderate	High	Very High	
Fisheries						√					
Forests											√
Wetlands							√				
Agriculture land									√		
Surface water									√		
Irrigation sources									√		
Health Hazard								√			
Water logging							√				
Vectors Increasing						√					
Job opportunity increase			√								

Assessment of environmental impact value

The Environmental Impact Value of the wastewater treatment plant of SARI-ITC, Teknaf, Cox's Bazar is described in Table 3. The adverse and beneficial changes in environmental parameters resulting from the formation of SARI-ITC are expressed in qualitative terms outlined in a scale of +5 to -5 to quantify the environmental modification. From the checklist analysis as shown in the Table, it was discovered that Fisheries and Forests have a very high Negative impact, which was measured as -5. Forests have no positive or negative impact on the environment, quantified as 0. In the physico-chemical parameters, water pollution has a very high negative impact, and flooding has a very low negative impact. Employment opportunity, which is a human-interest related factor, has a high positive degree of impact with the value of +5 (Table 3).

Table 3: Checklist of environmental impact value

Environmental Parameters	**Relative Importance Value**	**Degree Of Impact**	**Relative Impact**		**EIV**
			(+)	**(-)**	
Fisheries	3	-1		-3	

ISSN No. 2321-2705 | DOI: 10.51244/IJRSI |Volume XII Issue VIII August 2025

Forests	2	0		0	
Wetlands	3	-2		-6	-45
Agriculture land	4	-4		-16	
Surface water	5	-4		-20	
Irrigation sources	5	-4		-20	
Health Hazard	4	-3		-12	-37
Water logging	2	-2		-4	
Vectors Increasing	1	-1		-1	
Job opportunity increase	5	+3	+15		+15

Total Environmental Value: EIV = $\sum_{i=1}^{n}$ Vi Wi

= (-45 -37 +15)

= (-) 67

Environmental Impact Assessment is necessary to decide on the establishment of SARI-ITC like hospitals and their wastewater management system. Based on Environmental Evaluation System (EES) in the study Environmental Impact Value (EIV) is calculated, which describes the positive and negative effects on environment. EIV is an important small scale but very efficient evaluation process for the evaluation of environmental alteration. The parameters related for SARI-ITC wastewater were given various values based on prevailing environmental interests in Bangladesh. The values indicating importance or weight of the parameters can be used to calculate the relative impacts of the parameters, which are then summed up to find the total EIV of the hospital. The total EIV is found -67 which denotes mostly the negative impact on environment. Total EIV of parameter points out about degradation of ecosystem in regard to forest, tree plantation, wildlife, wetland etc. that have specific negative impact by wastewater management system. Only the Human-interest parameter has little positive impact, which is significant for the economic growth. Total EIV of Human-interest parameter was +15 which suggests the employment growth. This positive impact points out about the opportunity of founding this industry with consideration of economic viewpoint.

DISCUSSION

From the physico -chemical parameters of water sample, Turbidity of the water sample from the wastewater treatment plant varied repeatedly. The Turbidity values ranged from 8.80 to 09.90 NTU, which is not in the limit range (5 NTU). The Turbidity of wastewater sample gathered from outside of the treatment plant, like disposal pond area ranged from 8.80 FTU to 9.15 FTU, which was also not within the acceptable limit as described by DOE (1997). The BOD range of wastewater treatment plant area quite high. Before treatment, the range is around 290 mg/l and after treatment, also the result is not in satisfactory level. The most importantly when the disposed wastewater dumped into the dispose pond the range is around 180 mg/l, which is clearly not within acceptable limits (150 mg/l as described by DOE (1997). The COD range of wastewater treatment plant area also quite high. Before treatment, the range is around 775 mg/l and after treatment, the result is not in satisfactory level, which is 331 mg/l. The most importantly when the disposed wastewater dumped into the dispose pond. The range is around 310 mg/l to 320 mg/l, which is clearly not within acceptable limits (200 mg/l) as described by DOE (1997). The Electrical conductivity of wastewater treatment plant was examined and the value 804 µs/cm. In all sampling point of Vattier area EC was too high and went across the limit. Value of EC which are found in after treatment 820 µs/cm and 810 µs/cm was in disposal pond. The Standard EC limit for wastewater purpose is 400 µs/cm (DOE, Bangladesh, 1997) and calculated values were not within this limit. The standard limit of DO in wastewater for Bangladesh is 6.5-8 mg/L (DOE Bangladesh,1997) and within the treatment area the water sample shows the highest value of 2.54 mg/l in pretreatment stage and after the treatment the values little bit increased, which is 3.05 mg/l to 3.06 mg/. After treatment the range of DO is increased in a little which is 3.50 mg/l to 3.77 mg/l which is not within acceptable limit. The Standard limit of pH determined by DOE Bangladesh is 6.5-8.5. pH is almost similar in diverse sampling areas and differs slightly. The result ranges in pretreatment stages are 8.74. Present study showed that after the treatment of the results decrease a little, which is 8.13 and it's in acceptable limits. In the disposing pond area, the limits decrease significantly in 7.20 to 7.23 which is within acceptable limits. Both in pretreatment and after treatment samples, a higher amount of TDS was discovered due to the presence of various physical contaminants. For Bangladesh the Standard level of TDS for wastewater and inland surface water is 2,100 mg/l and 1,000 mg/l respectively (DOE, Bangladesh, 1997). In the current study the TDS values ranged from 3945 to 3952 mg/l in pretreatment stage. After the treatment the results is not in satisfactory level, which is range between 3580 to 3585 mg/l and the disposal area site the range is between 2480 to 2485 mg/l which is not in acceptable limits.

The Fecal coliform unit of wastewater treatment plant was examined and the value between 3100 to 3171 (CFU/100ml). In all testing point of Vattier area, fecal coliform was very high and traversed the limit. Value of coliform, which are observed in after treatment, is range between 2750 to 2790 (CFU/100ml). And from the range between 2100 to 2150 (CFU/100ml) was in disposal pond. The Standard limit of fecal coli for wastewater purpose is 1000 (CFU/100ml) as per DOE, Bangladesh, 1997) and determined values were not within this limit.

The producer of wastewater should take proper responsibilities to make sure the proper dispose system. The SARI-ITC is socially responsible to maintain the cleanness of the environment and disposal of the wastewater production to reduce the pollution in the nearby community. Wastewater management techniques is contradictory of the standard procedure of wastewater management policies for the hospital wastewater management systems. In this study focused how the wastewater disposal system is making harmful effect on the environment.

In the results it's clearly shown that the parameter of wastewater is not in standard limits accepts pH. Which clearly indicates that there is lack of understanding of proper wastewater management techniques in order to awareness of government policies and of health care wastewater treatment.

After The results of environmental impact value, it is shown that the disposal wastewater is making harmful effects on the nearby communities and the ecosystem as well. If the goal of wastewater management is to reduce disease transmission from the hospital, then the management should take strong management plans to reduce pollution. The different techniques or solutions should be introduced to achieve the goals as part of the overall system. National standards and operating procedures should be set up to match the international standards for the developing countries.

CONCLUTIONS

The summary demonstrates that there are some changes has observed by the regular dumping of wastewater from SARI-ITC. The main findings from the surveys are as

- From the disposal area sample pH was 7.20, which is within acceptable limits. Other parameters like Turbidity was8.80 NTU (>5), BOD was 180 mg/l (>150), COD was320 mg/l (>200), EC was 829 µs/cm (>400), DO was3.75 mg/l (<6.5-8), TDS was 2480 mg/l (>2100) and Fecal Coliform was 2100 CFU/100ml (>1000) of wastewater samples of SARI-ITC disposal area were not within the acceptable limit.

- Total Environmental Impact Value exposed a negative result of (-) 67, which undoubtedly implies the environmental degradation by wastewater disposal from SARI-ITC.

- This wastewater treatment plant must be modernized as the plant is making harmful objects of this area. Thus, the area deals with significant environmental change such as surface water pollution, irrigation resources pollution, health hazards, etc. As a result, many people from this area might suffer.

This report briefly explains the negative impacts of wastewater treatment plants, which can be lessened by proper steps taken on time. Besides some negative impacts, this project has a positive impact, such as the generation of employment opportunities, which has helped many local people to get rid of unemployment. After all, a well-modified wastewater treatment plant is necessary for the reduction of environmental pollution. It will also reduce the massive suffering of that area's people. After considering all issue, it is strongly suggested that an effective treatment plant and management should be set up.

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