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Characterization of Dairy Effluent and its Agricultural uses

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Abstract - *Many chemical as well as natural fertilizers are used for the proper growths of crops. These fertilizers contain required amounts of Nitrogen, Phosphorous and Potassium which are essential for growth of crops. The waste water generated in Milk Dairies and pasteurization plants also contains these important constituents which provide for the healthy growth of crops. This paper focuses on the characterization of dairy effluents and determining the quantity of nutrients.*

***Key Words*: COD, BOD, fertilizer, effluents, dairy, waste, etc.**

1. INTRODUCTION

1.1 Dairy Effluent Composition:

Dairy effluent contains soluble organics, suspended solids, organics. All these components contribute largely towards their high biological oxygen demand (BODs) and chemical oxygen demand (COD). Dairy wastes are white in colour and usually slightly alkaline in nature and become acidic quite rapidly due to the fermentation of milk sugar to lactic acid. The pollution effect of dairy waste is attributed to the immediate and high oxygen demand.

1.2 Dairy Effluent Characteristics:

The characteristics of a dairy effluent contain Temperature, Colour, pH (6.5-8.0), DO, BOD, COD, Dissolved solids, suspended solids, chlorides, sulphate, oil & grease. It depends largely on the quantity of milk processed and type of product manufacture.

1.3 Role of Potassium, Nitrogen and Phosphorous in Agricultural Crop Production:

Nitrogen, Phosphorous and Potassium play a vital role in production of crops. The various crop fertilizers (natural or chemical) contain these three components in varying amounts. Different characteristics of crops depend upon varying amounts of Nitrogen, Phosphorous and Potassium. For example, for Wheat crop, different levels of Nitrogen are required for number of stalks, length of crop, thickness of stem, etc. So proper amount of fertilizer is given to obtain desired variety of crop.

2. OBJECTIVE OF STUDY

The main objective of this study is to test the contents of Dairy waste. The major purpose is to determine the quantity of nutrients in the effluent. Along with this, other aim is to find out whether cost can be reduced on Dairy effluent treatment.

3. METHODOLOGY

3.1 Collection of sample:

The sample was collected from a dairy. Two kinds of samples were collected; one was the washing of the tankers that raw milk is transported in and the second one was the washing of the pasteurization units and cooling tanks. The samples consisted detergents and some amount of Caustic soda used for cleaning along with the milk content. The process of Pasteurization was closely studied so as to get a rough idea of the contents that go along with milk during the process as the sample will contain the same contents.

3.2 Characterization of wastewater sample:

The collected sample was then tested for Nitrogen, Phosphorous and Potassium contents using Fertilizer Control Order (FCO) test. The next test carried out was of Chemical Oxygen Demand (COD) and Biological Oxygen Demand (BOD). Further, pH test and Oil and grease test was also done on the sample.

Figure 1 pH Test

Figure 2 COD test

Figure 3 Oil and Grease test

4. RESULTS OF VARIOUS TESTS:

SAMPLE		I	II
MOISTURE CONTENT (%)		96.71	97.84
NITROGEN (ppm)		700	600
PHOSPHOROUS (ppm)	As P	150	120
	As P_2O_5	340	270
POTASSIUM (ppm)	As K	66	79
	As K_2O	75	90
COD (mg/lit)		150	100
OIL AND GREASE (mg/lit)		42.37	52.15
pH value		7.14	7.11

Table 1 Results of tests

Major crops of Maharashtra such as Wheat, Rice, Onions, tomato, etc. have following NPK requirements in ppm:

CROP	NITROGEN	PHOSPHOROUS	POTASSIUM
Wheat	31.25	15.625	7.5
Rice	31.25	7.5	7.5
Onions	25	12.5	12.5
Tomato	37.5	15.625	15.625

Table 2 NPK requirements of suitable crops

Now, considering Wheat crop:

Nitrogen required- 31.25ppm or 31.25 mg/lit.

1ppm 2.5/4 kg/ha

So for one hectare, a wheat crop requires 31.25*2.5/4 19.53 kg of Nitrogen.

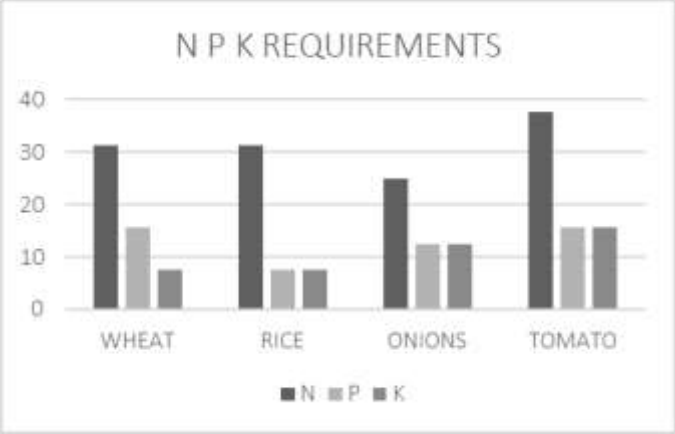
Whereas, the Nitrogen in the effluent is 650 ppm (Average of two samples) which is 650*2.5/4 406.25 kg.

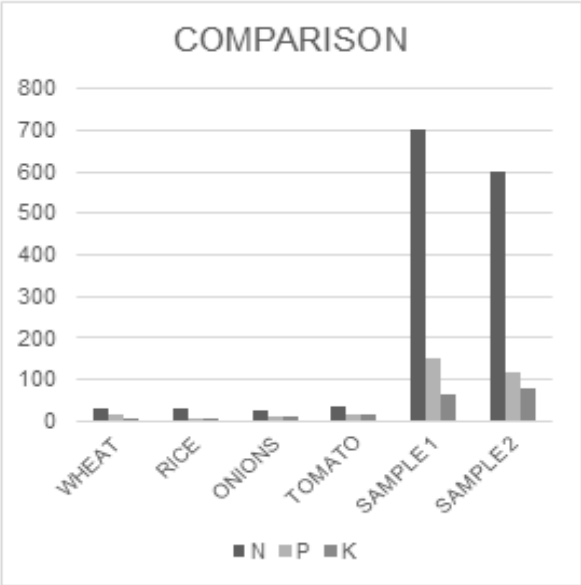
Hence, on the comparison of the amount of Nitrogen available in the effluent and amount required by the crop justifies that the sample effluent can be provided for NPK requirements.

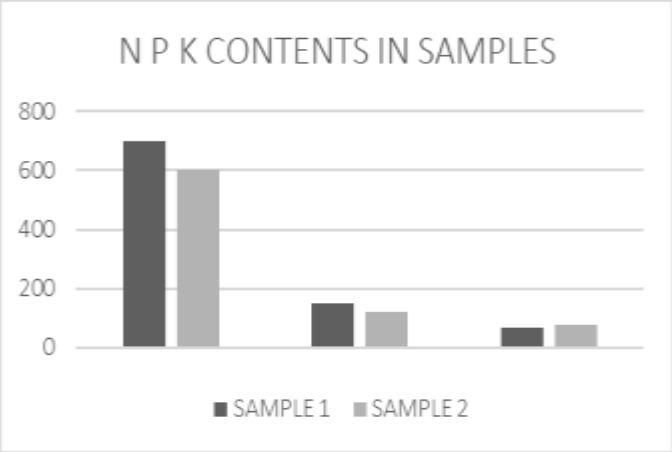
Following is the comparison table:

CROP	AMOUNTS REQUIRED IN kg		
	Nitrogen	Phosphorous	Potassium
AMOUNT AVAILABLE IN Kg	406.25	84.375 (as P), 190.625 (as P_2O_5)	45.313 (as K), 51.563 (as K_2O)
Wheat	31.25	15.625	7.5
Rice	31.25	7.5	7.5
Onions	25	12.5	12.5
Tomato	37.5	15.625	15.625

Table 3 Comparison







5. LIMITATIONS:

1) Dairy effluent has to be treated before it can be used as fertilizer as there are other components in it too.

2) The effluent to be used must be in a liquid form and the lumps, if any, need to be separated and discarded as they might affect the process.

3) The effluent has to be connected from dairies only. It cannot be done from a smaller plant as they output will not be sufficient from smaller plants as against bigger dairies. So it has to be done on a bigger level.

4) The number of samples taken were limited. A bigger sample space has to be taken for further studies.

6. CONCLUSION:

The idea of using Milk waste as fertilizer is efficient as it contains the various components present in a fertilizer readily and in good amounts. With proper treatment provided to the effluent, it can be used in agricultural fields as supplements to the crops which can improve crop growth. The value of COD and BOD is in the safe range. Because the moisture content of the sample is more than 90 percent the pH test says that the sample is Neutral. The dairy effluent treatment costs can be reduced as the reduction of Nitrogen, Phosphorous and Potassium need not be done since we have to retain these components. Hence, the treatment procedure will be cut short and so will the cost.

The amount of NPK required by the crops is provided by the fertilizers.

REFERENCES

[1] John Arundel, "Case Studies," in Sewage and Industrial waste treatment.

[2] William F. Ritter, "Potential for Reducing nutrient loads from the Dairy Industry in the Chesapeake Bay Watershed", Watershed Management Conference, American Society of Civil Engineers, 2005.

[3] Swati Patil et.al., "Dairy Wastewater- A case study", International Journal of Research in Engineering and Technology, Volume: 03, Issue: 09, September 2014.

[4] Aditya Patel et.al., "Performance and Evaluation study of Dairy waste water", International Journal of Advanced Technology in Engineering and Science, Volume: 04, Issue: 04, April 2016.

[5] Leena A. V et.al., "BOD/ COD a measure of Dairy Waste treatment efficiency- A case study", IOSR Journal of Mechanical and Civil Engineering, Volume: 13, Issue: 05, September- October 2016.

[6] Wallace D. F, Johnstone, "Dairy effluent- Composition, application and release", Foundation for Arable Research, July 2010.

[7] Vishakha Sukhadev Shivsharan et.al., "Physicochemical characterization of Dairy effluents", International Journal of Life Sciences Biotechnology and Pharma Reasearch, Volume: 02, Issue: 02, April 2013.

[8] R.D Longhurst et.al., "Farm dairy effluent: A review of published data on Chemical and Physical Characteristics in New Zealand", New Zealand Journal of Agricultural Research, Volume: 43, 2000.