

URINE POWERED BATTERY AND IT'S UTILIZATION WITH EXPERIMENTAL STUDY

RAVINDRA YADAV, NISHANT SINGH VERMA, RAHUL MAKWANA

M. Tech student in Thermal Engineering, Laxmi Narayan college of technology Indore. Email: ravindravadav22@gmail.com

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ABSTRACT

This paper describes the power generation from urine, and able to run various d.c. electrical equipments. It provides a lot of detail into the challenges of modifying the chemical cells by using urine as electrolyte. The design of urine powered battery basically works in principle, of electrochemical cells which is used to generate 1.6 volts (approx.). Also shows the characteristic curve between the human urine and cow urine on various parameters. And the application of urine powered battery. This battery is future changeable according to the requirement.

Keywords: *Battery, Electrical equipments, Electrochemical, Cell, Urine*

INTRODUCTION

August 17, 2005 – Scientists at the Institute of Bioengineering and Nanotechnology (IBN) in Singapore have developed the first urine-activated paper battery for use in biochip devices.. While researchers around the world race to produce ever smaller and more effective diagnostic biochips that can be mass produced cheaply, they have been unsuccessful in finding a power source that is as small and as cheap to fabricate as the detection technology itself. IBN's latest invention solves this problem by using the urine test sample as the power source for the testing device. The chemical composition of urine is widely used to test for signs of various diseases and as an indicator of a person's general state of health.

For example, the concentration of glucose in urine is a useful diagnostic tool for diabetics. According to IBN Principal Research Scientist Dr. Ki Bang Lee, who heads the team, a drop of urine placed on the battery will generate enough electricity to power a biochip device, enabling the latter to analyze the urine sample for specific disease biomarkers.

"We are striving to develop cheap, disposable credit card-sized biochips for disease detection," said Dr. Lee. "Our battery can be easily integrated into such devices, supplying electricity upon contact with biofluids such as urine."

IBN's battery unit comprises of a cathode sandwiched between an anode and an electron-collecting layer. This multi-layer unit is then held in place via a lamination process, which involves passing the battery unit between a pair of transparent plastic films through a heating roller at 120°C. The final product has a dimension of 60 mm x 30 mm, and a thickness of 1 mm. Studies have been conducted to characterize the urine-activated battery. Using 0.2ml of urine, IBN researchers were able to generate sufficient voltage to power the device and conduct effective analysis of analytes in the Biofluid (urine).

They also found that the battery performances such as voltage, power or duration may be designed or adjusted by changing the geometry or the materials used. "Our urine-activated battery would be integrated into biochip systems for healthcare diagnostic applications," said Dr. Lee. He envisions a world where people will be able to monitor their health easily at home, seeking medical attention only when necessary.

Brief history of U.P.B.

Scientists in research groups around the world are trying to design ever smaller "biochips" that can test for a variety of diseases at once, give instant results, and, crucially, can be mass produced cheaply. But until now, no one has been able to solve the problem of finding a power source as small and as cheap to fabricate as the detection technology itself.

Led by Dr Ki Bang Lee, a research team at Singapore's Institute of Bioengineering and Nanotechnology (IBN) have developed a paper battery that is small, cheap to fabricate, and which ingeniously uses the bio-fluid being tested (e.g. Urine) as the power source for the device doing the testing.

The chemical composition of urine is widely used as a way of testing for telltale signs of various diseases and also as an indicator of a person's general state of health. The concentration of glucose in urine is a useful diagnostic tool for diabetics. The lead researcher, Dr Lee, envisions a world where people will easily be able to monitor their health at home using disposable test-kits that don't need lithium batteries or external power sources.

Dr. Lee said: "We are striving to develop cheap, disposable credit card-sized biochips for disease detection. Our battery can be easily integrated into such devices, supplying electricity upon contact with biofluids such as urine."

The battery unit is made from a layer of paper that is steeped in copper chloride (CuCl) and sandwiched between strips of magnesium and copper. This "sandwich" is then held in place by being laminated, which involves passing the battery unit between a pair of transparent plastic films through a heating roller at 120 degrees Celsius. The final product has dimensions of 60 mm x 30 mm, and a thickness of just 1 mm (a little bit smaller than a credit card).

Writing in the Journal of Micromechanics and Microengineering, Lee describes how the battery was created and quantifies its performance. Using 0.2 ml of urine, they generated a voltage of around 1.5 V with a corresponding maximum power of 1.5 mW. They also found that the battery performances (such as voltage, power or duration) may be designed or adjusted by changing the geometry or materials used.

Methodology Of U.P.B.

1-Firstly we have to take 2 beakers of 1ltr each contains solution of cucl2 with molarity of 0.5 and filtered urine respectively.

2-Now for connectivity b/w both the solution we have to make a salt bridge by filter paper.

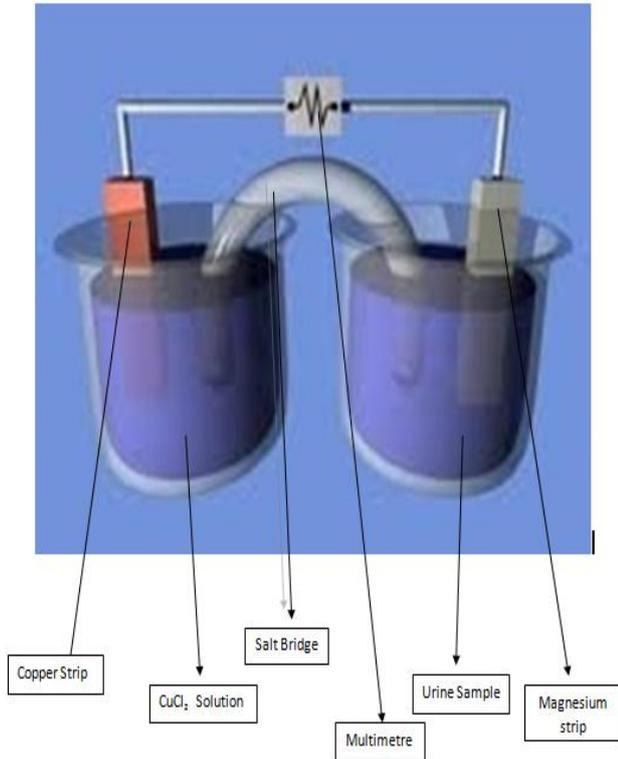
3-Now place a strip of copper in CuCl_2 solution and 5gm of magnesium into the filtered urine.

4-Now the ionization starts and electrons begin to emit.

5-Now pour both the beaker with 100ml of distilled water for getting the transformation of electron.

6-After 10 min we get the potential by the cathode and anode, by using multimeter we can visualize the voltage and current gain from the cell.

7-Now after 10 min the required voltage and current is a gain for led by making the solution dilute.



Schematic diagram of urine power battery with its setup

Experimental research

Part 1

The Statistical Data Of Electricity Generation From Urine In A Mall

The research is based on the statistical data taken from the mall treasure bazaar of Ujjain, in this we studied the whole mall about the urinary system that the discharge of human piss which is in terms of doing wastage as storage.

Table No. 2.1.1

Total Urinal toiletry	-3
No. of Urinal Basin in each toilet	-7
Total No. of Staff work in mall	-750
Total no. of people using the urinal toilet in a day.	-10000(apprx.)

CALCULATION

As we calculate,
Total no. of people using toilet = $10000 + 375 = 10375$

One person exhibit urine = 200-300 ml (approx.)
Total quantity of urine be collected = $10375 \times 225 = 2334.3$ liter
Now, 500 ml of urine generating electricity = 1.5-1.6 volt
So, if we take 50 liters of container then Electricity is generated = $50/5 \times 1.55 = 15.5$ volts
Then,
Total urine generating electricity = $2334.3/50 \times 15.5 = 723$ V

RESULT

"Hence, as we have seen if we utilize the source urine which is done by storing the urine and converting it into electricity we get approx. 723 volt/day which is enough to lighten the lamp using into urinal toilets."

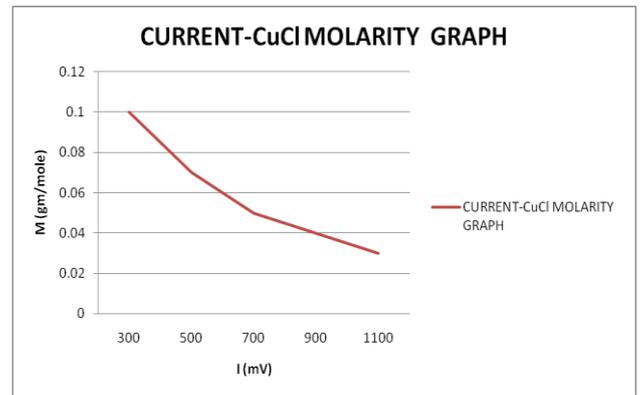
Part 2

CHARACTERISTICS GRAPH PLOTTING BETWEEN HUMAN AND COW URINE SAMPLE

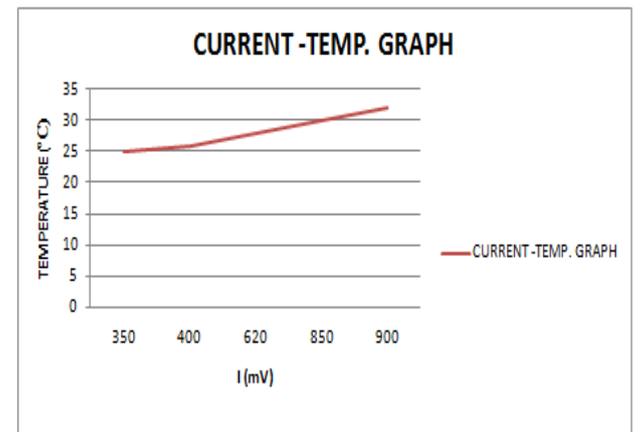
Human Urine Sample

As, we taking the human urine as an electrolyte in the urine powered battery, then, below characteristic graph is plotted.

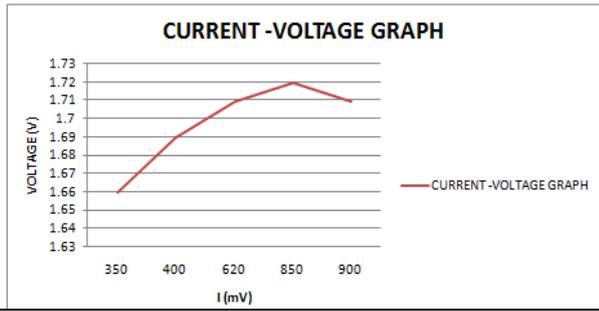
When we plot the graph between CURRENT and MOLARITY OF CuCl_2 solution, then the graph shows decrement of current when the molarity of solution decreases.



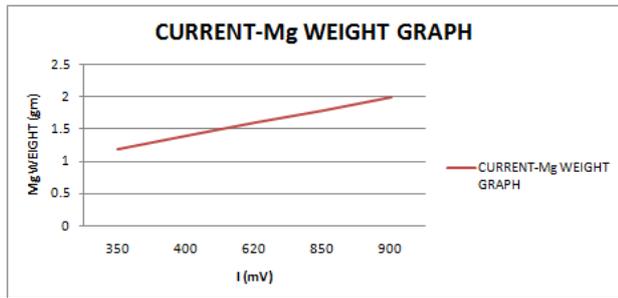
When we plot the graph between CURRENT and TEMPERATURE then the graph shows increments of current when the temperature of the solution increases.



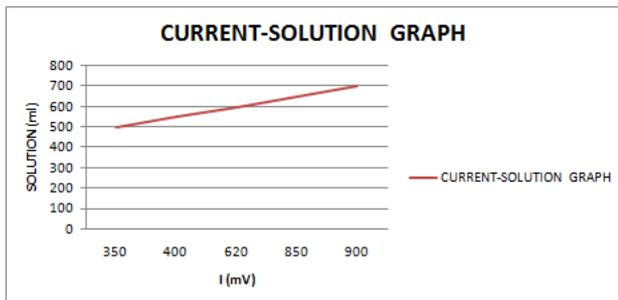
When we plot the graph between CURRENT and VOLTAGE then the graph shows first increment of current then it goes down when voltage is increased.



When we plot the graph between CURRENT and MAGNESIUM (mg) WEIGHT then the linear increment of current takes place by increasing the weight of magnesium strip.



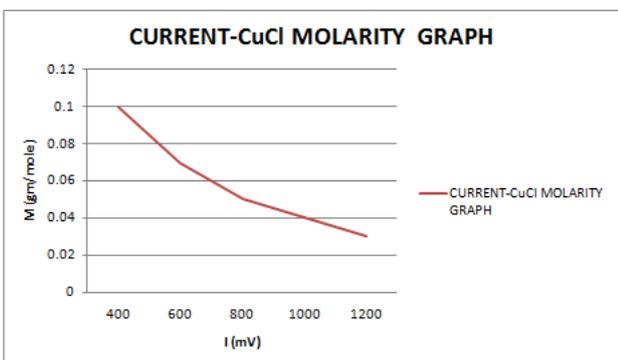
When we plot the graph between CURRENT and SOLUTION QUANTITY then the linear increment of current takes place by increasing the quantity of solution into the U.P.B.



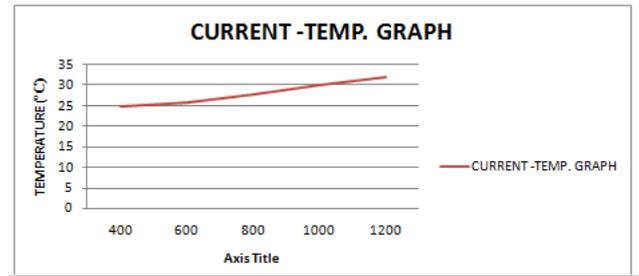
COW URINE SAMPLE

Now, we are taking the cow urine as an electrolyte in the urine powered battery, then, below characteristic graph is plotted.

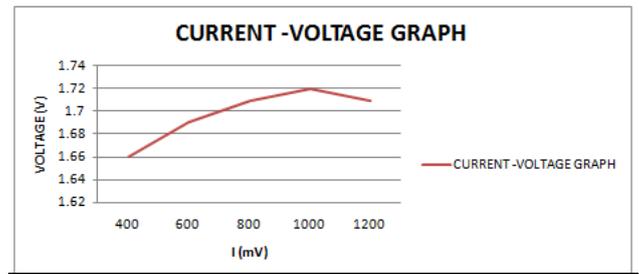
When we plot the graph between CURRENT and MOLARITY OF CuCl solution, then the graph shows decrement of current when the molarity of solution decreases.



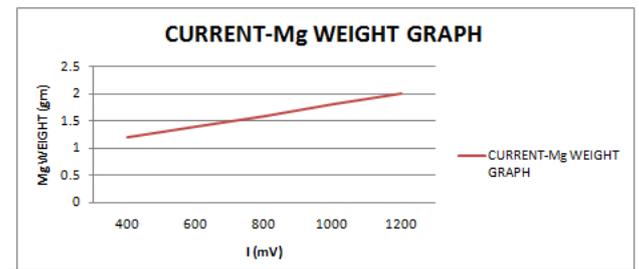
When we plot the graph between CURRENT and TEMPERATURE then the graph shows increments of current when the temperature of the solution increases.



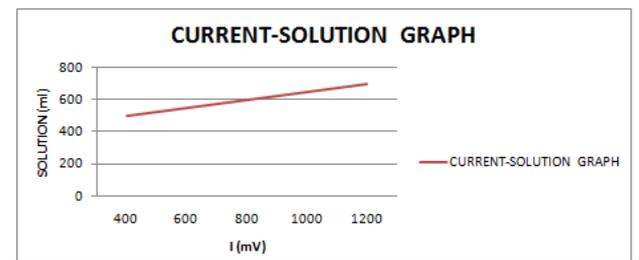
When we plot the graph between CURRENT and VOLTAGE then the graph shows first increment of current then it goes down when voltage is increased.



When we plot the graph between CURRENT and MAGNESIUM(mg) WEIGHT then linear increment of current takes place by increasing the weight of magnesium strip.



When we plot the graph between CURRENT and SOLUTION QUANTITY then linear increment of current takes place by increasing the quantity of solution into the U.P.B.



RESULT

“As we shown the characteristics graph plotted between various parameters of human urine and cow urine.

The result we get that the cow urine generate more electricity than the human urine can by using the urine powered battery setup.

Its also shows the cow urine is more efficient and reliable source of electrolyte for generating electricity than that of human urine.”

ADVANTAGES

COW Urine is very cheap source of energy.It can generate 1.5 volt to 1.5Mv of electricity as per dimensional variation of unit battery. Source can be easily available. The setup of this battery is simple as compare to other and we can get fast result than that of HUMAN urine.

DISADVANTAGES

Rate of generating electricity is very slow.

Rate of flow of electricity is not constant .

The unit of battery cell is affected by atmosphere.

CONCLUSION

"Hence, as we have seen if we utilize the source urine which is done by storing the urine and converting it into electricity we get approx. 723 volt/day which is enough to lighten the lamp using into the urinal toilets."

"As we have shown the characteristics graph plotted between various parameters of human urine and cow urine.

The result, we get that the cow urine generates more electricity than the human urine can by using the urine powered battery setup.

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FUTURE PROPOSAL & SCOPE

When this cell is connected in series of cell then it will generate more power and efficiency as well as current will increase.

When the more efficient electrolyte and metallic rod are replaced the power generation capacity will increase.

There are many applications for the biodegradable "BIOFLUID" batteries.

One day, the battery technology will be able to accomplish all sorts of things such as powering laptop, computers, television, ipod, even car.

"If these kind of power batteries plant is setup near the

Cows and buffalo shelter than these are very useful by using there urines"

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