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As an alternative renewable energy, a galvanic cell energy storage system employing electrolyte from a plant is used

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Abstract

The use of plant sap as an electrolyte in a Galvanic cell system comprised of zinc or iron and copper electrodes is regarded as a green alternative energy source that produces electricity through a spontaneous redox reaction. We studied in two ways: in the lab to learn about the influence of sap on Galvanic cell potential, and in the field with Spondius pinnata trees in Rantau Aceh as the pilot site for the energy from trees project. Aloevera sap was noticed as the principal object, with banana and Spondius pinnata stems serving as comparisons. The saps were then employed as electrolytes in a Galvanic cell to generate electricity. The potential generated by the cell was measured using several pairs of electrodes. The cell's potentials were also examined using a variety of electrolytes derived from plant saps, mineral acids, aquadest, and tap water derived from ground water. The presence of metal ions in saps was determined using an atomic absorption spectrophotometer. The results indicated that the presence of zinc or iron and copper ions in plant sap produced the high potential of the Galvanic cell system, but the potentials for electrolytes utilizing mineral acid, tap water, and aquadest were lower. Meanwhile, the electrode distance had no potential impact, and the series of the Galvanic cell produced a non-linear potential. To gather electricity, iron and copper electrodes put in Spondius pinnata plants were utilised as a source of power from trees in Rantau, Aceh, to illuminate a distant location at night.

***Keywords:** Nanoparticle; Photoelectrochemistry; Electrocatalysis*

Introduction

The usage of fossil fuels is still a priority for human needs, such as industrial activity, energy generation, and fuel for automobile vehicles, but the fuel will soon run out. As a result, it need ecologically acceptable renewable energy alternatives. Renewable energy sources include wind, ocean, and solar cells, as well as energy derived from plants. Plate electrodes were employed as a galvanic cell in Aloevera leaf and banana stem in this study as a substitute for tiny wire, as well as the influence of different electrolytes used in the Galvanic cell to obtain a greater power than prior work. Then, in Rantau, a remote place in Aceh, Indonesia, copper pipe and iron rod electrodes of the Galvanic cell with a length of 15 cm were applied in a larger live plant (Spondius pinnata tree) as an alternative energy to harvest electricity. Because Spondius pinnata is simple to grow and has anticancer properties, it was chosen as a sap source (sticky sap with a turpentine scent) for the Galvanic cell.

Methods of Experiment

Copper and zinc electrodes (pa grade) were cut to 2 cm 2 cm dimensions and soldered together with wires. The electrodes were then plugged into the items being researched (Aloevera leaf, banana stem, Spondius pinnata stem), and the potentials were measured with a multitester (Heles). In addition, mineral acids and tap water from ground water were employed as electrolytes to replenish the sap. When the electrodes were connected into the Aloevera leaf, the potentials were also recorded at various distances. Using the approach, an atomic absorption spectrophotometer (AAS Buck Scientific FTG 210) was used to determine the copper, zinc, and iron ions in sap samples. Spondius pinnata was chosen as a sap source (sticky sap with turpentine scent) for Galvanic cell to collect energy from living plants in Rantau, Aceh by inserting iron and copper electrodes because it is easy to cultivate. The live plant's stem diameter was around 20 cm. The electrodes were soldered together as contacts with other electrodes and linked to a load through copper wires (LED, light emitting diode). To put the cell into the Spondius pinnata stem,

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a drilling equipment was used to pierce the stem obliquely at a depth of little more than 15 cm, allowing the cell to be inserted well into the plant. We implanted three cells connected in parallel into each plant, and for the experiment, we used ten trees connected in series. The potential was transformed from DC to AC 220 V using an inverter to ignite LEDs 5 W 220 V. The potential electricity of the tree was measured both with and without loads, and the potential recovery was noted.

Result and Discussion

Plant sap (such as Aloevera, banana stems, and Spondius pinnata) may be used as electrolyte supplies, and iron, zinc, and copper electrodes can be used to create electricity utilising the Galvanic cell concept. A reduction and oxidation reaction takes place spontaneously in a galvanic cell with copper and zinc electrodes. The anode is zinc and the cathode is copper. Because copper has an E^o sel of 0.34 V and zinc has an E^o sel of -0.76 V, the reduction reaction takes place at a copper cathode with a higher E^o cell, while the oxidation process takes place at the zinc electrode. Cu^{2+} in the sap absorbs electrons and the ion forms copper solid, whereas Zinc electrode releases electrons and becomes Zn^{2+} ion.

Conclusion

Metal ion concentrations in plant sap (Aloevera leaf, banana stem, and Spondius pinnata stem) may be employed as electrolytes in zinc or iron and copper systems with a greater potential than electrolytes from mineral acids, tap water, ground water, and aquadest. When the cells were connected in series, the potential of the Galvanic cell of plant sap was not linear, and the highest potential of the series was around 4 volts for 10 plants. Because of the high power of the LED used, the cell's potential dropped dramatically, making it difficult to restore to its original potential. After being utilised as a Galvanic cell, anode metal accumulations in the live plant grew in the stem and leaf, whereas cathode metal stayed constant.