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Analysis of the Effectiveness of Cow Dung Ash in the Purification of Water

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Abstract: ***Cow dung ash is an eco - friendly and inexpensive adsorbent for the purification of water from its pollutants and contaminants. By the analysis of the effect of cow dung ash in various parameters of water, maximum reduction obtained for Hardness was at the dosage of 8 gm/litre, for Turbidity was at the dosage of 4 gm/litre, for COD as well as BOD was at the dosage of 6 gm/litre. Hence it can be concluded that the optimum dosage was 6 gm/litre. The cow dung ash is somewhat less feasible for disinfection of water samples. The efficacy of cow dung ash cannot not be stated in this aspect and valid conclusions could hereby not be drawn as no distinguishable results were obtained in bacterial culture in terms of number of enumerable colonies. The contact time of 24 hours between sample and the ash was although feasible and maximum so as to allow for adsorption to occur efficiently. Cow dung ash exhibits good potential as an adsorbent in the purification and treatment of water.***

Keywords: Water Purification and Cow dung ash

1. Introduction

Water is the indispensable and essential unit of eco - system which is recyclable easily. But, increasing resource consumption due to urbanization pose a negative impact on environment and misuse of water leads to drastic pollution of water resources. Purification of water generally involves treatment with Chlorine, UV radiations, reverse osmosis, chemicals, etc. which are not only expensive but they pose serious threat to the human body in the long run. Hence, the idea of purifying water using cow dung based water purifiers came into practice. Cow dung ash is an excellent water purifier, which is cheap, effective and easily available. It is a great adsorbent in removing heavy metals from water. (Ajinkya Thakare et. al., 2019).

Cow dung ash improves the mineral content of water. It can be used as an alternative to chlorine in disinfection in the tertiary stage of water treatment. Cow dung ash has been used as a pesticide since many years. It is economical and eco - friendly. (Suraj Pasalwad et. al., 2019).

The chemical composition of cow dung ash includes 12% Calcium oxide, 0.9% Magnesium oxide, 0.3% Calcium sulphate, 20 % Aluminium oxide, 20% Iron oxide and 61% Silica. The presence of high amount of Silica in cow dung ash makes it to exhibit affinity for metal ions. (Kingsley O. Iwuozor et. al., 2022).

Thus, the usage of low cost adsorbent obtained from cattle dung wastes for the purification of water has gained enormous attention over the years. These waste materials are underutilized and so they are easily available. (Prachi Sharma et. al., 2017). Consequently, the efficient use of cow dung ash as adsorbent in water treatment forms the prime focus of the present study.

2. Material and Methods

Preparation of cow dung ash: The low cost adsorbent used in this study was derived from cow dung cake. Cow dung was obtained from nearby shed and sun - dried for 10 - 15 days to remove its moisture content. The dried cow dung cakes were then burned completely to get it converted into ash. The obtained cow dung ash was then sieved with a mesh to obtain its fine texture.

Figure: Cow Dung Cake

Figure: COW DUNG ASH

3. Methodology

After the preparation of cow dung ash, the water sample was treated with cow dung ash and was analysed for various parameters of water analysis, prior to and after the addition of cow dung ash. The sample tested in this study was of groundwater derived via manual pump. Cow dung ash was

added in the dosages of 2 gm/litre, 4 gm/litre, 6 gm/litre, 8 gm/litre and 10 gm/litre in the water sample. Contact time of upto 24 hours was given between water sample and cow dung ash. The treated samples were then filtered using Whatman (90 mm) filter paper, and it was then utilized for further investigations.

Water Analysis Parameters:

- **Turbidity Test: -** turbidity of water sample was measured using Nephalometer and readings were noted before and after the treatment with cow dung ash. The recorded data is in NTU units.
- **Hardness Test: -** 1 ml of Ammonia Buffer solution was added to 50 ml of sample followed by 5 drops of Erichrome Black T indicator. Sample was then titrated against Standard EDTA solution until the colour changes from wine red to clear blue. Readings were noted down and hardness was calculated as mg/litre of sample.
- **Total Dissolved Solids (TDS): -** In the present study, TDS was determined using an electrical conductivity meter. Sample was collected in beakers and the meter was inserted into it. Observations were noted, measured in micro - Siemens. TDS (in mg/litre) was calculated using the standard formula: [TDS = KE * EC] where KE is the correlation factor (value 0.67) and EC is the measurement of conductivity.
- **Chemical Oxygen Demand (COD): -** 50 ml original and cow dung ash treated sample was taken in 100 ml flasks. After adding 5 ml Potassium permanganate, the flasks were placed in water bath for 1 hour. After cooling for 10 min, 5 ml Potassium iodide (muddy - green colour appears) and 10 ml conc. Sulphuric acid (dark red colour appears) were added. The sample was then titrated against 0.1 M Sodium Thiosulphate solution until pale yellow colour appears. Then 1 ml starch solution was added for solution to become blue. It was again titrated until blue colour disappeared completely. Observations were recorded.
- **Biochemical Oxygen Demand (BOD): -** Samples were collected in BOD bottles without the incorporation of air bubbles. The Dissolved Oxygen (DO) content of the samples was determined on the same day of test and also after 5 days of incubation. (Difference between DO values of both the days will determine the BOD of the sample). For DO determination, 2 ml Manganous sulphate and 2 ml Alkine iodide azide solution were added to the bottles. Brownish precipitate is obtained at the bottom after shaking the bottles upside down. This precipitate was dissolved by adding 2 ml conc. Sulphuric acid.50 ml aliquot from the bottles taken and titrated against Sodium thiosulphate (0.025 N), until pale yellow colour appears. After adding 2 drops of Starch indicator, the solution turns blue which was later completely disappeared after titrating further. Observations were recorded.

Bacterial Culture:

Preparation of Nutrient Agar Media – 6.2 gm of Nutrient Agar was dissolved in 200 ml distilled water in a conical flask. Flask was then kept in an autoclave at temperature of 121 ℃ at 15 psi for 15 minutes for sterilization. The culture media was taken out after 30 min and stored in aseptic conditions.

Culture method – Initial disinfection of Laminar Bench with Ethanol and equipments by UV light. The method implied for bacterial culture in this work was Pour Plate Method.1 ml of sample was taken in sterilized petri plates using micropipette and 18 - 20 ml melted nutrient agar media was poured over the sample in the plates. Plates were gently swirled to mix the sample well with agar media. Upon solidification, the plates were incubated at 37 ℃ for 48 hours in an inverted position. After 48 hours, the plates were taken out of incubator observed for the growth of bacterial colonies over the solidified agar media.

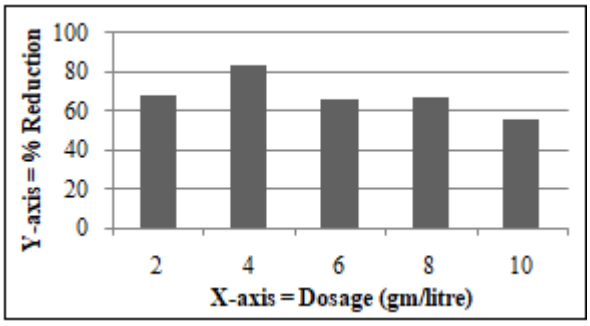
4. Result and Discussion

The treatment of water sample with cow dung ash as an adsorbent at varied doses of 2, 4, 6, 8 and 10 gm/litre respectively with a contact time of upto 24 hours yielded satisfactory results. Various parameters of water analysis (Turbidity, Hardness, TDS, COD, BOD,) were measured prior and after the addition of cow dung ash and the results obtained are depicted by a tabular format and graphical representation.

I. Turbidity:

Table 1: Percentage reduction in Turbidity

S. NO	Dosage (In gm/litre)	Initial Readings	Final Readings	% Reduction
1.	2	4.81	1.52	68.39
2.	4	4.81	0.80	83.36
3.	6	4.81	1.66	65.48
4.	8	4.81	1.60	66.73
5.	10	4.81	2.15	55.30

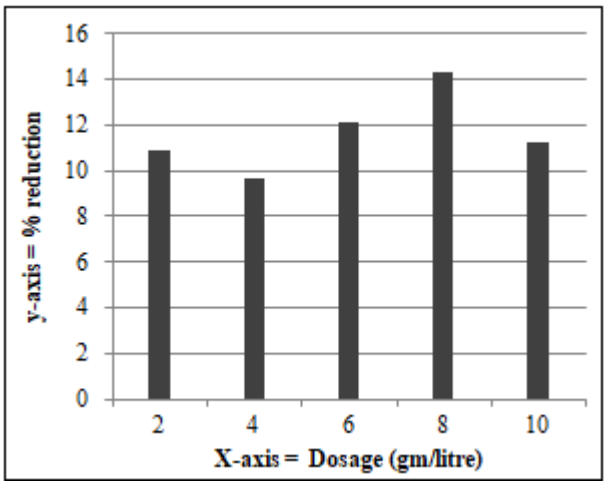


Graph 1: Percentage reduction in Turbidity

II. Hardness:

Table 2: Percentage reduction in Hardness

S. NO	Dosage (gm/litre)	Initial Reading	Final Reading	% Reduction
1	2	642	572	10.90
2	4	642	580	9.65
3	6	642	564	12.14
4	8	642	550	14.33
5	10	642	570	11.21



Graph 2: Percentage reduction in Hardness

III. Total Dissolved Solids (TDS):

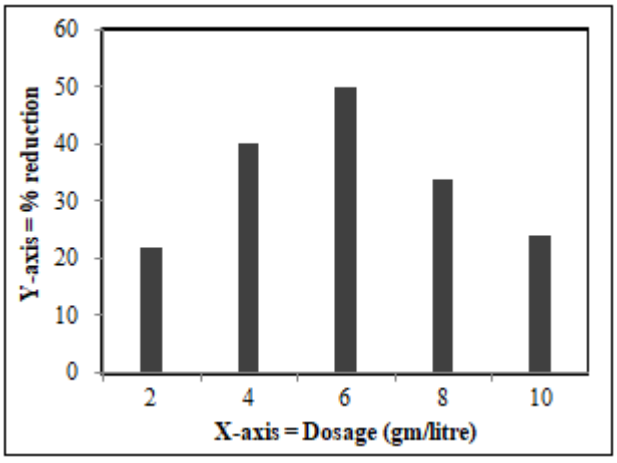
Table 3: Measured values of TDS (mg/litre)

S. No	Dosage (in gm/litre)	Initial Reading	Final Reading
1.	2	201	134
2.	4	201	201
3.	6	201	201
4.	8	201	268
5.	10	201	268

Chemical Oxygen Demand (COD):

Table 4: Percentage reduction in COD

S. NO	Dosage (in gm/litre)	Initial Readings	Final Readings	% Reduction
1.	2	3.286	2.563	22.00
2.	4	3.286	1.971	40.01
3.	6	3.286	1.643	50.00
4.	8	3.286	2.169	33.99
5.	10	3.286	2.497	24.01

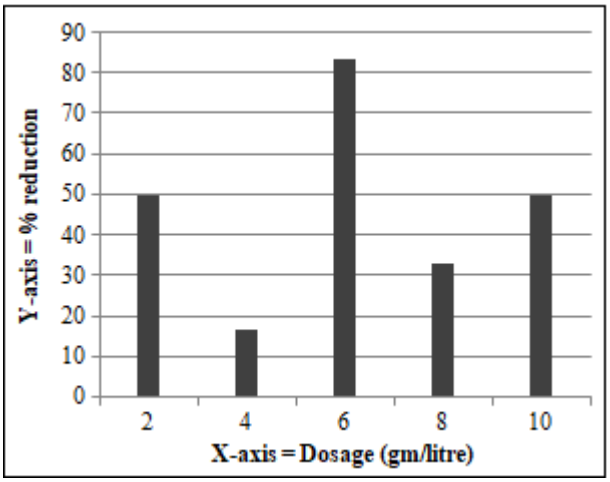


Graph 3: Percentage reduction in COD

Biochemical Oxygen Demand (BOD):

Table 5: Percentage reduction in BOD

S. No	Dosage (in gm/litre)	Initial Readings	Final Readings	% Reduction
1	2	2.4	1.2	50
2	4	2.4	2	16.66
3	6	2.4	0.4	83.33
4	8	2.4	1.6	33.33
5	10	2.4	1.2	50



Graph 5: Percentage reduction in BOD

Bacterial Culture

The result of the bacterial culture derived by following standard pour plate technique of sample inoculation was that there was no appropriate observations drawn upon the culture as there were no distinguishable bacterial colonies formed upon the nutrient media. However in few culture plates containing culture of cow dung ash treated sample, certain colonies were undefined, observed but were innumerable. The result of this parameter was not satisfactory and any valid remark could not be drawn from it, in terms of number of colonies.

As per this work, the effectiveness of cow dung ash in improving water quality for several standard parameters was analyzed successfully. These tests were performed after treatment with different dosages of cow dung ash with provision of 24 hours contact time.

5. Interpretations

In the determination of Hardness, Turbidity, COD, and BOD, it was observed that there was increase in the reduction of these parameters with increase in the dose of cow dung ash, but with further increase in the dose, the reduction decreases. This was in accordance with the work done by Prachi S *et. al*., (2017), Ajinkya T. *et al*., (2019), and is very much relevant. Unexpected and contradictory result to the previous researches was obtained in the analysis of TDS, where the recorded data shows initial increment in TDS for 2 gm/L ash treated sample, similar value for 4 and 6 gm/litre, and again increased values for 8 and 10 gm/L ash treated sample.

6. Implications

In terms of new insights, the present study also aimed to explore feasible and handy alternative to the centrifugation process done upon contact time of sample with cow dung ash. Therefore the implication of filtration technique to separate treated water was accepted. This could be relevant in rural areas with ease.

7. Limitations

There has not been any significant research on the disposal of used cow dung ash after the adsorption of pollutants or contaminants.

8. Recommendation

Its reusability in any other way is still unknown and need further research. Disinfection property of cow dung ash should be researched upon more so as to find its efficacy in some other important parameters in microbial studies.

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