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FEASIBILITY ANALYSIS OF ENERGY GENERATION POTENTIAL FROM ANIMAL WASTE ELECTROLYSIS

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ABSTRACT

Everybody is searching for a power source that is easily available and safe to use. The world is shifting from conventional sources of energy to non- conventional sources of energy. But the non- conventional sources also have their own limitations. Hence people around the world are also trying to turn waste into useful energy. This project is one such example where the waste from the animals is turned into useful energy. Basically the attempt is to replace the conventional acid batteries to bio-battery. This is done by replacing the conventional electrolyte (Sulphuric Acid) to biodegradable and natural electrolyte (Cow Urine + Lemon/sulphuric acid). The battery works because of the little bit acidic nature of the animal urine. Also apart from direct electrolysis we can also extract hydrogen gas from urine and then use it. In both the cases we successfully convert waste into best

KEYWORDS: Animal urine, Cow urine, Electrolysis, Electricity, Renewable energy, Energy from waste, Green Technology.

I. INTRODUCTION

Energy can neither be created nor be destroyed. It can only be transformed from one form to another." – First law of thermodynamics. This famous law, also known as law of conservation of energy is rarely understood deeply. It clearly and loudly states that whatever exists in this universe is a form of energy and one must not cease to believe that this energy can be reused and has every potential to be useful to mankind.

Seeing the rate of development of human race, it is clear that the world is going to face the energy crunch soon. All our reserves of coal and petroleum will be finished in near future. What will be the basis of our survival then is an important question in front of *homo-sapiens*. The alarming rate of depleting conventional resources has led for the search of some backup or rather the replacement. Human race has found a replacement in the form of non-conventional energy. This energy includes energy from wind, water, sun etc. But the biggest drawback of these non-conventional energy sources is that they have their own limitations which prohibit them from being used everywhere and all the time. If this is the scenario, where will people living in rural areas look up to. Spending life in darkness has become their fate. Is there any way or any hope by which they also can spend illuminated nights?

This is where the study under this project comes into picture. This study throws light onto something which has been neglected till date. Not many people look up to this option as a source of energy. They neglect it thinking it to be a waste. But this waste can do big wonders for those who have left all the hopes to illuminate their homes and hence their lives.

In the face of depleting oil and coal reserves, the search for alternative sources of fuels has been intensified more than ever before in the history of mankind. Aside energy security concerns, issues of climate change as a result of the emission of carbon dioxide (CO2) and carbon monoxide (CO) and other harmful compounds associated with the use of fossil fuel have also been one of the driving forces in the search for alternative sources which are environmentally friendly and sustainable.

The use of waste as a source of energy is not a new concept but has always kept a low profile in presence of rich and readily available conventional sources and also because of the absence of proper technique to utilize it. Aside economies of scale which favoured petroleum and coal derived energy subsequently, other factors have

also hampered the use of waste as useful source to extract energy including the lack of proper technology and also the lack of knowledge that waste can be converted to some useful product. All these factors have been observed to have a negative impact on the mankind as we are longing now to get cleaner and safer sources of energy and which can have a far reach to the masses. A possible remedy proposed by many authors is to extract best from the waste. This is expected to cut down on cost of energy, improve the conditions of poor who cannot afford electricity from grids and also reduce the pollution as a by-product of power generation. Although clarifying again, this best from the waste cannot replace the existing use of resources completely but can definitely take off the load from them and who knows what lies in the future!!!

II. LITERATURE REVIEW

Nandagaolil Y. G. et al [1] states that the potential of India to be a global technology leader is very high. The Indian economy is seeing the growth at the rate of around 8.5-9.5% per year. The Indian industry has also become globally competitive in several sectors and can increase its global market share. A critical factor in this will be the success of the system of renewable energy sources in India. The objective of this study is to review the management of the supposedly most wasteful thing that exist on the earth, i.e., animal waste.

Today there are many countries of the world where work is on to generate the best technology to tap the maximum out of the renewable energy sources. When we say something is waste it does not signify that the thing is a waste. It only throws light on the inability of the humans to develop such a technology that can convert the existing waste into some useful energy. As is clearly mentioned in the first law of thermodynamics that energy can neither be created nor be destroyed, it can only be transformed from one form to another.

According to Allen R. M., Bennetto P. et al [2] the live stock sector is one of the biggest contributors of greenhouse gases in the world. This sector is responsible for nearly 18% of total greenhouse gas emission. Angenent L. T. et al [3] found that the cattle raised for meat and dairy account for nearly 65% of livestock emissions as well as releasing 100 other polluting gases including 65% of all the ammonia in the atmosphere.

According to Bilcan A., LeCorre O., Delebarre A. et al [4] a global advocacy group on water and sanitation, 6.34 crore Indians are living without access to pure drinking water. This is the largest number in any country. Bond D. R., Holmes D. E., Tender L. M., Lovely D. R. et al [5] also said that only 1.678 crore rural households – 16% of the total- have access to piped water.

The energy crunch can be understood by this also that Chaudhuri S. K., Lovely D. R. et al [6] has reportedly developed a low cost wind turbine that can generate 3-5 kW hours of electricity daily. The turbine which is the size of the ceiling fan, costs just Rs. 50,000/.

Delaney G. M., Bennetto H. P., Mason J. R., Roller S. D., Stirling J. L., Thurston C. F. et al [7] have developed a new material that can be used to cool houses or power plants without using any electricity or water. The thin material, resembling an aluminium foil can manipulate the properties of the light while allowing objects beneath it to passively radiate heat to cool off. The super material could bounce 96% of the sunlight.
Katz E., Shipway A. N., Willner I. et al [8] have completed an advanced solar energy project on the island of Ta'u in American Samoa. It can power the entire island with a 1.4 MW solar array coupled with a 6 MW storage system. It can power the island for three full days even without sun. For decades, the island has been dependant on diesel generator, which gobbles up over 1,00,000 gallons of fuel every year.

All these happening around the world are for clean, green, cheap source of energy and so is this project.

III. RESEARCH METHODOLOGY

Apart from the review of various journals from different authors on utilising the waste to make usable energy particularly electricity, the study progressed over basic tools such as observation and data from the internet, different media etc.

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We can sum up the methodology used in this study under the given three points:

1. **Sampling analysis:**
   We took our sample for analysis from 10 different cows. The cows were from different farms in Badlapur City. The method used for sampling is Purposive sampling (also known as judgment, selective or subjective sampling). It is a sampling technique in which researcher relies on his or her own judgment when choosing the material in the study.
   Purposive sampling is used in the research with the sample of one already established and experimented material and the other on which the tests needs to be done along with the already present.
2. **Sources of Data Collection:**
   The point of data collection has been mainly the various dairy farms in Badlapur which keep different breeds of cow. For the purpose of our study, we took around one litre of urine from each of the ten cows.
   The Primary data is collected by observation and informal discussions and Secondary data are collected from various journals and records. The documents and records are taken from trusted journals, official websites, print media etc. The informal discussions are done with the persons who have some knowledge of the field.
3. **Method of Data Processing:**
   Although we tried to use Taguchi method from DOE but this method was not apt for our experiment because this method is used basically in Production where different process parameters come into picture and we need to get the optimum output. The data is analyzed for normality and linearity so as to prepare the same for statistical analysis.

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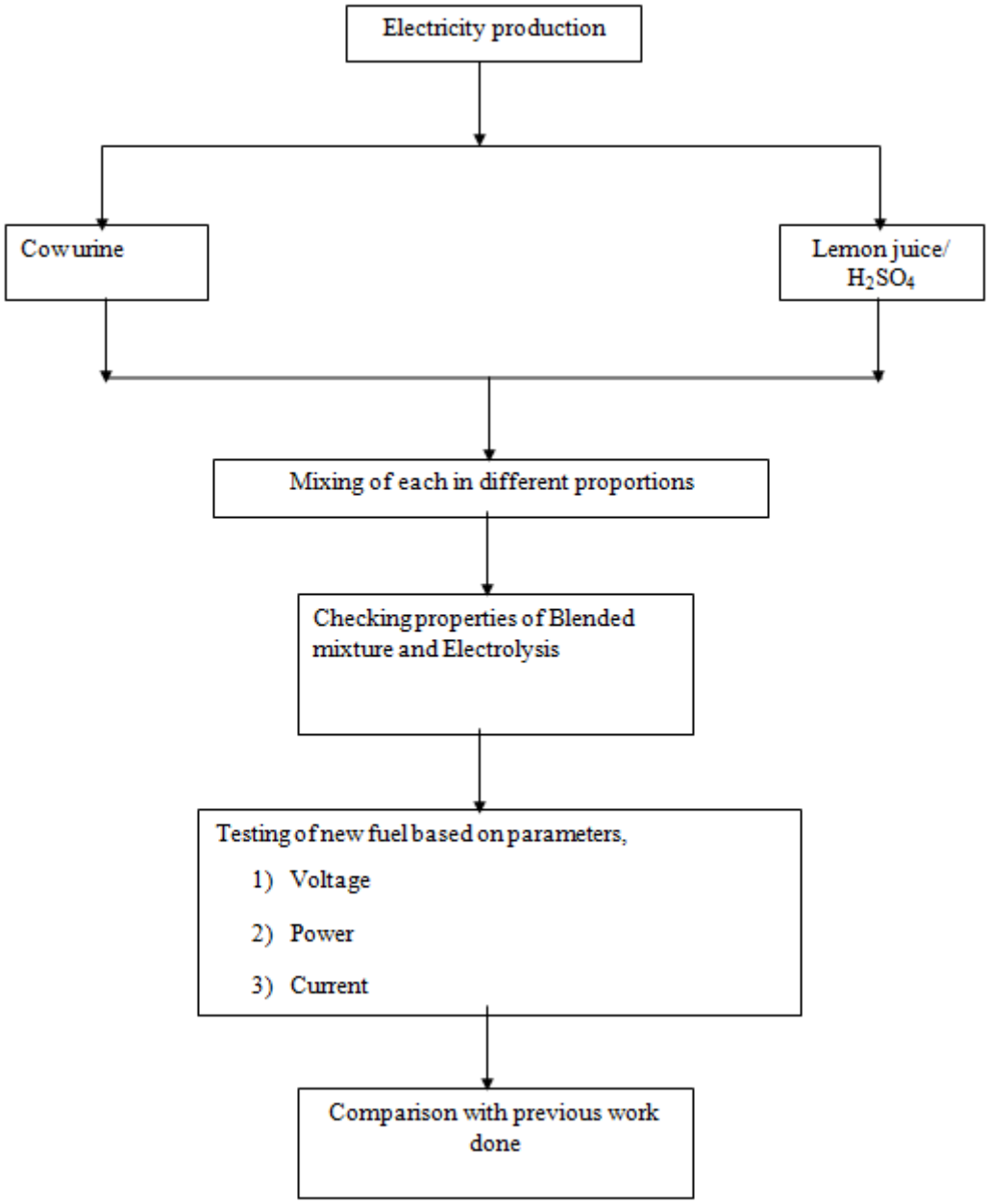
The research methodology is indicated in the following flow chart.



Flow chart of Research Methodology

IV. RESEARCH OUTCOME

Keeping all the work done till date by different people from around the world, we tried to take it a step ahead with some different approach. The aim of this study is not just to test the already done work but to check if we can increase the efficiency of the urine battery. With this study the focus is to bring out the best from the waste. This is also important in the context that conventional sources are running out of supply and sooner will be exhausted while full load will come on non-conventional sources. Hence to share that load and to ensure that the power reaches to masses, this is important.

The work we have done is presented below:

In our initial experiment we tested the cow urine alone and found out following results-

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Table 1: Volume of cow urine and corresponding voltage

Sr. No.	Only Cow Urine	pH	Voltage
1.	100 ml	6.4	0.16 V
2.	200 ml	6.4	0.31 V
3.	300 ml	6.4	0.51 V

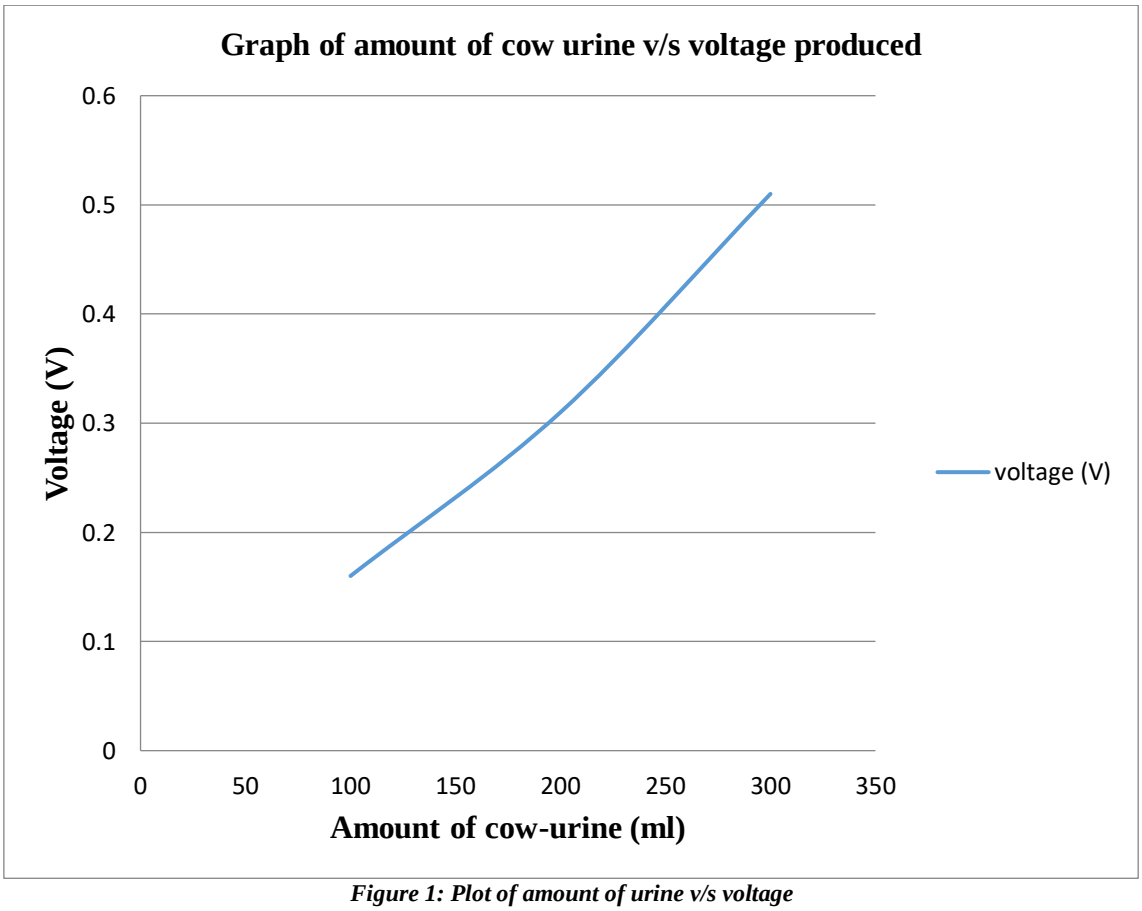

Figure 1: Plot of amount of urine v/s voltage

Again we tested the lemon juice alone and found this result-

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Table 2: Volume of lemon extract and corresponding voltage

Sr. No.	Only Lemon Juice	pH	Voltage
1.	50 ml	2.5	0.16 V
2.	100 ml	2.5	0.33 V
3.	150 ml	2.5	0.50 V

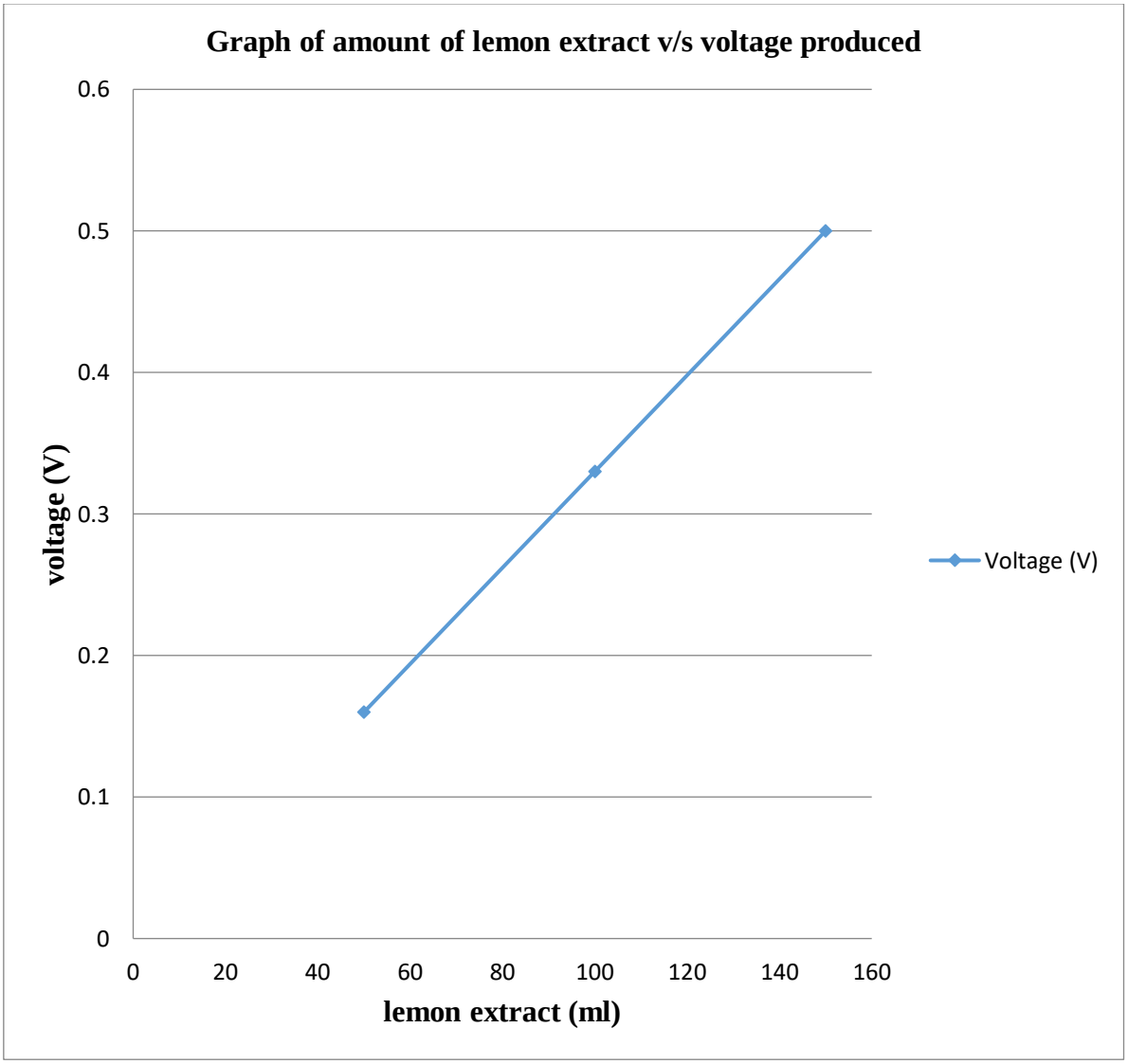

Figure 2: Plot of lemon extracts v/s voltage

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Figure 3: Experiment with lemon extracts to check the voltage produced

These positive results allowed us to go on further and blend the cow urine with the lemon juice and get the optimum volume.

During this experiment accidently we came across one more possibility. In an empty battery we poured the cow urine and saw the voltage shoot up abruptly. On analysis we came to the conclusion that the battery was not washed completely off the acid. Hence the traces of H_2SO_4 of the battery and the cow urine mixed together gave us the following result.

Table 3: Blend of cow urine and H_2SO_4 and corresponding voltage.

Sr. No.	Cow-Urine with traces of H_2SO_4	Voltage
1.	50 ml	0.31 V
2.	100 ml	0.61 V
3.	150 ml	0.92 V

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Figure 4: Experiment with cow urine blended with H_2SO_4 to check the voltage produced

Although this experiment is yet to be done formally with known quantities of the acid but the fluke has given a hope of some better results. If this experiment succeeds, there are chances that we can try batteries with not complete volume of acid in it but with a mix of cow urine which will make batteries better than they are now in context of their safety to environment and to the living beings.

The data collected, validate the hypothesis and the following contributions are expected from the study.

1. The study provides an alternative source to try our hands on.
2. It gives and outline by comparing the currently used sources of energy and the source which is not even thought about.
3. It provides a choice of one more source of energy to tap and fill in the gap between the supply and the demand of energy.
4. It provides a useful basis for the new technology to emerge and extract the hidden energy which is mostly left unused.
5. It provides a reference for various future experiments to be held in this field.
6. This study gives a chance to re-think the human reach in technology and work on the tools to tap the hidden potential within the so called waste.

V. CONCLUSION

From the above study and experiment, we can conclude that the potential energy stored in the animal waste is immense. The only need is to bring it out and utilise it. This methodology is not valid just for cow as in the case of this particular study but can also be utilised for any animal waste including human. Although the result may vary slightly but definitely we will get the result. If used in public urinals or in residential and official buildings this can lead to the production of remarkable amount electricity.

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