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The Preliminary Study on DC Power Generation by Using the Dung of Elephant, Buffalo and Cow

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ဆင်ချေး၊ နွားချေးနှင့် ကျွဲချေးတို့မှ လျှပ်စစ်ဗို့အားပါဝင်မှု ပမာဏအလိုက်လျှပ်စစ်ဓါတ်အား ထုတ်လုပ်မှုကို ပမာဏလေ့လာခြင်း

စုမြင့်သန်း၊ သုတေသနလက်ထောက်–၂
ခင်မေလွင် ၊ သုတေသနအရာရှိ
သီတာချို၊ သုတေသနလက်ထောက်–၂
သစ်တောသုတေသနဌာန၊ ရေဆင်း။

စာတမ်းအကျဉ်း

ပိုးမွှားကို အသုံးပြု၍ ဓါတုစွမ်းအင်မှ လျှပ်စစ်စွမ်းအင်သို့ ပြောင်းလဲခြင်းကို ဆဲလူးလို့အခြေခံတွင် ပိုးမွှားစွဲသော လောင်စာဓါတ်အိုးဟုသတ်မှတ်ကြပါသည်။ ၄င်းစွမ်းအင်အရင်းအမြစ်သည် နွား၏အကြီးမားဆုံး အစာအိမ်တွင် အရည်အဖြစ် တွေ့ရှိနိုင်ပါသည်။ ၄င်းအစာအိမ်တွင် အမျိုးမျိုးသော ပိုးမွှားများသည် အစားအစာများဖြစ်သော ဆဲလူးလို့ စသည်တို့ကို ချေဖျက်ခြင်းအားဖြင့် ဟိုက်ဒရိုဂျင် အိုင်ယွန်(အီလက်ထရွန်) များထွက်ရှိလာစေ၍ လျှပ်စစ်ဓါတ်အား ဖြစ်တည်စေပါသည်။ ၄င်းပိုးမွှားများသည် နွား၏အစာအိမ်တွင် အရည်အဖြစ် တွေ့ရှိနိုင်သကဲ့သို့ နွား၏မစင်ထဲတွင်လည်း တွေ့ရှိရကြောင်း ၂၀၀၅ ခုနှစ်တွင် Ohio State University မှ Ann Christy က ပြောကြားပါသည်။ သို့ဖြစ်ပါ၍ ကိုးကားစာပေအရ စားမြုပ်ပြန်သတ္တဝါ နွားချေး၊ ကျွဲချေးနှင့် အသီးအရွက်စားသော စားမြုပ်မပြန်တတ်သော မြန်မာနိုင်ငံ သစ်တောကြီးများတွင် တွေ့ရှိနိုင်သော သတ္တဝါ ဆင်၏စွန့်ပစ်ပစ္စည်း(မစင်)မှ လျှပ်စစ်ဓါတ်အား ထုတ်လုပ်မှု ကို လေ့လာနှိုင်းယှဉ်ထားပါသည်။ ၄င်းတိရိစ္ဆာန်တို့၏ စွန့်ပစ်ပစ္စည်းများကို သာမန်နည်းစဉ်နှင့် ပြောင်းလဲနည်းစဉ်ဟူ၍ နည်းစဉ်(၂)မျိုးဖြင့် စမ်းသပ်ထားပါသည်။ ပြောင်းလဲနည်းစဉ်သည် မစင်ထဲတွင် ပါဝင်သော ပိုးမွှားများ ဆက်လက်ရှင်သန် ရန် ဆဲလူးလို့ခေါ် အသုံးမလိုသော စက္ကူများနှင့် ရောနှောစမ်းသပ်ထားပါသည်။ ၄င်းနည်းစဉ်(၂)မျိုး၏ လျှပ်စစ်ဓါတ်အား ထုတ်လုပ်မှုနှင့် ကုန်ကျစရိတ်တို့ကိုလည်း နှိုင်းယှဉ်ထားပါသည်။ လေ့လာစမ်းသပ်မှုအရ သတ္တဝါ(၃)မျိုး (ဆင်၊ နွား နှင့် ကျွဲ) တို့၏ မစင်မှ လျှပ်စစ်ဓါတ်အား ထုတ်လုပ်မှုတွင် ကျွဲချေးသည်အနည်းဆုံးဖြစ်၍ နွားချေးသည် အများဆုံး ဖြစ်ကြောင်း တွေ့ရှိရပါသည်။ နည်းစဉ်(၂)မျိုးတွင် ကျွဲချေးနှင့်ဆင်ချေးတို့၏ လျှပ်စစ်ဓါတ်အားထုတ်လုပ်မှုပမာဏ ခြားနားမှုမရှိသော်လည်း နွားချေး၏ ပြောင်းလဲနည်းစဉ်သည် ပိုမိုကြာရှည်စွာ ထုတ်လုပ်နိုင်ကြောင်း တွေ့ရှိရပါသည်။ ထို့အပြင် နည်းစဉ် (၂)မျိုးတွင်လည်း ပြောင်းလဲနည်းစဉ်သည် သာမန်ရိုးကျနည်းစဉ်၏ သုံးပုံတစ်ပုံခန့်သာ ကုန်ကျစရိတ် ရှိကြောင်းနှင့် အလေးချိန်အားဖြင့် ပြောင်းလဲနည်းစဉ်သည် သာမန်ရိုးကျနည်းစဉ် တစ်ဝက်ခန့် သာရှိကြောင်း လေ့လာသိရှိရပါသည်။

နွားချေးသည် သဘာဝအလျောက် ချေပျက်ပါက ဖန်လုံအိမ်ဓါတ်ငွေ့များကို ထုတ်လွှတ်ပေးပါသည်။ အဓိက ထုတ်လွှတ်ပေးသော ဓါတ်ငွေ့(၂)ခုမှာ နိုက်ထရောက်အောက်ဆိုဒ်နှင့် မီသိန်းတို့ ဖြစ်ပါသည်။

နွားချေးကို ဇီဝဓါတ်အိုးပြုလုပ်ခြင်းသည် ဖန်လုံအိမ်ဓါတ်ငွေ့ကို ပို၍သန့်ရှင်းစေနိုင်ပါသည်။ အဘယ်ကြောင့်ဆိုသော် နွားချေးသည် ပုပ်သိုးဆွေးမြေ့သောအခါ ဘေးထွက်ပစ္စည်း ဟိုက်ဒရိုဂျင် အနုမြူလေး များ ထွက်ရှိလာပါသည်။ ၄င်းအနုမြူလေးများသည် ဘက်ထရီအိုးတွင် အသုံးပြု၍ အခြားဘေးထွက်ပစ္စည်းဖြစ်သော ကာဗွန်ဒိုင်အောက်ဆိုဒ်သည် ဆဲလူးလို့ကိုချေဖျက်သောအခါ ထွက်ရှိလာသောရေနှင့် ဓါတ်တိုး ပစ္စည်းနှင့် ပေါင်းစပ်သောအခါ ဆားအဖြစ်ထွက်ရှိလာပါသည်။ ထို့ကြောင့် နွားချေးသည် ဖန်လုံအိမ် ဓါတ်ငွေ့ကို သန့်ရှင်းစေပြီး စွမ်းအင်ပြန်လည်ဖြည့်တင်းပေးသော အရင်းအမြစ် ဖြစ်နိုင်ပါသည်။

The Preliminary Study on DC Power Generation by Using The Dung of Elephant, Buffalo and Cow

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Abstract

Biological batteries use bacteria to convert chemical energy into electrical energy known as the new study of cellulose-based microbial fuel cells, the bacteria feed on cellulose and release hydrogen that is oxidized within a fuel cell, creating electricity. The only by product is water (H_2O). The source of power for these fuel cells come from the break down of cellulose by a variety bacteria in rumen fluid, the microbe-rich fluid found in a cow's rumen, the largest chamber of a cow's stomach.

Some of the microorganisms found in the fluid are also found in the cow dung, which may prove to be a good source for generating electricity. Therefore the ruminant animals of buffalo dung and cow dung are studied. The non-ruminant animal of Elephant dung is also tested because of this animal is more utilized in our forest, this animal is herbivorous animal and "can non- ruminant animal be produced the electricity?"

The tested materials are cow dung, buffalo dung and elephant dung; are studied in three replications and two treatments or two methods such as traditional method and modified method. Traditional method is the mixture of 1:1 ratio of salt and animal dung and modified method is the mixture of 1:1:1 of salt, animal dung and waste paper (used paper), which as cellulose to survive the microorganisms and to more produce hydrogen ion.

Accordance with the studies, the electricity productivity of buffalo dung is lowest and the electricity productivity of cow dung is highest. The electricity productivity by two methods use of buffalo and elephant dung is not different, modified method is higher than traditional method use of cow dung. More over, among the two methods, the modified method is lower the cost and weight content of material than the tradition method.

Therefore animal dung could one day help to meet the rise in demand for alternative energy sources. And socio- economic of rural people enhance through the usage the animal dung as bio- battery.

Cow dung, left to decompose naturally, emits two particularly potent greenhouse gas emissions (GHGs) - nitrous oxide and methane.

Rumen fluid should be tested as bio battery because the hydrogen ion produced in fermentation is utilized in reduction of carbon dioxide to methane. In this way, cow dung should be also tested; the hydrogen ion produced in decomposition is utilized in battery and another carbon dioxide which react with water within cellulose break down and metal from oxidizing agent to form salt. Therefore biological battery can be cleaned the green house gas. So cow dung can be source of clean, renewable power.

Key Words: biological, chemical, electrical, cellulose, microbial, rumen fluid, nitrous oxide, methane, carbondioxide

Content

Introduction

Biological batteries use bacteria to convert chemical energy into electrical energy known as the new study of cellulose-based microbial fuel cells, the bacteria feed on cellulose and release hydrogen that is oxidized within a fuel cell, creating electricity. The only by product is water (H_2O). The source of power for these fuel cells come from the break down of cellulose by a variety bacteria in rumen fluid, the microbe-rich fluid found in a cow's rumen, the largest chamber of a cow's stomach. Any carbohydrates entering the rumen are fermented by the microbial population with the production of microbial cell, volatile fatty acid, carbon dioxide, and methane. The following equation shows a simplified of carbohydrates break down.

Polysaccharides (cellulose, fructose, pentose, pectin substances, etc ;) → sugar (sucrose, glucose) → pyruvate + 2H +2e$^-$

The hydrogen ion migrates to the cathode.

Many of the animal species variation in the digestive system can be related to diet. Herbivores may spend up to 75% of the day eating to obtain an equivalent amount of nutrients from a larger volume of food. This digestive tract contains a more voluminous, compartmentalized stomach and/ or hindgut, allowing for both a greater capacity and a more prolonged retention of digest. The increase in relative stomach size appears to involve expansion of the areas lined with cardiac mucosa and/ or stratified squamous epithelium. Among herbivores, there tends to be an inverse relationship between the volume of the stomach and the large intestine. In simple stomached herbivores the major site of microbial digestion may be either the cecum or the colon, tend to be continuous feeders. The stomach of ruminants has four compartments. The forestomach compartments (reticulum, rumen, omasum) function to store and delay passage of ingested food. They are the sites of anaerobic microbial fermentation of plant material and of absorption mainly of the fermentation products. The fourth compartment the abomasum, is similar to and performs comparably with simple stomachs.

These functional morphological relationships do not of course account for all species variations.

The gastrointestinal tract is colonized with micro organisms shortly after birth. They become primarily due to the slower rate of digest passage through these parts of the tract the small intestine is relatively sterile, although significant numbers of organisms can be found in the ileum of many species. This may be due to a slower rate of passage through the terminal intestine or occasional regurgitation of large-intestine content into the ileum. These microorganisms serve a multitude of purpose. One major function in some species is to convert a poor-quality diet into more readily utilizable nutrients.

Feces consist of materials of both dietary and endogenous origin. The largest single factor affecting quantity of fecal dry mater exerted is amount of indigestible dry matter consumed by an animal. Digestion in the ruminant has been described as continuous in nature; consequently, it is also characteristic of these species to exhibit a higher frequency of defecation than most simple-stomached animals.

Dry matter content of feces is typically 30.50 % in sheep and other species which excrete pellets, and much lower (15.30 %) in cattle. Fecal dry matter contains undigested dietary material; undigested cell walks of rumen bacteria, microbial cells from the cecum and large intestine, and residues of many endogenous substances including digestive enzymes, mucous and other secretions and epithelial cells sloughed from the walls of the alimentary tract into the rumen. The proportion of materials of dietary origin relative to those of metabolic and endogenous origin would be those greatest when diets containing substantial amount of poorly digested feed stuffs (i.e., low quality roughages) are fed. Conversely, animals consuming diets that are highly digestible (i.e., high grain) excrete feces containing very little material of dietary origin.

Feces also serve as a route for excretion of some endogenous waste products. In particular, bilirubin and biliverdin are eliminated by this route. Hrobilinogen, produced by the microbial conversion of these compounds in large intestine, is the compound which gives feces a characteristic brown coloration. Billiard secretion is also the typical excretory route for many mineral elements. The order of focus is due to the presence of certain aromatic compounds, mainly indole and skatole, produced by microbial degradation of tryptophan.

Some of the microorganisms found in the fluid are also found in the cow dung, which may prove to be a good source for generating electricity. According to the literature, rumen fluid can be found the ruminant animals. Therefore the ruminant animals of buffalo dung and cow dung are studied; these animals are found the most population in the whole Myanmar. The non-ruminant animal of Elephant is also tested because of this animal is more utilized in our forest and "can non- ruminant animal be produced the electricity?" .

2. Literature Review

COLUMBUS, Ohio -- A new study suggests that some of the microorganisms found in cow waste may provide a reliable source of electricity.

Results showed that the microbes in about a half a liter of rumen fluid -- fermented, liquefied feed extracted from the rumen, the largest chamber of a cow's stomach -- produced about 600 millivolts of electricity. That's about half the voltage needed to run one rechargeable AA-sized battery, said Ann Christy, a study co-author and an associate professor of food, agricultural and biological engineering at Ohio State University.

While rumen fluid itself won't be used as an energy source, some of the microorganisms found in the fluid are also found in cow dung, which may prove to be a good source for generating electricity. In fact, in a related experiment, the researchers used cow manure directly to create energy for a fuel cell.

Using cow dung as an energy source isn't a new idea -- some farmers already use the methane released by livestock waste to power machinery and lights. But converting methane into electricity requires costly equipment -- one California farmer reportedly spent $280,000 to convert his operation to a methane digester system.

"Methane still needs to undergo combustion, which creates issues with energy efficiency," said Hamid Rismani-Yazdi, the study's lead author and a graduate student in food, agricultural and biological engineering at Ohio State.

The research showed how electricity can be created as the microorganisms in rumen fluid break down cellulose -- a complex carbohydrate that is the primary component of the roughage that cows eat. That breakdown releases electrons.

This study represents the first time that scientists have used cellulose to help charge a fuel cell.

The researchers presented their findings on August 31 in Washington, D.C., at the national meeting of the American Chemical Society. Christy and Rismani-Yazdi conducted the work with Ohio State colleagues Olli Tuovinen, a professor of microbiology, and Burk Dehority, a professor of animal sciences.

The researchers extracted rumen fluid from a living cow. The rumen is essentially a fermentation vat crawling with microorganisms where much of the food that a cow eats is temporarily held and is continuously churned until it can be completely digested. This liquid mass is what scientists call rumen fluid.

The researchers collected the fluid through a cannula, a surgically implanted tube that leads directly from the cows hide into its rumen. The cow used in the study ate a normal diet.

The researchers filled each of two sterilized glass chambers with strained rumen fluid to create the microbial fuel cell. Each chamber was about a foot high and about 6 inches in diameter.

The chambers were separated by a special material that allowed protons to move from the negative (anode) chamber into the positive (cathode) chamber. This movement of protons, along with the movement of electrons across the resistor and wire that connects the two electrodes, creates electrical current.

The anode chamber was filled with rumen fluid and cellulose, which served as a food source for the microorganisms. Cellulose is plentiful on most farms, as harvesting usually leaves behind plenty of it in the form of crop residue in the fields. Electrons are released as the microorganisms break down the cellulose. The electrons are then transferred to the anode electrode.

The other chamber, the cathode, was filled with potassium ferricyanide, a chemical that acts as an oxidizing agent to round out the electrical circuit and helps close the electrical circuit by accepting electrons from the cathode electrode. Once the circuit is closed, electrons flow from the anode to cathode, creating electricity.

Two small pieces of plain graphite served as the fuel cell's electrodes (an electrode draws and emits electrical charge.) A piece of graphite was placed in each chamber. The researchers used a meter to measure the output of the fuel cell.

That output reached a consistent maximum of 0.58 volts. After about four days, the voltage fell to around 0.2 volts, at which time the researchers added fresh cellulose to bring the voltage back up to a higher level.

"While that's a very small amount of voltage, the results show that it is possible to create electricity from cow waste," Christy said. The microbial fuel cells with the least amount of resistance produced the most power- enough to run a miniature Christmas tree light bulb, Christy said. That's about three times more power than their first-generation fuel cells were capablae of producing.

"Putting a couple of these fuel cells together should generate enough power to run a rechargeable double-A battery," said by Rismani-Yazdi.

In related work done in Christy's lab, she and Rismani-Yazdi, along with a number of undergraduate students, used actual cow manure to power a microbial fuel cell. These individual cells produced between 300 and 400 millivolts.

"The students put a few of these cells together and were able to fuel their rechargeable batteries over and over again," Christy said.

In that work, the researchers didn't need to use cellulose to feed microbes, as some plant material passes undigested through a cow.

"We've run some of these trials well over 30 days without a decrease in the voltage output," Christy said. "Both studies suggest that cow waste is a promising fuel source. It's cheap and plentiful, and it may someday be a useful source of sustainable energy in developing parts of the world."

While the source of energy for the fuel cell used in these studies is somewhat unique, microbial fuel cells aren't a new idea; other scientists have produced electricity from a handful of specific microbes and also from effluent from municipal wastewater.

"Although it's too early to tell if this kind of fuel cell can produce significantly more electricity, the fact that the rumen fluid worked in our study means that there are additional electricity-producing microbes that we have yet to identify," Christy said.

"The hope is that one day livestock farmers could use their farm's livestock waste lagoon as a huge fuel cell and generate enough power for their operation," said by Rismani-Yazdi.

This work was supported in part by the Ohio Agricultural Research and Development Center in Wooster.

2.2 Objectives

1. To investigate DC power generation by using the dung of Cow, Buffalo and Elephant.
2. To compare the traditional method and the modified method.
3. To enhance the socio- economic benefits of the rural people through the usage by the animal dung as bio-battery.
4. To reduce the green house gases such as nitrous oxide and methane through the usage by the animal dung as bio-battery.

3. Materials and Methods

3.1 Materials

The tested materials were buffalo dung, cow dung elephant dung. These materials were tested in two methods such as traditional method and modified method. The following materials were needed for one battery in two methods;

1. 2inchesX1inch of 6 used cells (there are no charge and not over old)
2. 0.5L of 6 purified drinking water bottles (cut the tip and length is nearly six inches)
3. wire (4feet and 1inch)
4. salt (depend upon the methods)
5. fresh animal dung (depend upon the methods)
6. one lamp of 4volt
7. one basket or one suitable box
8. waste paper or used paper (0.35 viss for modified method)
9. volt meter

3.2 Methods

The dung of cow, buffalo and elephant are studied in three replications and two treatments or two methods such as traditional method and modified method.

3.2.1 Traditional Method

This method is 1:1 ratio of salt and animal dung. Normally, the dung 1.05 viss (1.715kg) and the salt 1.05 viss (1.715kg) are mixed and stirred by hand. This mixture is equally put into six bottles (already cut the tip of 0.5L of purified drinking water bottles) to the five inches. Six bottles are placed in the basket or a suitable box. Then the linkage six cells are put in the mixture of six bottles to the same level. Before the linkage six cells, the outer covered plastic or paper was removed to the metal surface. These cells were joined by lead welding. Again fill the mixture to the upper surface of the cells. The cells, interconnected in series, successfully produced electric current. After 30minutes, the voltage is measured by volt meter. When we get near or over 4.0volt, we join the battery's wire and the lamp's wire. Then we can get light by Switch on.

3.2.2 Modified Method

This method is 1:1:1 ratio of waste paper, salt and animal dung. Therefore, for one battery, 0.35 viss (0.572kg) the dung, 0.35 viss (0.572kg) of salt and 0.35 viss (0.572kg) of waste paper is needed. Firstly, waste papers are cut into smaller 1square inch to get 0.35 viss. Then these papers are mixed with 1L of water. After 1hour, water waste paper are mixed and stirred with the animal dung. Then the mixture is mixed and stirred with 0.35viss (0.572kg) of the salt. This mixture is equally put into six bottles (already cut the tip of 0.5L of purified drinking water bottles) to the four inches. Six bottles are placed in the basket or a suitable box. Then the linkage six cells are put in the mixture of six bottles to the same level. Before the linkage six cells, the outer covered plastic or paper was removed to the metal surface. These cells were joined by lead welding. Again fill the mixture to the upper surface of the cells. The cells are interconnected in series, successfully produced electric current. After 30minutes, the voltage is measured by volt meter. When we get near or over 4.0volt, we join the battery's wire and the lamp's wire. Then we can get light by Switch on.

4. Result and Discussion

4.1 Study-area

Buffalo dung and cow dung were collected from Thittat village and elephant dung took from NayPyiTaw Zoo. The total days of light and the electricity productivity of materials and of two methods were estimated by using regression model. Performances of all tested materials were generally found by variation of material and method. Each average voltage of three days was assessed in three different dung and two methods at Wood Chemistry Section, Forest Research Institute.

4.1.1 Mean performance of Material and method

Mean performance of Material and method for electricity production with standard error and least significant differences are given in table 1 and 2.

Table1. Means of Materials measured each average voltage of three days with standard error (SE) and least significant differences (LSD) (n=3)

Days	BD	CD	ED	SE	LSD
AVG 1-3	4.011	3.844	4.172	0.0679	0.2141
AVG 4-6	2.861	3.450	3.556	0.878	0.2767
AVG 7-9	2.128	3.144	3.189	0.089	0.2804
AVG10-12	1.528	3.039	2.994	0.1219	0.3840
AVG13-15	1.02	2.94	2.81	0.178	0.562
AVG16-18	0.981	2.196	2.130	0.091	0.2867
AVG19-21	0.981	2.196	2.130	0.091	0.2867
AVG22-24	0.981	2.196	2.130	0.091	0.2867
AVG25-27	0.981	2.196	2.130	0.091	0.2867
AVG28-30	0.981	2.196	2.130	0.091	0.2867
AVG31-33	0.981	2.196	2.130	0.091	0.2867
AVG34-36	0.981	2.196	2.130	0.091	0.2867
AVG37-39	0.981	2.196	2.130	0.091	0.2867
AVG40-42	0.981	2.196	2.130	0.091	0.2867
AVG43-45	0.5	1.635	1.569	0.1321	0.4162

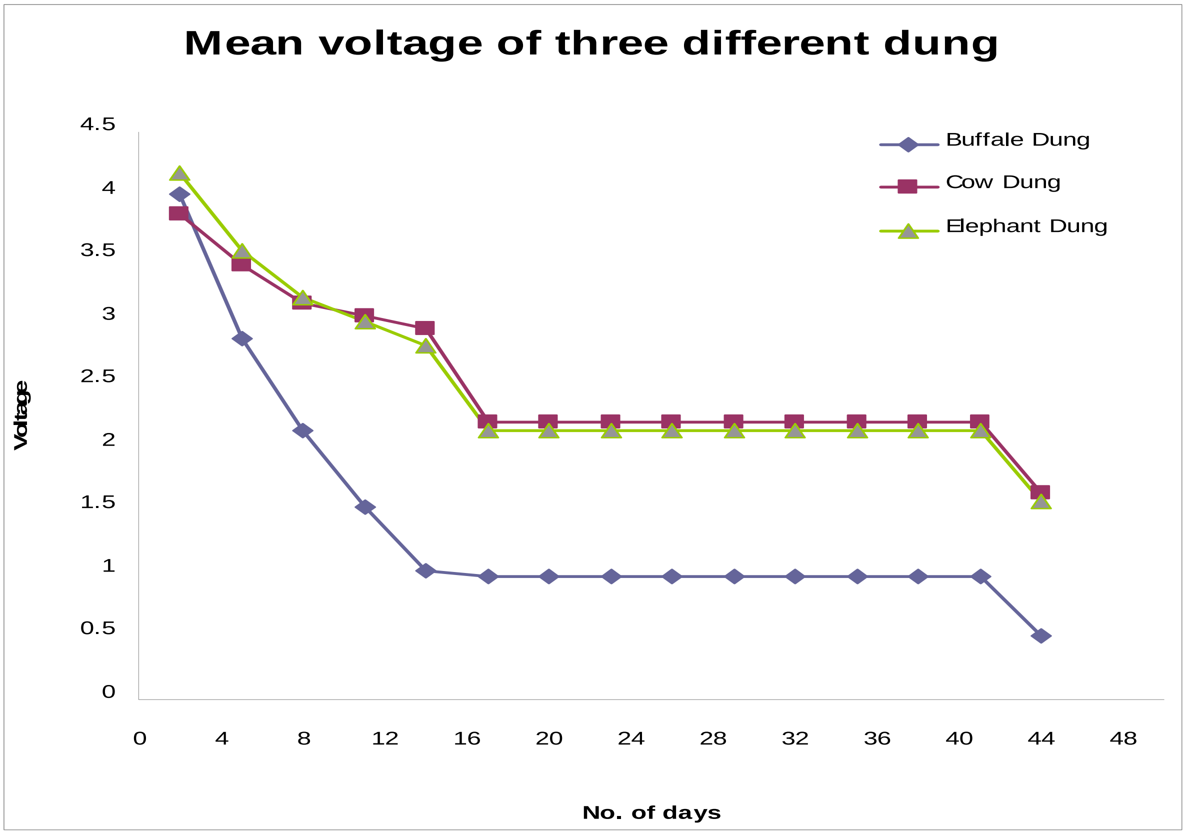

Fig.1 Means of Materials

Table2. Means of Methods of measured each average voltage of three days with standard error (SE) and least significant differences (LSD) (n=3)

Days	Modified method	Traditional method	SE	LSD
AVG 1-3	4.039	3.926	0.0555	0.1748
AVG 4-6	3.244	3.333	0.717	0.2259
AVG 7-9	2.707	2.933	0.727	0.2289
AVG10-12	2.404	2.637	0.995	0.3135
AVG13-15	2.18	2.34	0.146	0.459
AVG16-18	1.684	1.854	0.0743	0.2341
AVG19-21	1.684	1.854	0.0743	0.2341
AVG22-24	1.684	1.854	0.0743	0.2341
AVG25-27	1.684	1.854	0.0743	0.2341
AVG28-30	1.684	1.854	0.0743	0.2341
AVG31-33	1.684	1.854	0.0743	0.2341
AVG34-36	1.684	1.854	0.0743	0.2341
AVG37-39	1.684	1.854	0.0743	0.2341
AVG40-42	1.684	1.854	0.0743	0.2341
AVG43-45	1.355	1.114	0.1079	0.3399

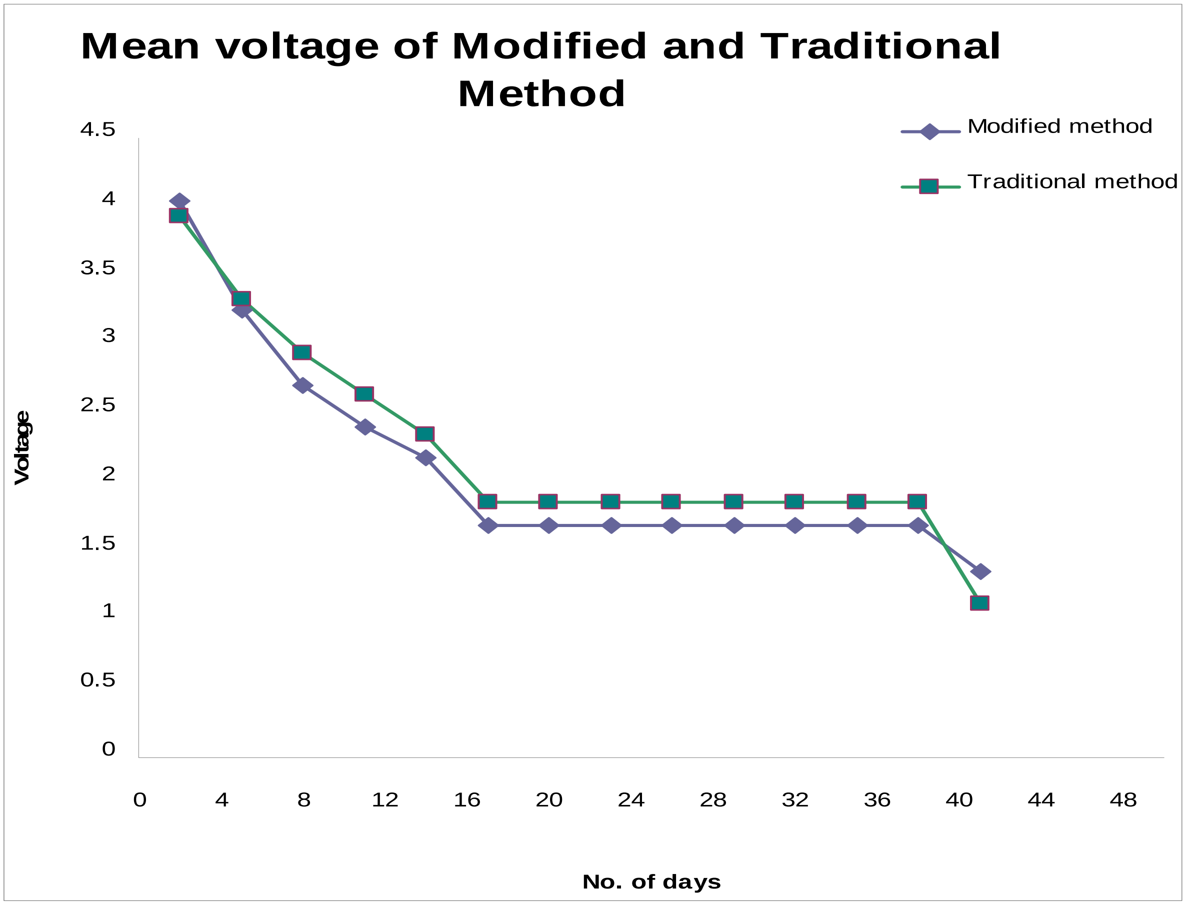

Fig2. Mean of method

4.1.2 Analysis variance for materials and methods

For each average voltage of three days from four day to forty-five day, significant differences ($p<0.001$) were found for material in table 3. The result indicate that average voltage of three days from one day to three day was found no significant among all tested material as well as each average voltage of three days from one day to forty-five were found no significant in method.

Table3. Analysis variance for each average voltage of three days in materials and method showing mean square values and significant differences level (n=3)

Source of variation	d.f	AVG 1-3	AVG 4-6	AVG 7-9	AVG 10-12	AVG 13-15	AVG 16-18 to AVG 40-42	AVG 43-45
Materials	2	0.161	0.840**	2.161**	4.436**	6.913**	2.799**	2.435**
Treatment	1	0.125	0.036	0.230	0.245	0.109	0.131	0.261
Residual	10	0.028	0.046	0.047	0.089	0.191	0.050	0.105

** Indicates significant differences at $p<0.001$

4.2 Performance of total days of light

The total days of light for all tested dung of two methods were studied in table 4.

Table4. Total Days of Light for all tested dung of two methods

Sr.	Materials	Treatment	Battery No.	Voltage	Total days
1	Cow Dung	Traditional method	1	4 – 2.6	27
			2	3.8 – 2.6	23
			3	3.6 – 2.6	21
		Modified method	1	3.8 – 2.6	37
			2	4.4 – 2.6	45
			3	4.2 – 2.6	44
2	Buffalo Dung	Traditional method	1	4.6 - 2.6	7
			2	4.8 – 2.6	7
			3	4.9 – 2.6	12
		Modified method	1	5.2 – 2.6	6
			2	4.9 – 2.6	5
			3	5.0 – 2.6	5
3	Elephant Dung	Traditional method	1	4.6 – 2.6	13
			2	4.3 - 2.6	34
			3	4.3 - 2.6	34
		Modified method	1	4.5 – 2.6	34
			2	4.4 – 2.6	13
			3	4.4 – 2.6	34

This table shows that, the initial voltage of all batteries were different but light stopped at 2.6v in all batteries. The electricity productivity of buffalo dung is lowest. The electricity productivity by two methods of buffalo and elephant dung is not different, modified method is higher than traditional method use of cow dung.

4.2.1 Mean performance of light days

Mean performances of light day for all tested dung of two methods were studied in table 5.

Table5. Mean performances of light days

Sr.	Materials	Methods	Battery no.	voltage	Total days
1.	CD	TM	1,2,3	4 – 2.6	24
		MM	1,2,3	4.4 – 2.6	42
2.	BD	TM	1.2,3	4.9 – 2.6	9
		MM	1,2,3	5.2 – 2.6	6
3.	ED	TM	1,2,3	4.6 – 2.6	27
		MM	1,2,3	4.5 – 2.6	27

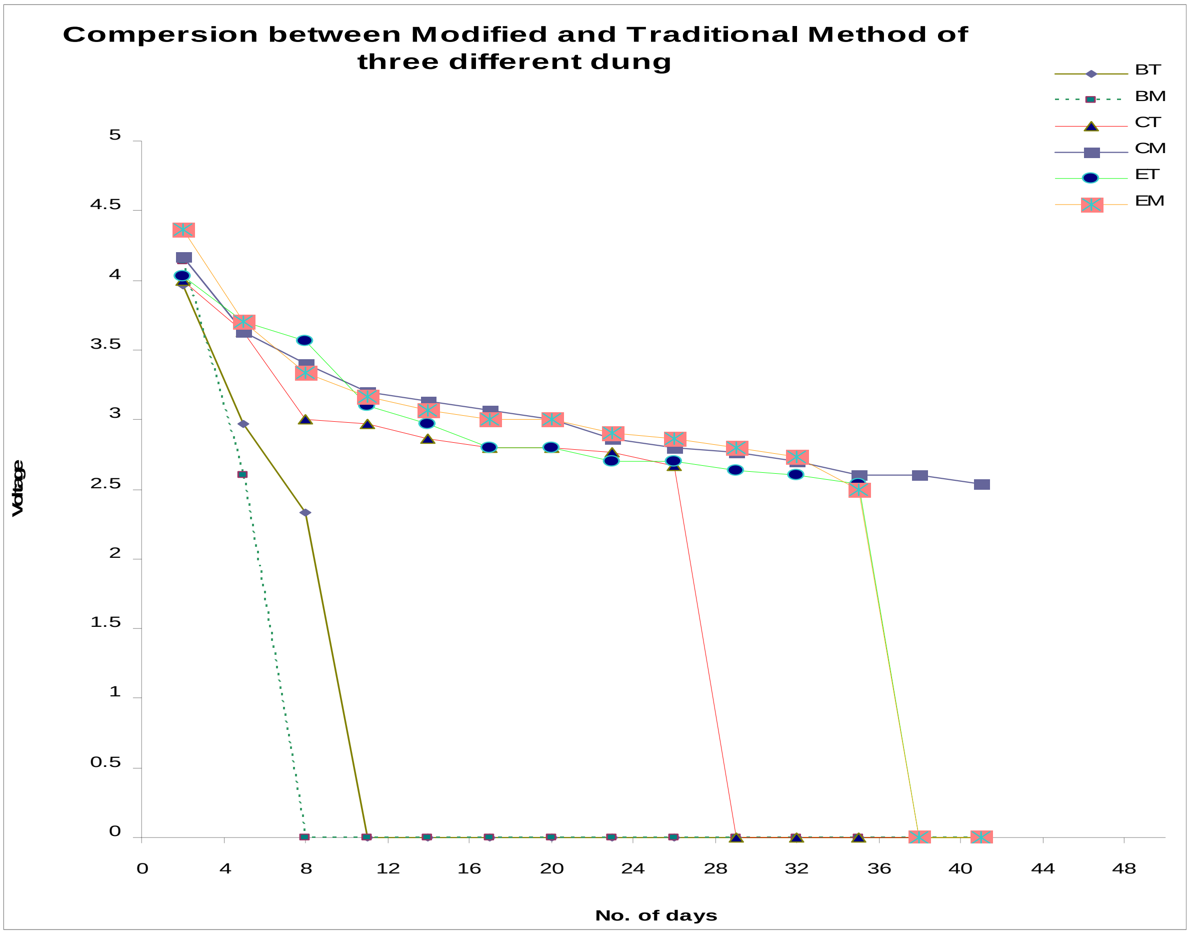

Fig.3 Mean of light days

It could be suggested that light days were longest in modified method of cow dung.

Continually, the cost of the traditional method and the modified method can be calculated. Among two methods, the differences are the salt and paper content, and the other materials are not different.

1. Traditional method
   (i) 1.05viss of salt = 603kyats

   Total = 603 kyats

2. Modified method
   (i) salt 0.35 (viss) = 210 kyats
   (ii) Waste Paper 0.35 = 105 kyats

   Total = 315 kyats

Therefore the modified method of the tested animal dung is lower cost than the traditional method.

5. Conclusion and Recommendation

Animals dung could one day help to meet the rise in demand for alternative energy sources. Therefore the socio- economic benefits of the rural people are enhanced by the use of the animal dung as bio-battery.

Energy is produced as the bacteria break down cellulose, which is one of the most abundant resources on our planet, as harvesting usually leaves plenty behind in the form of crop residue in field other prime sources of cellulose include waste paper and items made of wood.

The importances of Herbivorous species are more emphasized when we look at the total world land area. The ruminant animals of cow and buffalo are highly imported to the human race because of due to these herby various species are capable of cultivation to support economic crop production. The addition to being used as a source of meat milk or fiber, Cattle and buffalo are provided power for guiding fodders or grains Estimates of Myanmar inventories of domestic animals indicates about 14 million of cow and 3 million of buffalo in 2006-2007. Therefore the ruminant animals of Cattle and Buffalo are studied. In the study, the electricity productivity of Cattle dung is more than buffalo dung through the two methods. Next animal of Elephant is more utilized in our forest to carry the log. This animal is changed from the wild animal to domestic animal.

In our study, each average voltage of three days from four day to forty-five day, significant differences ($p<0.001$) were found for material in table 3. The result indicate that average voltage of three days from one day to three day was found no significant among all tested material as well as each average voltage of three days from one day to forty-five were found no significant in method.

According to the study, table5 shows that the electricity productivity of buffalo dung is lowest. The electricity productivity by two methods use of buffalo and elephant dung is not different, modified method is higher than traditional method use of cow dung. Table5 predicts that, light days were longest in modified method of cow dung.

In addition, according to Ann Christy said “some of the organisms found in the fluid are also found in cow dung”, it means that the electricity productivity depend upon the tested dung of microorganisms content.

The animal dung should be fresh.

This dung should be neither soft nor hard.

The batteries should not be over old due to the battery are easily salted.

The water should not be contained more 1L in the modified method because of the voltage fall down.

The mixture is stirred, to be careful in modified method.

Cow dung, left to decompose naturally, emits two particularly potent greenhouse gas emissions (GHGs) - nitrous oxide and methane. Nitrous oxide warms the atmosphere 310 times more than carbondioxide; methane does so 21 times more, according to the Intergovernmental Panel on Climate Change (IPCC).

The study creates two hypothetical scenarios and quantifies them to compare energy savings and GHG reducing benefits. The first is “business as usual with coal burnt for energy and with manure left to decompose naturally.

The second is one where manure is anaerobic ally digested to create biogas and then burnt to offset coal. Through aerobic digestion similar to the process by which compost is created, manure can be turned into energy –rich biogas, which standard micro-turbines can use to produce electricity.

And, as manure left to decompose naturally has a very damaging effect on the environment this new waste management system has a net potential GHG emissions reduction of 99 million metric tones, wiping out approximately four percent of the country's GHG emissions, wiping out approximately four percent of the country's GHG emissions from power production.

The burning of biogas would lead to the emission of some carbon dioxide but the output from biogas-burning plants would be less than that from, for example, coal.

The above two methods reduce the greenhouse gas. But did not cleaned.

Continually, rumen fluid should be tested for electricity productivity indeed; the hydrogen ion produced in fermentation is utilized in reduction of carbon dioxide to methane. In this way, cow dung should be also tested; the hydrogen ion produced in decomposition is utilized in battery and another carbon dioxide which react with water within cellulose break down and metal from oxidizing agent to form salt. Therefore biological battery can be cleaned the green house gas. So cow dung can be source of clean, renewable power.

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