Role Of Rh-B-Edta Solar Cell For Conventional Energy Conversion In Electrical Energy

Mahesh Chandra

Department of Chemistry, Deshbandu College, University of Delhi, New Delhi, India
Email: - drmahesh100@gmail.com

ABSTRACT

All around the globe people are working to find out renewable source of energy. Apart from the renewable energy resources like geothermal, biomass wind, tidal and hydro energy etc. The solar energy has required characteristics for present day suitable energy source. Solar energy is not only none polluting, inexhaustible and harmless but clean, low cost and hazardless having no disposal problem. In this study it is proposed the "conversion" and "storage capacity" of "solar energy" taking different types of reductants with the photosensitizers. This field of research is still in its initial stage as far as "viability and applicability" is concerned and the exploration is required so that the "conversion efficiency" and the "storage capacity" can be increased by choosing better pair of "photo sensitizers" and different kinds of "reductants".

Keywords: "Photo potential," "Photocurrent," "Fill factor," "Conversion efficiency," "Power point," "Storage Capacity"

1. INTRODUCTION

Today, the modern world is plagued by the severe threat of global warming and increasingly depleting energy resources by mass consumption of fossil fuels. This problem brings light to the use of renewable energy resources, like solar energy, which seems like a propitious proposal to resolve depleting energy resources. The prevalence of renewable resources is attempted by harnessing nature like the sun, wind, water and tides. Alternatives to this problem have led to primitive ways of domesticating the preexisting forces of nature, quite similar to the domestication of fire by early man. Rh-B is being employed in the existing analysis as a 'photo sensitizer' while EDTA is used as 'restrictive' in the current photo galvanic cell model for generating 'electric power.' Becquerel was the first to observe the "photo effects" in "electrochemical systems"[1-2]. The use of an electro deposited "CdSeO-5 TeO-5 electrode" for the conversion of "solar energy" as a plausible option was discovered by Alonso et al.[3]. The power of the "solar cell" is improved in which there is the mixture of dyes and this was first noticed by Jana and Bhowmik [4] and was further divulged by Hara et al. as they had analyzed the framework of "coumarin "dye"s" that has "thiophene moieties" for organic "dye" sensitized "solar cells" that are very efficient [5]. In "Azur A-KI"[6] "Bromophenol-EDTA" [7] and "Fluoroscein-EDTA" [8]systems, the inclusion of "toluidine blue nitroloacetic acid (TB-NTA)" [9] was noticed. For an educational endeavor in photo galvanic cells, [10] and "femto-second excited state dynamics of an iron (II) polypyridyl solar cell" [11] an analogous observation can be made. In nano porous, "dye" sensitized, "photo electrochemical solar cell" there was present both photo voltage and photocurrent according to Schwarzhurg and Willig [12]. "Tennakone and Kumara"[13] experimented with the sensitization of nano-poreous "tio2" film with "santaline" (red sandalwood pigment) to further develop the utilisation of a sensitised "photovoltaic" solid state.Yadav et al. discovered using a "bismarck brown-ascorbic acid (BB-AA) system" in "photo galvanic cell" to convert "solar energy" to harness power [14]. Numerous journals and archives prove the use of different photo sensitizers and reductants in the current model of the photo galvanic cell.

2. EXPERIMENTS AND METHOD

The solutions are produced in DD water (double distilled water). They are stored in yellow-brown, opaque urns to protect them. A saturated calomel electrode (SCE) and reference "platinum electrode (1 to 1 cm2)" have been taken in one section of the H-shaped glass cell.The heterogeneous "dye," "sodium hydroxide" and "water" mix was filled in the other portion. In the absence of light,The calomel electrode was held saturated and the Platinum electrode was opened for the lamp '200 W.A constant temperature of 303 K (±0.1) remained within the system.

A water filter was performed to disrupt infrarot radiation. For evaluating the "potential" and "current," a "digital pH metre" and a "micro ammetric" are employed. Extensive pressure was applied by means of a "carbon pot (log 500 K)" connected to the circuit and the current and voltage Circuit and current and voltage curve coupled was drawn by means of the variable resistor (carbon pot).

3. RESULT AND DISCUSSIONS
3.1 pH impacts

The pH impact on the "electric output" of the cell with an increase of pH in pH to pH 13 but the photo-potential and photo-pressure output decrease again. The effects of pH are more severe in pH. The dependence on the concentration of "photo potential" and "photo current" was researched and results were presented in Table 1. It is shown that with the growth in "Rh-B" concentration, the "photo current" and "Photo potential" increase to their maximum value, which is "$4.8 - 10{-}6$ M," and decreases after that. Only a limited quantity of output at low concentration of "Rh-B," As the "dye" molecules are to arouse limited amounts and deliver the electrons a platinum electrode in a consecutive way. The photo potentials fall as the "faring" concentration increases, as the "light intensity" drops as it reaches the "faring" molecules near the electrode, because the "faring" in its path takes up the major section of light.

Table-1

S.No.	Electrical parameter	Observations
		Rh B-EDTA System
1.	Photo potential	1162
2.	Maximum photocurrent	510
3.	Short circuit current	450
4.	Equilibrium photocurrent	450
5.	Power point current	200
6.	Potential at place of power	658
7.	Strength at place of power	131.6
8.	Rate of generation of current	14.17
9.	Charging time	140
10.	Fill factor	0.2516
11.	Conversion efficiency	1.2653
12.	$T_{1/2}$	170
13.	Open circuit voltage	1162
14.	Storage capacity	1.2142

3.2 Concentrations Effects of EDTA

The dependence on the reductant (EDTa) concentration of "photo potential" and "photo current" has been researched, and Table 1 shows the outcomes.. The photo potential and photo current attained their maximal value when the EDTA concentration is $2 \times 10 -3$ M. The reduction molecule is much less available when its concentration is low, which is why the "force output" obtained is very small, because electrons are not sufficiently available for "dye" molecule donation,but moleculs do not allow the "dye" molecule for time reaching the electrode in time at high reduction concentrations.

3.3 Intensity effects of light

"Electrical parameter" changes of "light intensity." linearly increasing the photo current with "light intensity" rising and photograph potentials with the "light intensity" increasing logarithmically.The quantity of photons (event power) per unit area is growing, and this is why the picture

current and photo potential for the 'pictures of the galvanic cell' are raised also. The molecule "dye" hits around the "Platinum Electrode."

3.4 Dissemination length effects

The impacts of the differences in "diffusion distance," on current imax parameters, ièq and original rates of the cell were detected using h-cells of different sizes.The present photograph (imax) originally showed a quick rise. It translates into the 'slow rate-determining phase' of a 'initial quick reaction.'

3.5 "Current voltage (i–V) characteristics, conversion efficiency and performance of the cell"

A "carbon pot (linear 470 K)" connected by a "multi-mètre circuit" and an "external charging" indicated the differences between the "current" and the 'potential' of the 2 higher values (Voc and isc). The values for "open circuit voltage" and "short circuit current" respectively were combined with an electronic multi-meter with an open circuit setup and a micro-ameter with a closed circuit setup. Illustrates i–V characteristic of "Rh-B-EDTA system." the cell 'fill factor' and 'efficiency conversion' were estimated at 0.2516 and 1.2653 percent as below:

$$\text{Fill Factor} \quad = \quad \frac{V_{pp} \times i_{pp}}{V_{oc} \times i_{sc}}$$

$$\text{Conversion Efficiency} \quad = \quad \frac{V_{pp} \times i_{pp}}{10.4 mWcm^{-2}} \times 100 \quad \%$$

The "power point" is the point at which V_{pp} represents the maximum product of the "photo current" and the "photo potential," and the current is shown in i-V curve at that point..
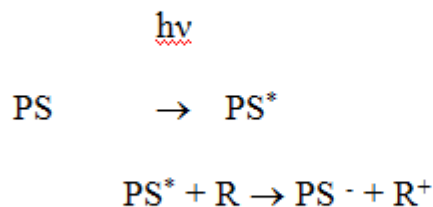
In contrast to "photovoltaic cells," which do not work in the absence of light, the cell operating without light at its own "power point" for 170 minutes. The "photogalvanic cell" system is of benefit with "lowest conversion efficiency," because of its use in the dark. The "cycle performance," while the cell is in the darkness, can be calculationed by external setting of the "current" and the "power point" intended load.

3.6 Mechanism

The studies conclude that the redox potential of EDTA is greater compared to "Rh-B" and "redox potential" does not react when the system is kept dark. The "potential" is shown to suddenly decline when the "platinum electrode" is kept clear and stable. While the path of "potential change" is reversed when the light is removed and the initial value is not obtained. This demonstrates that a certain irreversible reaction results in an enterprise having major "reversible picture chemical reaction." In this 'photo-galvanizing system,' the 'electro-active species' is not the same as in 'thionine-iron' (ii) system.' Active species such as "leuco- or semi-treated species".In this study, in the room there is an active species such as "leukos - or half-diminished colour," which has light and the coloration itself in the chamber is light-free. The 'generating mechanism' in a 'photo galvanic cell' can be shown according to the prior data as:

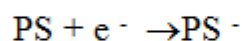**Illuminated Chamber**

Bulk solution

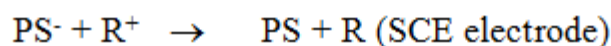$$PS \xrightarrow{h\nu} PS^*$$

$$PS^* + R \rightarrow PS^- + R^+$$

At electrode

$$PS^- \rightarrow PS + e^- \text{ (Platinum electrode)}$$
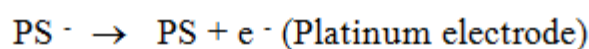
Dark chamber

At electrode

$$PS + e^- \rightarrow PS^-$$

Bulk solution

$$PS^- + R^+ \rightarrow PS + R \text{ (SCE electrode)}$$

Where, R (reductant EDTA), R+ (oxidized reductant EDTA), PS (Rh-B), PS− (leuco or semileuco)

4. Conclusion

Inferences show that Rh-B is used as "photosensitizer" in the "photogalvanic cell" model, following the evaluation of study and experiment conclusions. The "cell conversion efficiency" is 1.2653%, which works for 170 minutes without light at "power point." "Photo galvanic cell" is an advantage due to its "built-in capacity" and this is why it shows a favourable possibility of being an option in the market. "Photogalvanic cell"

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References

[1]. Becquerel E, Studies of the effect of actinic radiation of sunlight by means of electrical currents. *C.R. Acad.Sci.Paris.*, 9,145–159 **(1839a)**

[2]. Becquerel E,On electric effects under the influence of solar radiation. *C. R. Acad. Sci. Paris.* , 9,561 **(1839b)**

[3]. Alanso V N, Belay M, Chartier P, Ern V, *Rev. Phys. Appl.*,16, 5 **(1981)**

[4]. Jan a A K, Bhowmik B B, Enhancement in power output of solar cells consisting of mixed "dye"s. *J. Photochem.Photobiol,* 122A, 53 **(1999)**

[5]. Hara K, Kurashige M, Dan-oh Y, Kasada C, Shinpo A, Suga S, Sayama K, Arakawa H, Design of new coumarin "dye"s having thiophene moieties for highly efficient organic "dye"- sensitized solar cells. *New J. Chem.,* 27,783–785 **(2003)**

[6]. Ameta S C, Ameta R, Seth S, Dubey T D,Studies in the use of toluidine bluenitrilotriacetic acid (TB-NTA) system in photogalvanic cell for solar energy conversion. *Afinidad.* XLV, 264–266 **(1998)**

[7]. Ameta S C, Khamesare S, Ameta R,Bala M, Use of micelles in photogalvanic cell for solar energy conversion and storage: AzurA-KI system. *Int.J. Energy Res*, 14,163–167 **(1990)**

[8]. Ameta S C, Punjabi P B, Vardia J, Madhwani S, Chaudhary S, Use of Bromophenol Red–EDTA system for generation of electricity in a photogalvanic cell. *J. Power Sources.* 159,747–751 **(2006)**

[9]. Madhwani S, Ameta R, Vardia J, Punjabi P B, Sharma V K, Use of Fluoroscein-EDTA System in Photogalvanic Cell for Solar Energy Conversion. *Energy sources,* 29,721-729 **(2007)**

[10]. Bohrmann-Linde C, Tausch M W, Photogalvanic cells for classroom investigations- A contribution for the ongoing curriculum modernization. *J. Chem. Educ.,* 80, 1471–1473 **(2003)**

[11]. Monat J E,McCusker J K, Femtosecond excited-state dynamics of an Iron (II) polypyridyl solar cell sensitizer model. *J. Amer. Chem. Soc.,* 122, 4092–4097 **(2000)**

[12]. Schwarzburg K, Willig F, Origin of Photovoltage and Photocurrent in the Nanoporous "dye"- Sensitized Electrochemical Solar Cell. *J. Phys. Chem.,* 103B, 5743 **(1999)**

[13]. Tennakone K, Kumara GR R A, "dye"-sensitized photoelectrochemical and solid-state solar cells: Charge separation, transport and recombination mechanisms. *J. Photochem.Photobiol*, 117A, 137 **(1998)**

[14]. Yadav Sushil, Yadav R D, Singh Gautam, Use of "dye"s in Photogalvanic cell for solar energy conversion and storage: Bismarck Brown and Ascorbic Acid System. *Int. J. Chem. Sci.,* 6 (4), 1960-1966 **(2008)**