

# Generation of Electricity using reverse electrolysis of urine

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## ABSTRACT

The conventional process of generating electricity is very costly affair, requires bulky infrastructure, maintenance and by products harm environment Organic materials such as begasse, dung, kitchen waste, human waste and many more have potential to produce clean energy. For example, human urine is abundantly available but goes wasted The conventional batteries require recharging after discharge but this urine battery needs only fresh urine to get reactivate. As no electricity is required to recharge, the urine battery can be a solution to energy crises. The urine battery requires less space, does not pollute environment and cost effective. In this research paper I have explained the design, construction and working aspect of urine battery which uses human urine and produce electricity without any harmful or toxic by product like ash, smoke or other toxic gases like nitrous oxide, Sulphur.

## Keywords

Urine, Reverse electrolysis, Urea, Electrolytic cell, Electricity, Electrodes, LED

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## 1. URINE—COMPOSITION

Urine, an aqueous solution contains large volume of water. Other ingredients are potassium, sodium, urea, chloride, creatinine, and other dissolved ions, inorganic and organic compounds. Any other constituents in urine are symptom of disease. Color of urine is normally pale yellow which is due to a pigment called urochrom. The color change is normally seen when a person takes druglike B-complex. The second property is smell which is due to urinol and strong smell in urine appears due to urea changes to ammonia. It has also been detected that color also changes due to alcohol. The third property is specific gravity which generally lies between 1.003-1.04, making it little heavier than water. Tonicity or concentration is little hypertonic i.e. little more concentrated than water. Generally a person delivers 1.05-1.07 ltr per day but it also depends on liquid intake, physical exercise and di-uretic substances like tea, coffee which increase output amount of urine. The chemical composition of urine consists of 95%-96% water, 2%

urea(nitrogenous waste), and other things are potassium ions  $K^+$ , phosphate and oxalate.

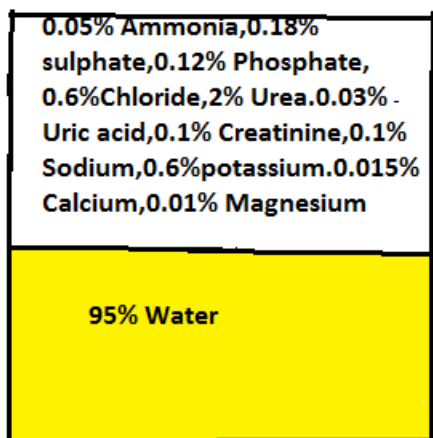


Fig. 1 Urine composition

## 2. WORKING PRINCIPLE OF SETUP

Electrolysis is conducted in non-conducting vessel, called electrolytic cell. Two metal plates or wire or graphite rods called electrodes immersed in the electrolyte through which current flows. An electrolyte in aqueous solution or in molten state dissociates into free mobile ions i.e. cations and anions. The positively charged electrode to which negatively charged particles i.e. anions are attracted is called anode and positively charged particles i.e. cations attracted to the electrode which is positively charged, called cathode. The number of positive charges is equal to the number of negative

charges in the solution is in equilibrium (electrically neutral). The cations gain electrons from cathode and anions lose the electrons to the anode and this transfer of electrons is prevented by the electrolyte so these electrons flow from anode to cathode through an external wire which is called current. The products of electrolysis are formed at the cathode and anode itself since the exchange of electrons take place at the surface of the electrodes.

## 3. METHODOLOGY

When electrodes, made up of copper and zinc, are immersed into the urine which acts as electrolyte, the chemical reaction creates opposite charges on copper and zinc but the urine prevents charge from flowing. However, when a LED is connected in the circuit, the charge flows through and powers LED.

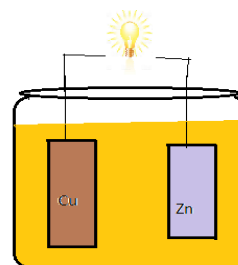


Fig.2 Urine battery

Urine contains many electrically charged atoms called ions which enable electricity generating chemical reaction to take place

in urine battery. Bodily fluids like tears, saliva, semen and blood also easily work to activate urine battery.

I collected fresh human urine and prepared three urine batteries containing equal amount and used two electrodes of each copper and zinc of area measuring about  $75.00\text{cm}^2$  as shown below. I found voltage between 1.15-1.7. Current and voltage can be increased by increasing number of batteries and arranging them in parallel and series combinations respectively. I used a 1.5v LED to light as shown in fig11.

At the end of the process, I found no harmful or toxic by-product, proving that this process of generation electricity is safe to our environment.

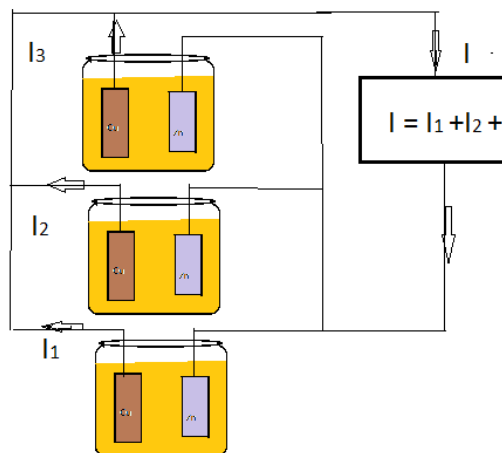


Fig.3 Parallel Combination of Setup

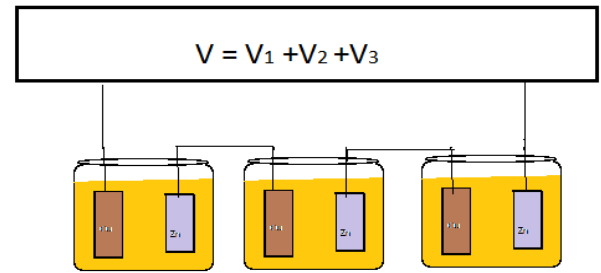


Fig. 4 Series Combination of Setup

#### 4. ANALYSIS OF RESULTS

During the experiment, several observations have been taken. The experiment is performed with human urine& electrodes are kept unchanged. I examined different measurement with volume, voltage, current and power with respect to time and drew following graphs from the observations.

On the basis of experiments and tests, initially urine battery was delivering high voltage but over the time period, I found low voltage and this kept decreasing.

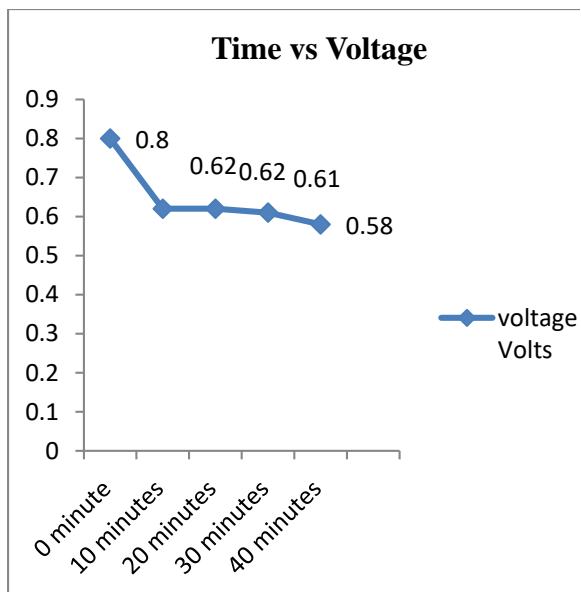


Fig.5 Time vs Voltage

Initially, I obtained higher current but over the time period I found it decreasing as shown below.

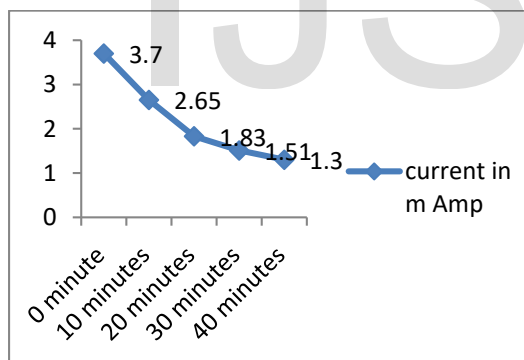


Fig. 6 Time vs Current

Since power of battery depends upon voltage and current, I found it to be decreasing over the time period

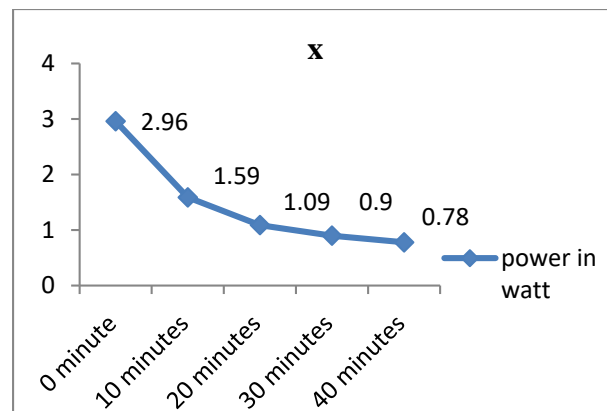


Fig.7 Time vs Current

TABLE-1

Observation	Time (min.)	Volume (ml)	Voltage (V)	Current (mAmp)
1	00	250	0.8	3.7
2	10	250	0.61	2.65
3	20	250	0.60	1.83
4	30	250	0.60	1.51
5	40	250	0.58	1.30

Area of each electrode = 75.00cm<sup>2</sup>

## 5. PICTURES FROM EXPERIMENT

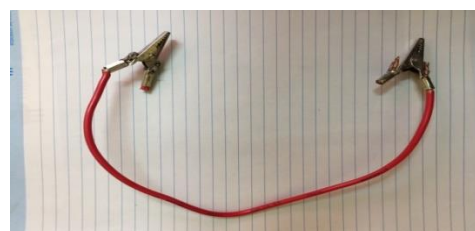


Fig-8.1 Connecting Wire used to connect electrodes



Fig-8.2 Copper electrode



Fig-8.3 Zinc electrode

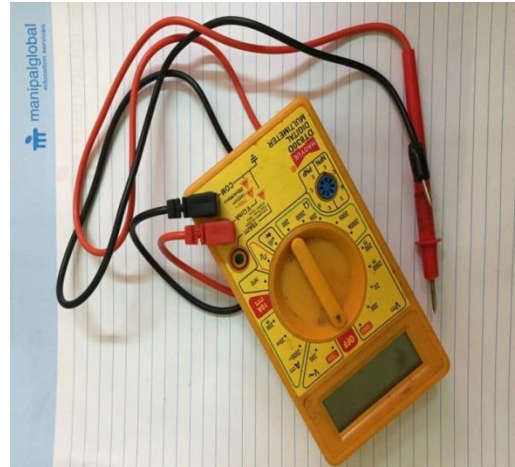


Fig-8.5 Device used to measure voltage and current of the system

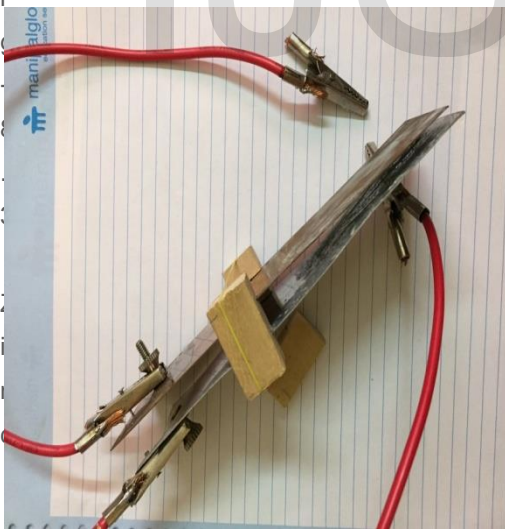


Fig-8.4 Set of electrodes with connecting wire

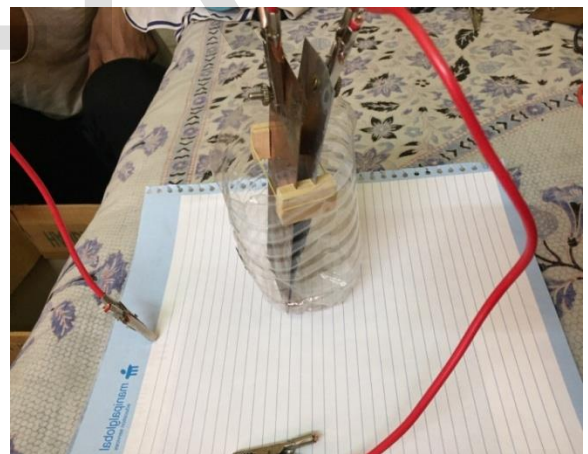


Fig-8.6 Urine battery container

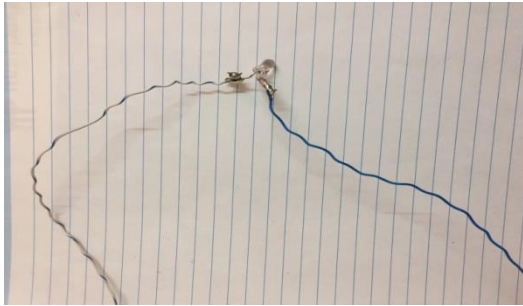


Fig-8.7 LED used to deliver output



Fig.8.8 Potential difference of 2.81V from Alovera plant



Fig.8.10 Urine battery powering a bulb



Fig-8.9 One hour old human urine giving potential difference of 0.71V

## 6. CONCLUSION

The urine-based electric generators can generate enough energy for a smart phone to text, browse the internet and make short phone calls, but, eventually these could help power houses, buildings, and maybe even entire off-grid villages. From This experiment it has been demonstrated that human urine can be a source of pollution free energy which is need of hour. This can be implemented on large scale in rural areas and public places with the little efforts from government.



The biggest hurdles are cost, scale, and output. Allowing the huge number of toilet/fuel cell combinations out in the field is itself a huge logistical problem along with the cost involved.

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