

Generation of Electricity Using Cow Urine

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ABSTRACT: For healthy environment and sustainable economic growth we need clean and efficient electric power generation systems. The natural sources of renewable energy available to human are: the solar, tidal, wind, bio-gas and biomass etc. This paper introduces a new renewable source of energy; energy from cow urine that can produce electricity by electrolytic conduction. The alkaline nature of fresh cow urine acts as a good electrolyte liquid. The system works like a conventional battery system. However, a discharged battery needs to recharge by electricity in order to reactivate it. On the other hand, cow urine based system needs only to replace old urine by fresh urine to activate the system again. As no electricity is required for charging the system, the daily available fresh urine from a dairy farm could be a possible source of renewable energy. In order to understand the feasibility of the source, we built a car battery size prototype that can hold approximate five liter of fresh urine as electrolyte. We used similar and equal number of electrode that a typical car battery does. We measured the performance of the source with loads and observed its outputs. The details of the system and its performances have been described in this paper.

KEYWORDS: Cow urine, Renewable energy, Green technology, Sustainable growth.

1 INTRODUCTION

Global demand for energy has risen inexorably in the last 150 years in step with industrial development and population growth. Hunger for energy is predicted to continue to rise, by at least 50% by 2030 [1]. Developing country like Bangladesh is seeking a tremendous scarcity of electricity generation and it is of incredible importance to cope up with the overwhelming demand of electricity. So if we devise self-sustainable energy production via simple yet recyclable way that would be helpful to reduce the inevitable scarcity. As natural resources can be utilized in a more efficient manner, we planned to utilize cow urine as an alternative source of electricity generation to lighting the domestic animal farm & other purposes. We can build some urine based plant to facilitate backup power system which will help the rural people immensely. The natural sources of energy available to man include; the sun, fossil fuels, flowing water energy available to man include; the sun, fossil fuels, flowing water and wind. Therefore, to make the decision on which of the aforementioned sources to use, a careful process of consideration has to take place. These considerations include: Availability, Extraction costs and feasibility, Conversion costs, Efficiency, Sustainability, and Economic implications. Research efforts for developing alternative sources of energy for electricity generation, has heightened [2-3]. The most desirable source would be one that is non-pollutant, available in abundance, and renewable, and can be harnessed at an acceptable cost in both large-scale and small-scale systems. The most promising source satisfying all these requirements is cow urine, a natural energy source. Process generation of electricity from cow urine shown fig-1

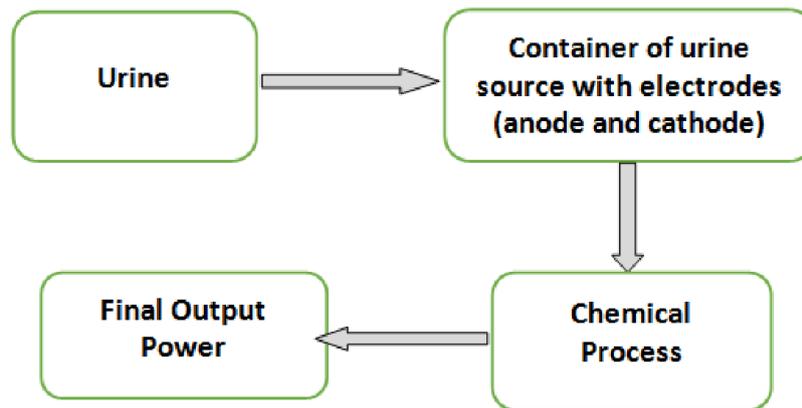


Fig.1. Block Diagram of proceeding of alternative source mechanism

2 WORKING PRINCIPLE

An anode is an electrode through which electric current flows into a polarized electrical device. The direction of electric current is, by convention, opposite to the direction of electron flow. In other words, the electrons flow from the anode into, for example, an electrical circuit. A commonly used mnemonic is ACID (Anode Current into Device). [4]

A cathode is an electrode through which electric current flows out of a polarized electrical device. The direction of electric current is, by convention, opposite to the direction of electron flow thus, electrons are considered to flow toward the cathode electrode while current flows away from it. This convention is sometimes remembered using the mnemonic CCD (cathode current departs).

The chemical reactions in this source cause a build-up of electrons at the anode. This results in an electrical difference between the anode and the cathode. We can think of this difference as an unstable build-up of the electrons. The electron wants to rearrange them to get rid of this difference. But they do this in a certain way. Electrons repel each other and try to go to a place with fewer electrons. In this system, the only place to go is to the cathode. But, the electrolyte keeps the electrons from going straight from the anode to the cathode within the battery. When the circuit is closed (a wire connects the cathode and the anode) the electrons will be able to get to the cathode. This is one way of describing how electrical potential causes electrons to flow through the circuit. However, these electrochemical processes change the chemicals in anode and cathode to make them stop supplying electrons. So there is a limited amount of power available in output. When we recharge a battery, we change the direction of the flow of electrons using another power source, such as solar panels. The electrochemical processes happen in reverse, and the anode and cathode are restored to their original state and can again provide full power. Fig 2 shows the configuration of electrodes.

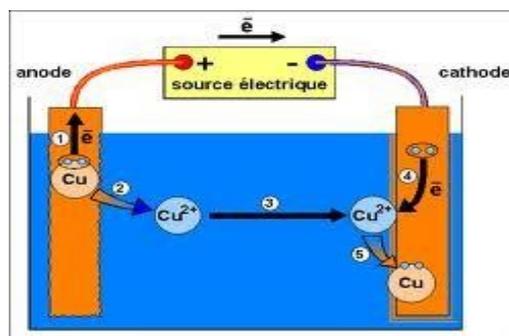


Fig.2. Diagram of a system which act as electrolyte

3 CHEMICAL PROCESS

The source we made from cow urine through is mostly evaluated by chemical composition of urine. Actually, from chemical composition we perceived that when copper and zinc plates come in contact with uric acid movement of electrons begins, generating electricity.

3.1 URIC ACID

Uric acid is a heterocyclic compound of carbon, nitrogen, oxygen, and hydrogen with the formula $C_5H_4N_4O_3$. It forms ions and salts known as urates and acid urates such as ammonium acid urate [5]. Chemical Bond of Uric acid is given below:

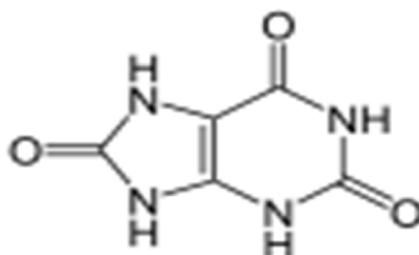


Fig. 3. Bond of uric acid ($C_5H_4N_4O_3$)

3.2 CHEMICAL CONCEPT OF ELECTRICITY GENERATION

Uric acid is a hetero cyclic compound of carbon, nitrogen, and hydrogen with the formulated of $C_5H_4N_4O_3$. [6] Copper with the presence of water will be reacted with Uric acid. Then oxidation reaction will be happened as a result uric acid will be oxidized by Cu and produced Cu urate. This is basically a salt solution and can be made ionic bond then this bond will be contacted with zinc plate. So, from this reaction it can be realized that, when copper and zinc plates come in contact with uric acid movement of electrons begins, generating electricity.

4 METHOD & MATERIALS USED IN URINE BASED POWER GENERATION SYSTEM

For the purpose of the renewable energy we collected several amount (liters) of urine for the primary test & put two different plastic pots containing half liter each & connect those using wires & electrodes; we measure the voltage as 1.1V to max 6.2V using multimeter where connecting probes into the different poles of the electrodes. The electrodes are made of zinc & copper respectively which acts as a battery cell. Connecting wires to the electrodes we found low voltage from urine after a while. We also connected two metal pins to the solution as cow's urine so that electron can flow from zinc plates to copper plates as a close loop system. Several affords we did in order to bring more urine so that we can get more voltage that we found before. It is anticipated that the more volume of urine we tested the more voltage we got. For the second time testing with 2 liters of cow's urine provide comparatively high in output. There are some remarks that we noticed that while using metal pins for the close loop system, the electrolysis process starts with few delay. The fresh urine might provide much more voltage as 1V for certain cases. It is found that while the flow of electron occurs through the electrodes & those pins as well, the gradual decay of metal pin happens. As a result there needs a change of metal pins testing with four or five experiments for better output. Besides, connection of the wires must be good enough to get the desire output. Observing the preliminary test, we think off the basic circuit diagram about how the process working. The equivalent circuit design of our system is given below in Fig. 4

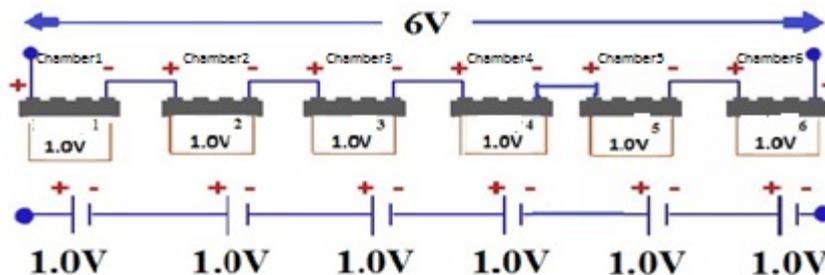


Fig. 4. Equivalent circuit diagram of urine based power generation system

According to our own system that works individually as a battery cell for each slot of container of a battery. In practical, situation every cell gives approximately about 1V & they connected as a series combination fig 5(a) which sum up three slots provides 3V & six slots provides 6V. The power varies according to the series combination of the battery & the current varies because of the condition of electrodes as well as urine. Total four loads (LEDs) are connected parallel to close the whole loop of the battery Fig 5(a) Continuous dissipation of energy cause the cow urine power tends to almost zero Fig 5(b) & Fig 5 (c).



Fig. 5. (a) Practical set up of the System for Three Slot

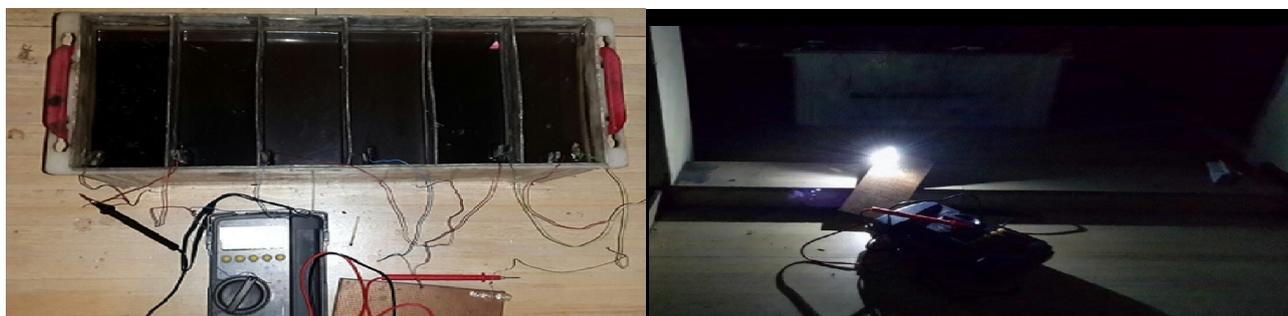


Fig. 5. (b), (c) Practical setup of System for Six Slot

5 EXPERIMENTAL RESULT & ANALYSIS

In this research, the cell technology is experimented with different terms which included volume of urine, voltage, current and power with respect to time which inscribed in different table with graph. Variations of load are applied so that the behavior of the system can be well understood. Several observations are taken. According to (table) it is clear that the system dissipate energy due to continuous connection of load. The experiment is performed with six segments where volume of urine changed from three liters to six liters & electrodes are kept unchanged.

In our research we examined different measurement with volume, voltage, current and power with respect to time which inscribed in different table with graph. In this project we have taken various data from various observations.

Table 1. Experiential data of the implementation for 4 liters of urine and data were taken 24 hours interval.

Observation	Time(Hour)	Volume(ltr)	Voltage(V)	Current(I)	Power(W)
1	24	4ltr	4.26V	287 mA	1.222W
2	72	4ltr	4.15V	228 mA	0.946W
3	96	4ltr	4.13V	221 mA	0.912W
4	144	4ltr	4.11V	217 mA	0.891W

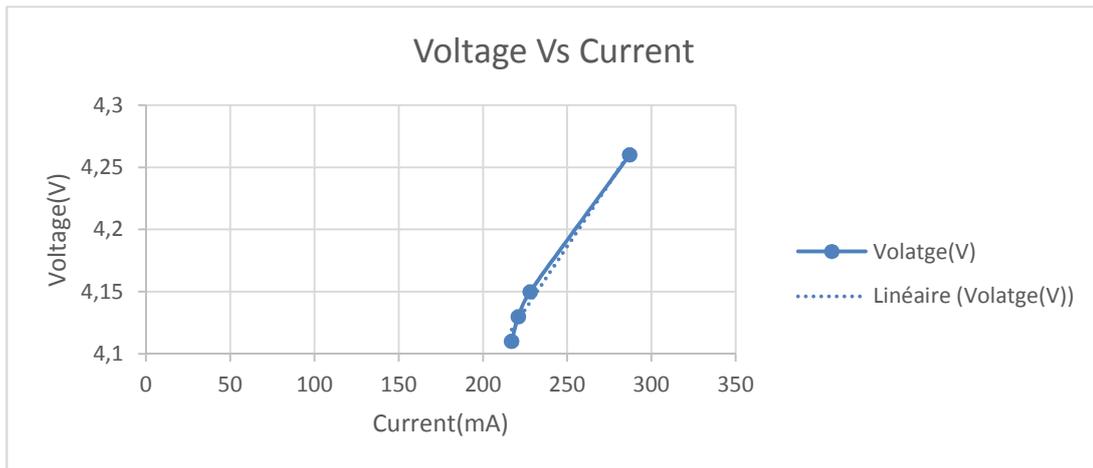


Fig. 6. Four liters of urine & new electrodes with load connected decreases the voltage & current

Table 2. Experiential data of the implementation of 5 liters of urine and load was connected continuously to check the system strength

Observation	Time (Hour)	Volume (ltr)	Voltage (V)	Current (I)	Power (P)
1	24	5ltr	6.00V	187 mA	1.122W
2	48	5ltr	5.62V	150 mA	0.843W
3	96	5ltr	5.32V	112 mA	0.595W
4	144	5ltr	5.16V	47 mA	0.242W

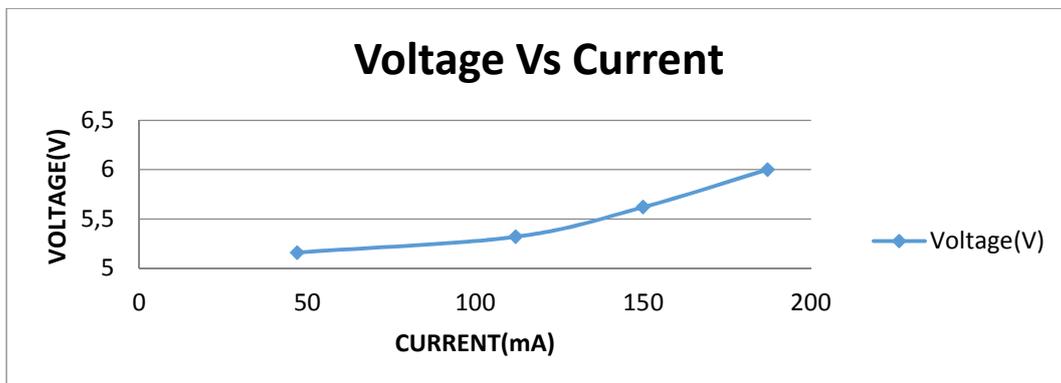


Fig. 7. V-I curve for Five liters of urine (Power is increased with respect to increase of urine quantity and it is observed that increasing the liters of urine can able to produce more energy)

Similarly several experiments are performed with different interval of time to understand the system response for every week. The power vs hour curve gives a brief idea of the system. From above experimental data it is clear that increasing

volume of urine can increase the voltage but with respect to time it will be downward because of decaying of electrodes and continuous dissipated of power. In figure 8 illustrated different experiment which shows the output power vs hour and also shows the behavior of movement. Different characteristics of different experiment curve shown in figure 8.

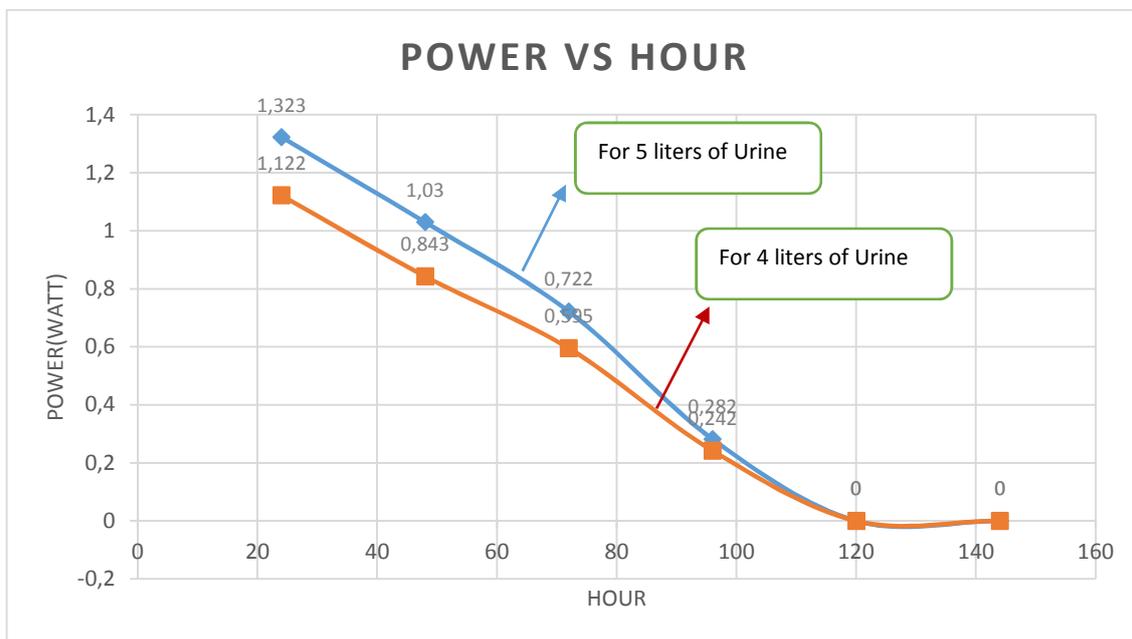


Fig. 8. Different volume of urine & unchanged electrodes with load connected where decreases power with respect to time. (From above graph it can be optimized that when urine will give sufficient amount of energy, then again chamber need to be filled with fresh urine so that it can produce energy likewise)

From the power vs hour graph, it can be conclude that is every battery cell technology has different factors & performance parameters depending on operating power, its chemistry & legibility. It's obvious that every time for every experiment fresh urine & fresh electrodes provides max output power depending on the volume of urine. Continuous flow of electrons & electrode decays causes the system to decreases current which is proportional to voltage. As a result power decreases with respect time gradually which is very obvious in practical cell technology system. It is clearly indicates that cow urine can be the alternative renewable source for generating electricity. From experimental data and analysis shows that higher quantity of urine and best quality of electrodes can produce higher and strong output which strength will be the best as well as longibity will be higher.

6 CONCLUSION

From the experiment we have demonstrated a small cow urine based power generation system. The performance of the system is satisfactory. Here, to understand the feasibility of the system needs to build a longer scale of the system & test it for a longer period of time. Moreover options, processes and systems may vary to use cow's urine based plant for households as well. In our researches we only worked with very smaller quantity of urine which only 5 liters and electrodes were old and we got almost 1.5 watt. Our aim is to work with large quantity of urine as well as larger size of own design electrodes to establish a power plant which will be able to mitigate the demand to a substantial extent in future. In order to prosper and thrive, energy consumption must be proportional to its supply and storage capacity while currently we are suffering. Hence any kind of alternative like this will make a significant change to that situation. So we expect our local government to make an active effort to invest and endorse in such research activities.

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