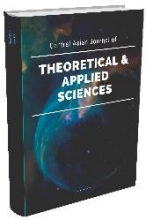

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Study of Photogalvanic Effect by Using of Natural Dye as Photosensitizer for Solar Energy Conversion And Storage

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Abstract: *Energy was a great discovery of human being which made our life more and more comfortable. The vital source of energy is the sun and life on earth is heliocentric as most of its energy is derived from the sun. The sun rays shower the surface of earth and humans have been using them to meet their energy needs. Although, earth receives only small fraction of sun total energy, yet one year's worth of solar energy reaching the surface of the earth is twice the amount of all non-renewable resources, including fossil fuels and nuclear uranium. Mankind has been harnessing the energy from the sun since the17th century B.C. The ancient civilizations (Rome and Greece)has demonstrated their first documented use of sun light by burning mirrors to light torches for religious purpose sand ancient architecture has utilized passive solar design i.e. the use of sun light to heat and light indoor spaces.*

19th century saw the incommensurable and revolutionary discovery of the A.E. Becquerel, known as Becquerel effectin1839. The 20th century witnessed the discovery of the photoelectric effect by Einstein and others. This led to research in the field of materials whose chemical properties were desirable to convert solar energy in to electrical energy. Sustainable energy supply remains a main requirement of modern society in order to respond to the increased demand caused by the larger consumption and population growth. For a long time, the energy boom was based on fossil fuels. Not only that the supply of oil, coal, and natural gas is limited, but there is also major pollution and environmental concerns associated with such traditional energy sources.

Solar energy is the newest and most cost effective way to satisfy the huge energy needs of human beings. There are many useful applications of the solar energy in day-to-day life, with many advantages over traditional and the conventional sources of energy. Selection of solar energy as a Non-Conventional and Renewable source of Energy is due to its following advantages-

1. *It will save you money on your electricity bill if you have one at all.*
2. *It is diffuse and cheapest.*
3. *Solar energy does not require any fuel.*
4. *Solar Energy is clean, renewable and sustainable, helping to protect our environment.*

Keywords: *Solar Energy, environment, solar design.*

Photogalvanic cell is a Photoelectrochemical device. In Photogalvanic cell, energy is produced by absorbing light by a highly absorbing electrolyte solution through chemical reaction. To generate the Electrical energy through subsequent transfer of charge to electrode by photo-reduction or photo-oxidation of the molecule which diffusing in the bulk of the electrolyte. This device is in principle, perhaps closest of the PEC devices for photosynthesis.

Introduction

Today, global warming and the rapid decrease in energy resources caused by the large-scale consumption of fossil fuels have become serious. Accordingly renewable energy resources are attracting a great deal of attention, and solar energy is one of the most promising future energy resources.

The photo effects in electrochemical systems were first reported by Becquerel [1839a, 1839b] in his investigation on the solar illumination of metal electrodes long back. Surash and Hercules [1962] proved that only negative photopotential should be obtained with carbonyl compounds.

Alonso et al. [1981] reported the use of electrodeposited CdSe0-5 Te0-5 electrode for solar energy conversion. Jana and Bhowmik [1999] reported enhancement in the power output of a solar cell consisting of mixed dyes. Hara et al. [2003] investigated design of new coumarin dyes having thiophene moieties for highly efficient organic dye-sensitized solar cells.

Ameta et al. [1988] reported use of toluidine blue nitroloacetic acid (TB-NTA) system in photogalvanic cell for solar energy conversion. Ameta et al. [1990, 2006] also reported the use of micelles in photogalvanic cell for solar energy conversion storage in Azur A-Glucose system, Bromophenol-EDTA system.

Some important photogalvanic system has been reported by Madhwani [2007] investigate the use of Fluoroscein-EDTA System in Photogalvanic Cell for Solar Energy Conversion, Bohrmann-Linde and Tausch [2003] reported photogalvanic cells for classroom investigation

Monat and McCusker [2000] reported the femto-second excited state dynamics of an iron (II) polypyridyl solar cell. Schwarzhurg and Willig [1999] explored the origin of photovoltage and photocurrent in nanoporous, dye-sensitized, photoelectrochemical solar cell.

The sensitization of nanoporous films of TiO2 with santaline (red sandal wood pigment) and the construction of a dye–sensitized solid-state photovoltaic cell was attempted by Tennakone and Kumara [1998].

Photogalvanic solar energy conversion with different systems reported on Toluidine Blue-Malachite Green in presence of NaLS by Genwa et al[2009], Yadav et al[2010] reported the conversion and storage by using Thionine as photosensitizer and EDTA as reductant in the presence of CTAB as surfactant.

Yadav et al [2010] observed the Bismarck Brown–Glucose system for generation of Electricity in a Photogalvanic cell. Yadav et al [2016] report the advance environment successive key for solar energy conversion and storage using Thionine- Glucose- CTAB

The Solar energy conversion and storage using Naphthol Green-B dye photosensitizer in photogalvanic cells report by Koli [2014] and Study of enhanced photogalvanic effect of Naphthol Green-B by Koli [2015] result obtained in these study may be due to the very small sized Pt with the SCE component of the combination electrode.

In the present investigation it is proposed to study the conversion efficiency and storage capacity of Natural Dye (photosensitizer) taking from the plants flower, root or steam in system with reductant like

Ascorbic Acid, Mannitol, N.T.A. And Glucose etc. in the presence of different Anionic or neutral surfactant like NaLS and Tween etc.

4. Objectives-

To meet the problem of energy crisis scientist has started their exploration to harvest the solar energy in the form of solar batteries. Photoelctrochemical cells and photogalvanic cells are considered as viable medium to accept the challenge.

- The photogalvanic cell is cheap and source energy is non-conventional and abundantly occurs in universe.
- This held of research is still in the intent stage with respect to its viability and applicability, required through exploration to increase the conversion efficiency and strong capacity by selecting the suitable redox couple, Natural Dyes as Photosensitizer, Reductant and Surfactants.
- Solar Energy can be meet and the crisis energy world.

Importance of Proposed Research Work

- Solar energy is not only a non-polluting, inexhaustible and harmless but clean, low cost and hazardless with no disposal problem and can fulfil the energy demands of the world.
- Energy is consumed for variety of our needs and has become an essential ingredient an everyday life.
- The high energy consumption has traditionally been associated with high quality of life and high gross national product.
- There is a very good correlation between the quantum of energy used by any nation and its development.

The concept and fundamental operation of photogalvanic cell is different from that of photovoltaic cell. The photogalvanic cells are based on some such chemical reactions which gives rise to high energy products on excitation by photon on one hand the energy rich products lose energy electrochemically. On the other hand, Photovoltaic cell involves direct excitation of an electron by a photon and thus producing electricity.

Hypothetical Issue

- To investigate the Photogalvanic cells by using of Natural dye as Natural Sensitizer which is prepared from flowers, leaves and roots etc using simple ethanol, methanol or water extraction process thus less costly as compared to synthetic dyes in photogalvanic cells for solar energy conversion and storage have not been well exploited.
- To prepare solar cell which will be prudent and contamination free, low cost and can be handle simple**.** This efforts must made to rise electrical out-put by picking appropriate material to reach the preferred results for commercial sustainability of the photogalvanic cells to decrease the energy crisis in some extent.

Methodology and Experimental detail

1. All the Solutions were prepared in doubly distilled water and kept in amber colored containers to protect them from sunlight.
2. A mixture of the solutions of reductant, surfactant and Natural dye (photosensitizer) taken in H-shaped glass tube.

3. A platinum foil as a electrode immersed into one arm of the H-tube and a saturated calomel electrode (SCE) was kept in the others, the whole system was first placed in dark till a stable potential was obtained and then, the arm containing the SCE was kept in the dark and the platinum electrode was exposed to a tungsten lamp.
4. A water filter is put between cell and lamp to cut off infra-red radiation with the aim of curbing heating effect of cell, which otherwise may adversely affect cell leading to lower performance.
5. On illumination, the Photopotential and Photocurrent generated by the system was measured with the help of the digital pH meter and microammeter, respectively and the spectra of the solution are measured by Spectrophotometer.
6. The current voltage characteristics of photogalvanic cell have been studied by applying an external load with the help of a carbon pot (log 470 K) connected in the circuit through a key to have close circuit and open circuit device.
7. The experimental set-up of photogalvanic cell is shown in Figure 1.

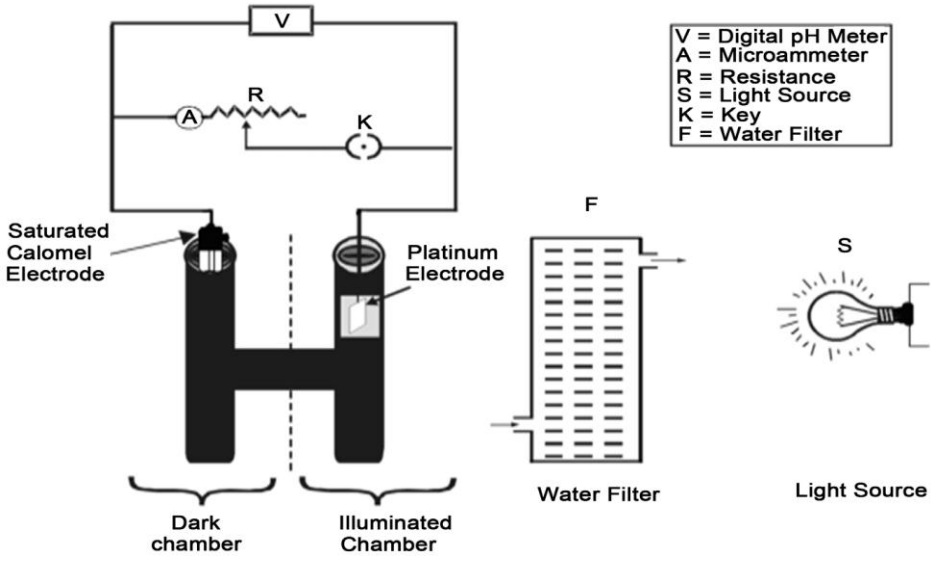

Figure.1 The experimental set-up of photogalvanic cell

It is proposed to explore the use of Natural Dye as photosensitizer in photogalvanic cells under following salient feature:

a) Variation of concentration of photosensitizer (dye) on the current and voltage output.
b) Variation of concentration of Reductant on the current and voltage output.
c) Variation of concentration of Surfactant on the current and voltage output.
d) Variation in pH and its effect on current and voltage output.
e) Current – Voltage (i-V) characteristics of the photo galvanic system.
f) Variation in diffusion length of the H type cell.
g) Variation of the temperature and its effect as the current and voltage output.
h) Variation in the intensity of light and its effect on the current and voltage output.
i) Study of potential with time.

j) Study of current with time.

k) Output of the cell.

l) Conversion capacity of the cell.

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