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Quality Determination of Dairy Farm Wastewater in Dinajpur

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ABSTRACT

At present environmental pollution is a talked about issue. Due to environmental pollution, humans and animals face threats. The scientist has pointed out that waste is one reason for climate change. Solid, liquid, gaseous etc. are different types of waste. The experiments were conducted to determine the chemical constituents present in dairy farm wastewater, wastewater management practice and environmental impact and compare it with the groundwater Dinajpur Sadar upazila. The data concerning the dairy farm wastewater in Dinajpur was obtained through a designed questionnaire, and separate area inspection interacting with the proprietor and workers in the dairy farm. Randomly collected samples from different dairy farms. The chemical constituents of the wastewater sample were determined by a laboratory experiment. The wastewater contained Mg, Na, Ca, Cl^-, K, EC, P, HCO_3^-, p^H, TDS, DO, COD, Zn, S, BOD, H_T and NO_3^-. The Na, K, Ca and pH concentration of wastewater under the range in groundwater in Dinajpur. However, concentrations of P, TDS, Mg, EC, Cl^-, HCO_3^- and H_T are above the groundwater range in Dinajpur. The produced wastewater was disposed of either through drainage or piping systems on fellow land, ponds, open lakes, roadside land, urban drains, and rivers. The unplanned wastewater disposal creates bad odor, and environmental pollution, seduces the growth of mosquitoes decreases the water quality, soil quality and health hazards. Therefore, it can be concluded that the prevailing dairy farm wastewater disposal system not being satisfactory. The proper disposal system should be improved to reduce environmental impacts.

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Introduction

Wastewater is primarily composed of used water and melted mud mixed with animal and human excreta, industrial slush. (Islam *et. al.* 2020). Milk is a good source of many vital nutrients, as well as calcium, protein, and vitamin D. Around the world in 2011, Dairy farms produced milk of around 730 million tons from dairy cows of 260 million. Bangladesh produced 9.92 million tons of milk in 2018 (DLS, 2019). The milk and milk products demand are growing day by day because of the quick growth in population and growing nutrition awareness. Bangladesh desires a considerable increase in milk production to become self-sufficient. For this reason, there are many dairy farms developed in the area of Dinajpur district recently. Animal Feeding Operations (AFOs) are well known as a major reason for damage to surface water, polluted air, and contaminated groundwater. EPA and USDA surveys claimed that among several AFOs, dairy farms are the biggest wastewater producers, conducive 48% of animal wastewater. Fat, proteins, dissolved sugar and residues of additives are dissolved in dairy wastewater. Biochemical oxygen demand (average 0.8-2.5 kg per metric ton), chemical oxygen demand (about 1.5 times of BOD), total suspended solids (100–1000 mgl^{-1}), and total dissolved solids are the key parameter. (EPA, 1999) The average COD and BOD concentrations were 4997 mgl^{-1} and of 1003 mgl^{-1}. Depending on operation conditions, wastewater management, climate, and types of flushing, the concentration of COD varies from 2000–7000 mgl^{-1}. The high concentration of COD because of manure, waste milk, detergent and waste feeds combined in the laundry. Also, K, Ca, Mg, Na, Cl, Fe, CO, Ni, and Mn were present in dairy wastewater with major quantities. Because of its high organic content with high BOD, dairy wastewater dumped directly to the environment is causing serious contamination problems. The high BOD increases the level of dissolved content in aquatic systems and it's harmful for aquatic life. Direct discharge of these effluents in coastal marine and inland water bodies may change the physicochemical, biological, and enzyme activities (Brown, 1997; Chhonkar *et al*., 2006). The disposal management practices of huge volumes of water are used in most dairy farms either by piping or draining systems. Finally, the wastewater is disposed of on the roadside in the pond or in the urban drain, which causes environmental pollution. It creates a bad odor, causes growth of mosquitoes, reduce the quality of water, pathogenic micro-organism spreading, some waterborne diseases. (Kumar and Desai, 2011; Bhadouria and Sai, 2011) Mosquitoes are the main cause of malaria and other diseases like dengue fever, yellow fever, and chikungunya and it's become the propagation site. So it is necessary to determine the chemical analysis to know the parameters it contains and its range so that it could be achieved such a way that it may not be harmful of human living and animal as well as the environment. The experiment aims to determine the chemical constituents and it's range in the waste water and compare it with ground water in Dinajpur.

Materials and Methods

Study Area

Therefore, this study was carried out in the Dinajpur district. It is located 413km (25°37′N 88°39′E / 25.617°N 88.650°E) north-west of Dhaka Bangladesh.

Dairy Wastewater Environmental Impact

To know the environmental impact of dairy wastewater a questionnaire is prepared. At first, a draft questionnaire was prepared. The questionnaire was pre-tested by interviewing a few respondents in the study area. After pre-testing, a set of the final survey questionnaires was developed with necessary corrections and modifications. The questionnaire was elaborated to include all types of questions relating to the objectives of the study. Data collection included the amount of waste generation, waste collection, transportation and storage, the environmental impact of generated waste and disposal systems in the studied area. Both qualitative and quantitative data were collected through direct field observation of the study area, focus group conversation with the participants.

Data Collection

According to the questionnaire, data was collected from the owner and worker of dairy farm in the study area through individual interviews. Data was collected using face-to-face interviews in the site of dairy farm, so we had a chance to observe the management practice of wastewater.

Sample Collection

More than 100 dairy farms in the Dinajpur district. The sample of dairy farm wastewater was collected from 7 selected dairy farms in Dinajpur district shown in Table 1. Three samples were collected from each of the dairy farms. The samples were collected in plastic bottles. The samples were carried in the Department of Agricultural Chemistry, laboratory, HSTU, Dinajpur for testing.

Table 1. Information about the dairy farm from where the sample was collected.

SN	Name of the dairy farm	Address
1.	HSTU dairy farm	HSTU, Basherhut, Dinajpur.
2.	Iftekharul dairy farm	Raniganj, Dinajpur.
3.	Tuhin dairy farm	Shakehuti, Gopalganj, Dinajpur.
4.	Buradighi dairy farm	Buradighi, Kamalpur, Dinajpur.
5.	Rabeya dairy farm	Noyonpur, Dinajpur.
6.	MR dairy farm	Basherhut, Dinajpur.
7.	Tasfiya dairy farm	Rampur, Birol, Dinajpur.

Analytical Method for Analysis of Wastewater

Color

Firstly, in a conical flask, the sample was taken. Then by the visual observation of the eye, the sample's color was found.

Odor

In a conical flask, the wastewater sample was taken and then it was brought close to the nose. After that, the odor of the wastewater was found.

Temperature

Temperature may be defined as the hotness or coldness of any material. It was determined by the thermometer.

pH

According to Ghosh *et al*. (1983) mentioned procedure, the pH of dairy wastewater was determined electrometrically by using pH meters (Hanna instrument-211 model) in the laboratory.

Electrical conductivity (EC)

The total amount of dissolved solids (TDS) or total salinity (without silica) represents the electrical conductivity of a system. (Ghosh *et al*., 1983) Using the Conductivity Bridge (Harnainstrument-HI8033) the EC of wastewater samples was determined.

Total dissolved solids (TDS)

Total dissolved solids represent the amount of small organic matter and the inorganic salt existent in the water solution. (Chopra and Kanwar, 1980) The amount of solid residue found by evaporating a measured aliquot of filtered water samples to dryness, are measured total dissolved solids (TDS).

Calcium (Ca)

40 ml sample was poured in 250 ml conical flask. After that distilled water (hot) 50 ml and NaOH (10%) 5 ml were added and shaken properly. Then hydroxylamine hydrogen chloride, Potassium ferrocyanide, Triethanolamine of each 10 drops were added. After that, a falcon indicator of 4-5 drops solution was added to the flask and shaken. Against Na_2-EDTA of 0.01M from a burette to the conical flask, the solution was titrated. Without waste water, taking all the reagents a blank experiment was conducted. The data was arranged and enumerated from the supplied samples.

Magnesium (Mg)

(Islam *et al.,* 2020) In a 250 ml conical flask, exactly 40 ml of wastewater was taken. Distilled (Hot) 50 ml water and NH_3-NH_4 of 5 ml buffer solution were added. Properly shake the flask. Sodium tungstate solution, Hydroxylamine hydrogen chloride, Potassium ferrocyanide, Triethanolamine of 10 drops each were added and shaken properly. The EBT indicator of 4-5 drops solution was added and shaken properly. Against Na_2-EDTA (0.01M) from a burette to conical flux, the solution was titrated. Without waste water, taking all the reagents a blank experiment was conducted. The data was arranged and determined from the supplied samples**.**

Sodium (Na) and Potassium (K)

A flame emission Spectrophotometer was used to determine the amount of sodium and potassium in the wastewater using sodium and potassium filters respectively. In a gas flame, the sample was aspirated and careful stimulation was performed and formative conditions. The 10 psi pressure of air was fixed. The 589 nm and 768 nm light intensity was nearly proportional to the concentration of the components of sodium and potassium, respectively. According to Golterman (1971) and Ghosh et al. (1983), the percent emission was recorded.

Phosphorus (P)

In a 100 ml volumetric flask, exactly 5 ml of sample and 4 ml of sulphomolybdic acid solution were taken. Then distilled water was added to 2/3rd of flask volume. Stannous chloride solution of 5-6 drops was added to the solution and mixed thoroughly. Then, the distilled water was added up to the mark of volume. Within 3-4 minutes full-color intensity was developed and then read the colored solution at 660 nm wavelength immediately in a spectrophotometer. Except for the phosphorus solution, taking all chemicals as described a blank solution was prepared. Calibration curves were ready by plotting the Y-axis absorbance (optical density) of light and on the X-axis solution concentrations on graph paper. The level of test sample was found by plotting of reading of spectrophotometer on the standard curve.

Sulfur (S)

Firstly, in a 1000 ml volumetric flask, 0.769g dissolved Epsom salt ($MgSO_4.7H_2O$) was taken to make a 100 ppm sulfur standard solution. Then a standard series sulfur solution was prepared from the 100-ppm solution and was added barium chloride of about 0.3 g (1 scoop) to each standard series. Then barium chloride of about 0.3 g (1 scoop) was added to an unknown test solution of 20 ml. It was diluted until barium chloride dissolved totally and before reading it was kept to stand for 30 minutes. Taken 425 nm wavelength of spectrophotometer reading at cuvette putting in the cuvette chamber in contrast to the blank one. Then from the standard curve, the concentration of sulfate.

Zinc (Zn)

In a 250-ml volumetric flask waste water sample was diluted carefully to the mark with deionized water and mixed properly. Pipet 25 ml aliquots into each of the four 250 ml Erlenmeyer flasks. Immediately before titrating a sample, deionized water 15 mL, pH 10 buffer 9-10 ml and Eriochrome Black T 3 drops were added. Until the pink solution turns light blue, titrated with standardized EDTA. Calculated the zinc in the total sample.

Hardness (H_T)

The level of calcium and magnesium in the water is the determinant of hardness in it. The H_T was measured by the equation:

$$H_T = (2.5\ Ca^{2+}) + (4.1\ Mg^{2+}).$$

Chloride (Cl^-)

Firstly, in a 1000 ml volumetric flask, $AgNO_3$ of 3.4 g was taken. Then distilled water of 200-300 ml was added to make up the volume and mixed properly. Secondly, in a 250 ml volumetric flux, 1.2 g k_2CrO_4 was taken and distilled water of 100-150 ml, saturated $AgNO_3$ solution of 1-2 drops and distilled water was added up to the mark. After that in a 250 ml conical flask, 5 ml of the sample was taken and distilled water of 20 ml was added and k_2CrO_4 of 5-6 drops was added then titrated against $AgNO_3$ solution of 0.02 N until red brick tinge appeared.

Bicarbonate (HCO_3^-)

The sample bicarbonate was measured by the acidimetric process of titration using phenolphthalein indicator ($C_2OH_{14}O_4$) for carbonate, with diluted sulphuric acid, bicarbonate forms at the end of the titration rose-red color complex. According to Chopra and Kanwar (1980) and Ghose et al. (1983) the bicarbonate was estimated titrimetrically.

Dissolved oxygen (DO)

Dissolved oxygen in water represents the level of free, non-compound oxygen in it. It was determined by DO meter (DO-5509) in the laboratory.

Chemical Oxygen Demand (COD)

50ml of supplied water was poured in a 100 ml conical flask and added distilled water in it and shaken well. Then 5 ml of $AgNO_3$ solution and 10 ml of H_2SO_4 were added to it and shaken thoroughly. Then it was heated at 60 –70ºC and titrated with 0.025N $KMnO_4$ solution. Then COD was calculated.

*Biological Oxygen Demand (BOD***)**

Two BOD bottles were taken, one bottle was filled with only dilution water (B_1-blank) and another bottle was filled with 5ml of wastewater (A_1-sample) and dilution water. Then immediately measure DO of both BOD bottles. Then two BOD bottles were kept for 5 days in an incubator at 20ºC. After 5 days again measure DO of two bottles (A_2 and B_2). Here B_2 is for blank and A_2 for sample.

$$BOD = \{(A_1-A_2) -(B_1-B_2)\}/P\ mgl^{-1}$$

P = Volumetric fraction of wastewater.

Nitrate (NO_3^-)

10 ml of the supplied sample was poured in a 50 ml volumetric flask and added 1.0 ml of 1N HCl solution and shaken thoroughly. Then the absorbance of standard and unknown solution at 410 nm wavelength. Calculated the amount of NO_3^- mgl^{-1} from the graph.

After chemical analysis, the dairy farm wastewater was compared to the groundwater in Dinajpur.

Results and Discussion

Present Status of Study Area

The generated waste from the dairy farm was solid and liquid. Solid waste including cow dung and liquid waste including waste water. Cow dung was used as a fertilizer in the field for growing crops and also used for biogas production. However, wastewater was not used for any purpose. The wastewater source was urine, washing of cows, and cleaning of the farm. There was no effect of the wastewater on the health of the laborers. When using an open drainage system, because of odor problems sometimes the worker was not able to do their work comfortably. Very few of workers used masks for health safety. The factor of the wastewater generation depends on the number of cows, the number of washing per day, fand arm capacity. The waste water was not reused in the studied dairy farm. The waste water was not reused.

Disposal System

The piping or drainage system was used to dispose of wastewater the studied dairy farm. Most of the dairy farms used piping systems and some used drainage systems for disposal of wastewater. It is a cost-effective and easy method for disposal of wastewater. The drainage system was permanent system made by concrete and PVC pipe used in piping system. Finally, the wastewater was disposed of in the fallow land, pond, river, urban drain, along road site and the open land. There was no concern about where the wastewater was finally disposed.

Effect On Environment

As the waste water disposed of fallow land, road site, field, pond, river and the urban drain, it is a thoughtful environmental anxiety. It created bad odor, degraded water quality, soil quality, it seemed to be very unhygienic. The wastewater was also destructive for the pisciculture, water-born animals and aquatic plants.

Chemical Composition of Dairy Farm Wastewater

Color

The appearance of dairy farm wastewater was found turbid and brown. The sample's turbidity is due to the different particulate impurities such as finely divided inorganic and organic matter and colored composites existing. Due to it, the color of the water was changed, the sunlight did not penetrate and depletion of oxygen content and the water was unsuitable for use.

Odor

The dairy farm's effluent smell or odor was found unpleasant or foul. The unplesant odor due to the unstable substance related to organic matter and anaerobic decomposition by living organisms, primarily microorganisms in it. The undesirable odor decreases the water quality and reasons nausea and vomiting.

Temperature

The temperature was measured to know its effects on the biochemical responses in the living organisms. It was also significant for pH determination, conductivity and level of saturation gases in water. The temperature was ranged in studied samples from 27.4^0C to 27.6^0C. The mean value was 27.5^0C.

pH

The pH value of the samples ranged from 6.57 to 6.65 (Table 1). The 6.61 was the mean value. The pH is the determination of hydrogen ion concentration and it denotes instantaneously the strength of alkalinity in effluent. It affects many chemical reactions and functional biological systems only in relatively slender ranges of pH. The studied samples were acidic due to their pH value. The pH tolerance limit of industrial effluents ISI recommended is 5.5 to 9.0 for the release in irrigation land as well as into inland surface water. In the Dinajpur district pH of groundwater ranges from (Table 3) 5.32 to 7.00 (Uddin, 2004).

Electrical Conductivity (EC)

Electrical conductivity represents the capacity of a substance or solution to conduct electricity. It represents the concentrations of several ionic classes in effluent. The studied sample's electrical conductivity was found from 860µS cm $^{-1}$ to 6780 µS cm $^{-1}$ (Table 2). (Uddin, 2004) The EC of ground water in the Dinajpur district was 75.47 to 565.35 µScm^{-1} (Table 3).

Total dissolved solid (TDS)

The dissolved solids may be defined as the soluble compound (both inorganic and organic) present in the water. The TDS was found 430mgl^{-1} to 3477mgl^{-1} (Table 2)in the studied samples. The mean value was 1758 mgl^{-1}. According to ISI, the value of industrial effluent's dissolved solids tolerance limit for the discharge on land or into inland water was (100 mgl^{-1}) which was below the studied sample's value. (Uddin, 2004) The concentration of TDS ground water in the Dinajpur district was 52.02 to 422.51 mgl^{-1} (Table 4).

Calcium (Ca)

The calcium concentration in the studied samples was found from 17.36 mgl^{-1} to 64.13 mgl^{-1} (Table 1). The mean value was 32.06 mgl^{-1}. Karanth (1994) reported that calcium concentration in water mostly depends on the solubility of $CaCO_3$, $CaSO_4$, and rarely on $CaCl_2$. The calcium concentration of ground water in Dinajpur district from 4.21 to72.54 mgl^{-1} (Table 4) (Uddin, 2004).

Magnesium (Mg)

The Mg concentration in studied samples was found minimum of 31.59 mgl^{-1} and maximum of 69.67 mgl^{-1} (Table 1). The mean value was 49.65 mgl^{-1}. The Mg concentration was 0.85 to 18.60 mgl^{-1} (Table 4) ground water in Dinajpur district (Uddin, 2004). It was showed that the studied sample's magnesium content was greater than the reported ground water in Dinajpur.

Sodium (Na)

Sodium is highly soluble in water and important cations are present in water. Chloride and sulphate are associated with sodium and make the water unportable. High sodium content water is unsuitable for agriculture because it weakens the soil for crops. The sodium content was minimum 12.50 mgl^{-1} and maximum 33.33 mgl^{-1} the samples. The mean value was 19.76 mgl^{-1} (Table 2). (Uddin, 2004) In Dinajpur the sodium content in ground water was from 2.29 to 54.02 mgl^{-1} (Table 4).

Potassium (K)

Potassium is also a naturally occurring component and without undergoing any precipitation remains in solution. The potassium in the studied samples was from 25.83 mgl^{-1} to 57.50 mgl^{-1} (Table 2). The mean value in the wastewater sample was 38.21 mgl^{-1}. (Uddin, 2004) In Dinajpur district, the potassium concentration in groundwater was from 0.39 to 57.08 mgl^{-1} (Table 3). In studied samples potassium concentration was above the reported ground water range in Dinajpur.

Phosphorus (p)

The content of phosphorus was 7.80 mgl^{-1} to 26.82 (Table 2) mgl^{-1} in the wastewater samples. The mean value was 18.04 mgl^{-1}. According to Hossain (2014) the amount of phosphorus content in ground water was ranged from 0.001 to 1.08 mgl^{-1} (Table 4) in Dinajpur district. The studied sample's phosphorus concentration was above the reported ground water range in Dinajpur.

Sulphur (S)

The minimum sulphur content was 8.95 mgl^{-1} in studied samples and maximum 38.69 mgl^{-1} (Table 3). The mean of studied samples sulphur content were 23.59 mgl^{-1}.

Bicarbonate (HCO_3^-)

The bicarbonate amount in the wastewater minimum was 8.80 mgl^{-1} and the maximum was 42.26 mgl^{-1} (Table 3). The mean value in the studied sample was 22.94 mgl^{-1}.

(Hossain, 2014) The bicarbonate range in ground water in Dinajpur was 2 to 6.20 mgl^{-1} (Table 4). The studied sample's bicarbonate range was not within the ground water range in Dinajpur.

Chloride (Cl^-)

In all types of water chloride anions are usually found. Chloride concentrations are fairly low in normal fresh water and generally are less than sulphate. Industrial waste and domestic sewage discharge in water tend to increase chloride concentrations. The amount of chloride in the studied dairy farm wastewater was found from 175.01 mgl^{-1} to 988.59 mgl^{-1} (Table 3). The mean value of chloride in the wastewater was 437.21 mgl^{-1}. (Uddin, 2004) The range of chloride concentration in ground water was 5.67 to 63.46 mgl^{-1} (Table 4) in Dinajpur.

Zinc (Zn)

The minimum and maximum amount of Zinc content in the waste water was found 83 $mgl^{-1}$and 193 mgl^{-1} respectively (Table 3). The mean value of Zinc in the studied samples was 133 mgl^{-1}.

Hardness (H_T)

Hardness is a significant components that is necessary to evaluate water quality, whether is to be used for household, agricultural and manufacturing purposes. Major cations conveying hardness are calcium and magnesium. Other cations like as aluminium, barium, iron, manganese and strontium also donate to the hardness. The minimum amount of hardness in studied samples were found 182.31 mgl^{-1} and maximum 455.96 mgl^{-1} (Table 3). The hardness mean value in the waste water was 282.87 mgl^{-1}. Uddin (2004) reported the hardness concentration in ground water in Dinajpur was ranged from 14.01 to 242.19 mgl^{-1} (Table 4).

Dissolved oxygen (DO)

Determination of water quality for various purposes, dissolved oxygen is a significant parameter and indicates the capability of water to support aquatic life. DO in clean surface water normally is about 7.6 mgl^{-1} at 30^0c. Inorganic reductants like hydrogen sulphide, nitrite, ammonia, ferrous ion and other oxidizable substances are responsible for decreasing DO level in the water. In studied samples, the DO was found from 0.2 mgl^{-1} to 0.5 mgl^{-1} (Table 3). The mean value of DO was 0.3 mgl^{-1}.

Chemical Oxygen Demand (COD)

Chemical oxygen demand may be defined as the level of oxygen required to oxidize the organic matter existing in water. Determination of COD is necessary to know the amount of oxidation that will happen and the level of organic matter existing in a water sample. The amount of COD content in the studied waste water was obtained from 42.93 to 291.35 mgl^{-1} (Table 3). The obtained mean value of COD was 140.13 mgl^{-1} in wastewater.

Biological Oxygen Demand (BOD)

Biochemical oxygen demand may be defined as in aerobic conditions, the quantity of oxygen expended by bacteria and other microorganisms while they decompose organic matter. Determination of BOD is important to know the amount of oxygen needed in the decomposition process to eliminate waste organic matter from water by the aerobic bacteria. The BOD content in waste water was found minimum 0.1 mgl^-1 and maximum 0.3 mgl^{-1} (Table 3). In the studied samples, the mean value of BOD was 0.2 mgl^{-1}.

Nitrate (NO_3^-)

The NO_3^- content in studied wastewater was found minimum 38 mgl^{-1} and maximum 276 mgl^{-1} (Table 3). The mean value of Zinc was 145 mgl^{-1} in the studied sample.

Table 2. Quantity of different components in wastewater samples

Sample No.	P^H	EC μScm^{-1}	Temp.℃	TDS mgl^{-1}	Ca mgl^{-1}	Mg mgl^{-1}	K mgl^{-1}	Na mgl^{-1}	P mgl^{-1}
1	6.60	6780	27.6	3477	49.43	69.67	57.50	29.17	26.82
2	6.57	2287	27.5	1240	17.36	42.12	25.83	15.42	20.38
3	6.65	1443	27.4	687	25.38	31.59	27.50	13.75	12.06
4	6.58	5597	27.6	2620	21.37	55.09	45.00	20.83	23.34
5	6.61	2533	27.5	1437	25.38	44.56	29.16	13.33	17.25
6	6.63	860	27.4	430	21.37	32.41	28.33	12.50	7.80
7	6.65	4930	27.4	2417	64.13	72.10	54.16	33.33	18.51
Mean	6.61	3490	27.5	1758	32.06	49.65	38.21	19.76	18.04
Maximum	6.65	6780	27.6	3477	64.13	69.67	57.50	33.33	26.82
Minimum	6.57	860	27.4	430	17.36	31.59	25.83	12.50	7.80

Table 3. Quantity of different components in wastewater samples

Sample no.	S mgl^{-1}	HCO_3^- mgl^{-1}	Cl^- mgl^{-1}	Zn mgl^{-1}	H_T mgl^{-1}	DO mgl^{-1}	COD mgl^{-1}	BOD mgl^{-1}	NO_3^- mgl^{-1}
1	23.01	34.53	543.97	187.0	409.24	0.2	291.35	0.3	276
2	24.46	14.00	392.60	113.0	216.14	0.5	54.8	0.1	154
3	26.76	8.80	241.02	87.00	192.99	0.3	86.77	0.1	175
4	24.74	42.26	406.79	150.0	279.31	0.4	225.59	0.3	188
5	18.57	14.67	316.92	117.O	244.16	0.2	54.8	0.1	97
6	8.95	21.60	175.01	83.00	182.31	0.5	42.93	0.1	38
7	38.69	24.73	988.59	193.0	455.96	0.2	224.68	0.1	85
Mean	23.59	22.94	437.21	133.0	282.87	0.3	140.13	0.2	145
Maximum	38.69	42.26	988.59	193.0	455.96	0.5	291.35	0.3	276
Minimum	8.95	8.80	175.01	83.00	182.31	0.2	42.93	0.1	38

Table 4. Comparison of components of waste water with the ground water in Dinajpur.

Components	Waste water range (mgl^{-1})	Groundwater range in Dinajpur (mgl^{-1})	References
Cl^-	175.01-988.59	5.67-63.46	Uddin, 2004.
HCO_3	8.80-42.26	2-6.20	Hossain, 2014.
K	25.83-57.50	0.39-57.08	Uddin, 2004.
Na	12.50-33.33	2.29-54.02	Uddin, 2004.
P	7.80-26.82	0.001-1.08	Hossain, 2014.
S	8.95-38.69	-	-
H_T	182.31-455.96	14.01-242.19	Uddin, 2004.
P^H (no unit)	6.57-6.65	5.32-7.00	Uddin, 2004.
TDS	430-3477	52.02-422.51	Uddin, 2004.
EC(μscm^{-1})	860-6780	75.47-565.35	Uddin, 2004.
Mg	31.59-69.67	0.85-18.60	Uddin, 2004.
Ca	17.36-64.13	4.21-72.54	Uddin, 2004.

Summary and conclusion

An investigation was done to determine the dairy farm wastewater quality, and management practice and to know the environmental impact in Dinajpur district. It was found that the wastewater in the dairy farm was generated from urine, washing of cows, and cleaning of farm. The disposal system used on the studied dairy farm is either a drainage or piping system. to fellow land, urban drain, pond, river or roadside. Such unplanned disposal of waste water creates bad odor, air pollution, decreases the quality of water and soil and also health hazard. If dairy farms are want to regulations of law, health and environmental sustainability the safe discharge of wastewater is necessary. The pH concentration in samples was found from 6.57 to 6.65, which means it was acidic. The EC concentration was 860 to 6780 μScm^{-1}, TDS was 430 to 3477 mgl^{-1}, Ca was 17.36 to 64.13 mgl^{-1}, Na was 12.50 to 33.33 mgl^{-1}, K was 25.83 to 57.50 mgl^{-1}, P was 7.80 to 26.82 mgl^{-1}, S was 8.95 to 38.69 mgl^{-1}, Hardness was 182.31 to 455.96 mgl^{-1}, Mg was 31.59 to 69.67 mgl^{-1}, Cl^- was 175.01 to 988.59 mgl^{-1}, HCO_3^- was 8.80 to 42.26 mgl^{-1}, DO was 0.2 to 0.5 mgl^{-1}. COD in waste water was 42.93 to 291.35 mgl^{-1}, BOD was 0.1 to 0.3 and NO_3^- was 38 to 276 mgl^{-1} in studied wastewater samples. The Ca, Na, K and pH concentration in the waste water under the range of ground water in Dinajpur. But on the other hand, the level of TDS, EC, Cl^-, P, Mg, HCO_3^- and H_T in the wastewater were above the range of ground water in Dinajpur. The process of waste management should be improved and disposal system should be supervised by concern authority regularly.

References

Bhadouria, B.S., Sai, V.S. (2011). Utilization and treatment of dairy effluent through biogas generation a case study. Int J Environ Sci 1(7): 1621–1630.

Chhonkar, P., Datta, S.P., Joshi, H.C., Pathak, M. (2006). Impact of industrial effluents on soil health and agriculture-Indian experience part II. Tannery and textile industrial effluents. J.Sci. Ind. Res 59: 446-454.

Chopra, S.L., Kanwar, J.S. (1980). Analytical Agricultural Chemistry. Kalyani Publishers. Ludhiana, New Delhi, pp, 148-289.

DLS. (2019). Livestock Economy at a glance, Livestock Economic Division, Department of Livestock Services, Dhaka. http://www.dls.gov.bd/site/page/22b1143b-9323-44f8-bfd8-647087828c9b/Livestock-Economy.

EPA. (1999). Water pollution feedlot waste: an analysis of its magnitude and geographic distribution. Washington, DC.

Ghosh, A.B., Bajaj, J.C., Hasan, R., Sing, D. (1983). Soil and Water Testing Method. A Laboratory Manual, Division of Soil Science and Agricultural Chemistry. IARI. New Delhi-1100012., 1-48.

Golterman, H.L., Clymo, R.S. (1971). Methods for Chemical Analysis of Fresh Waters. IBP Handbook No. 8. Blackwell Scientific Publications. Oxford and Edenbourgh., 41-46.

Hossain, M.A. (2014). Chemical constituents and suitability studies of ground water for irrigation uses in Dinajpur. M.S. Thesis, Department of Agricultural Chemistry, Hajee Mohammad Danesh Science and Technology University, Dinajpur.

Islam, M., Nasrin, T., Rahman, M., Islam, M., Ray, T.K. (2020). Quantitative Constituents Analysis of Rice Mill Wastewater. Turkish Journal of Agriculture - Food Science and Technology, 8(10): 2034-2039, 2020 DOI: https://doi.org/10.24925/turjaf.v8i10.2034-2039.3042

Kamalinasab, M., Vakili, A., Mesgaran, M.D. (2016). Modelling anaerobic digestion of cow manure to predict methane flow rate: Discovery service para Timbó. Iranian Journal of Applied Animal Science 6: 525–533.

Kumar, D., Desai, K. (2011). Pollution abatement in milk dairy industry. Curr Pharm Res 1(2):145–152.

Uddin, M.G. (2004). Comparative studies of ground water quality at different aquifers of Dinajpur district. M.S. Thesis, Department of Agricultural Chemistry, Bangladesh Agricultural University, Mymensingh.