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Effect of Concentration on Parameters of DSSCs was Fabricated by Alcian Blue 8GX Dye at Different Concentrations and Meh-PPV Polymer

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Abstract

Economical solar energy conversion to electricity can be boosted by the discovery of fundamentally new photovoltaic mechanism. However, in this paper reports the observation the effect of different concentration of Alcian Blue 8GX dye on the DSSCs was fabricated by depositing the polymer solution on ITO a glass manner Spin Coating method and MEH-PPV polymer photovoltaic, efficiency varied from 0.351% to 2.383%.

Keywords: ***Polymer; Photovoltaic; Alcian blue; 8GX dye***

Introduction

It is expected that the global energy demand will double within the next 50 years. Fossil fuels, however, are running out and are held responsible for the increased concentration of carbon dioxide in the earth's atmosphere. Hence, developing environmentally friendly, renewable energy is one of the challenges to society in the 21st century. One of the renewable energy technologies is photovoltaic (PV), the technology that directly converts daylight into electricity. PV is one of the fastest growing of all the renewable energy technologies, in fact, it is one of the fastest growing industries at present.1Solar cell manufacturing based on the technology of crystalline, silicon devices is growing by approximately 40% per year and this growth rate is increasing. This has been realized mainly by special market implementation programs and other government grants to encourage a substantial use of the current PV technologies based on silicon. Unfortunately, financial support by governments is under constant pressure [1].

In 1991, Brian O'Regan and Michael Grätzel introduced the dye sensitized solar cell (DSSC). This type of solar cell is considered as accost effective alternative for silicon solar cells. The heart of the DSSC is a high surface area TiO_2 nano

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particulate electrode, covered with a monolayer of dye molecules. Upon photo excitation of the dye an electron is injected into the conduction band of the TiO_2. A redox couple (I-/I3-) in an electrolyte [2-3].

Materials and Methods

Were 7 sample of Alcian Blue 8GX dye different concentration and MEH-PPV polymer solar cells made on ITO a glass manner Spin Coating. Gold was fabricated on the layers to represent the anode and ITO Cathode. A clean glass plate with a thin layer of ITO (Indium Tin Oxide) is needed. The ITO acts as the first part of the solar cell, the first electrode. The fabrication process started by preparing the Alcian Blue 8GX dye different concentration (1.5, 1.4,1.3,1.2,1.1, 1 and 0.9) mg. L^{-1} of Alcian Blue 8GX dye dissolving by acetone and then interest on spin coated on indium tin oxide glass. The Alcian Blue 8GX dye solar cell was made on ITO glass. The ITO glasses were firstly cleaned by ethanol and distilled water. Alcian Blue 8GX dye was dissolved into acetone. Then 3mg of MEH-PPV polymer dissolved into 0.5 of high pure chloroform was deposited on Alcian Blue 8GX dye. Being inserted electrical circuit containing the (voltmeter and Ammeter and a light source Lamp with the intensity radiological" and a solar cell). Cell was offered to light and fulfilled taking the results of the current and voltages were recorded. The samples were prepared.

Results

The DSSCs was fabricated by depositing the polymer solution on ITO a glass manner Spin Coating method for eight types of Alcian Blue 8GX dye different concentration and MEH-PPV polymer, DSSCs parameters was calculated from the (I-V) characteristics, the figures below i.e. TABLES 1-7 from sample 1 to sample 7 show these (I-V) characteristics.

TABLE 1. **I-V reaction for sample 1.**

Voltage (V)	Current (mA)
0.04556	20.40674
0.05248	20.40674
0.05941	20.40674
0.06784	20.40674
0.07814	20.40674
0.09012	20.40674
0.10061	18.83226
0.10098	16.56598
0.10192	14.05543

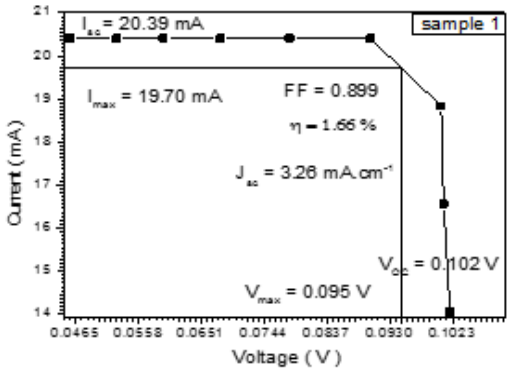

FIG. 1. **I-V characteristics for sample 1 cells.**

TABLE 2. **I-V reaction for sample 2.**

Voltage (V)	Current (mA)
0.07566	20.68402
0.08323	20.65762
0.09099	20.65762
0.10011	20.68402
0.11232	20.68402
0.12319	20.45528
0.13386	18.8585
0.13465	16.27199
0.13543	14.09018

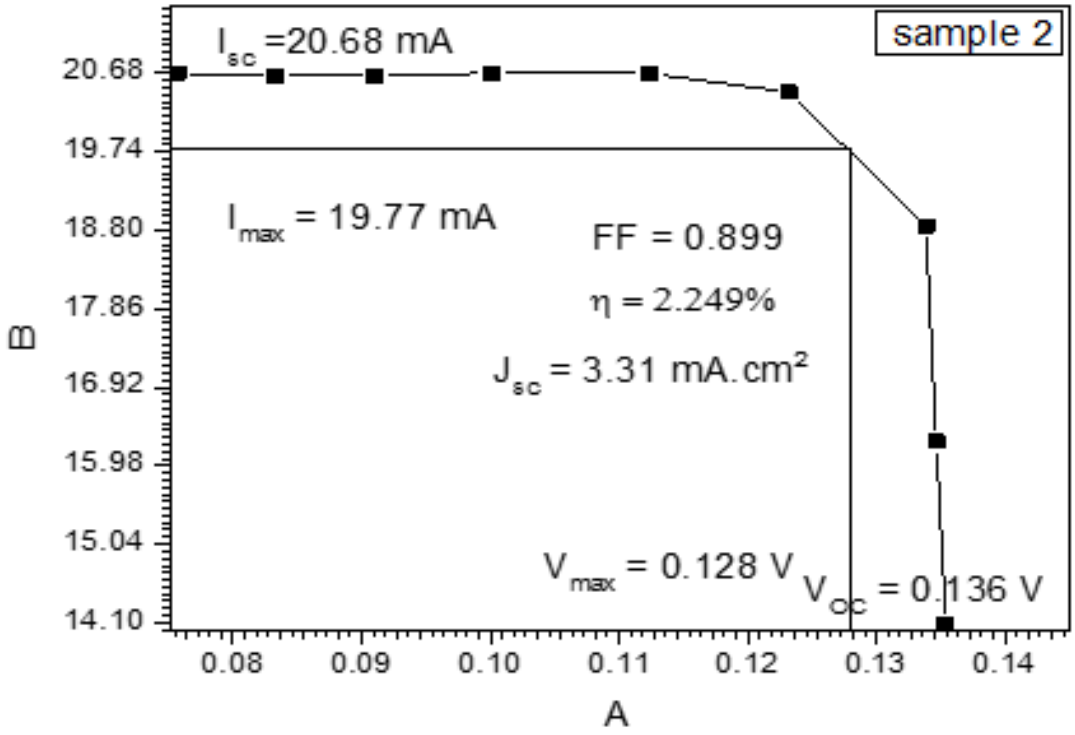

FIG. 2. **I-V characteristics for sample 2 cells.**

TABLE 3. **I-V reaction for sample 3.**

Voltage (V)	Current (mA)
0.09275	22.02823
0.09785	22.05352
0.10273	22.05352
0.10803	22.05352
0.11561	22.02823
0.12227	21.98974
0.12664	21.06488
0.12747	19.74633
0.12747	18.79509

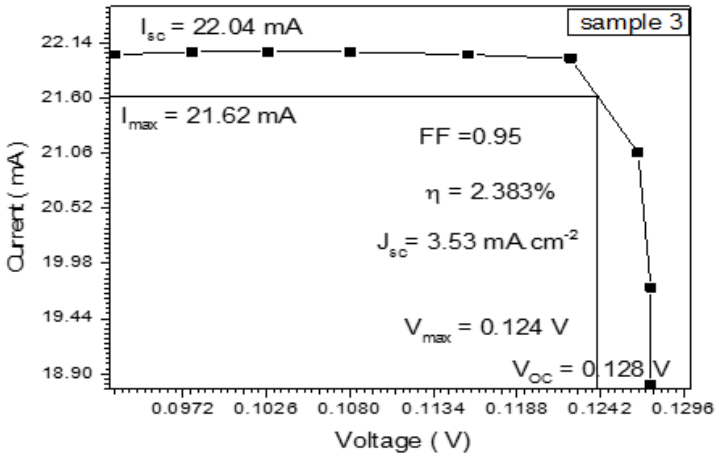

FIG. 3. **I-V characteristics for sample 3 cells.**

TABLE. 4. **I-V reaction for sample 4.**

Voltage (V)	Current (mA)
0.11541	29.54531
0.118	29.57522
0.12037	29.57522
0.12418	29.60264
0.12898	29.60264
0.13477	29.60264
0.13912	27.90762
0.14019	25.40748
0.14019	22.1022

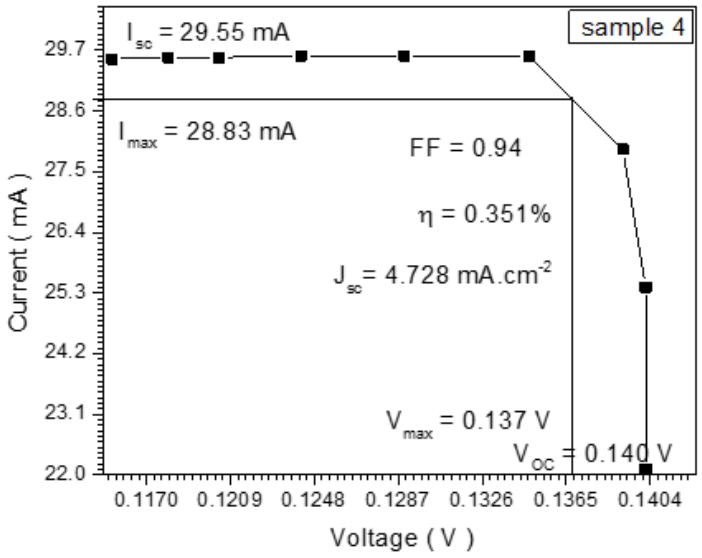

FIG. 4. **I-V characteristics for sample 4 cells.**

TABLE 5. **I-V reaction for sample 5.**

Voltage (V)	Current (mA)
0.14802	23.0165
0.15214	23.0165
0.15874	23.00601
0.16462	22.99457
0.17216	22.98409
0.181	22.95073
0.1863	22.11584
0.18713	20.95117
0.18724	20.02859

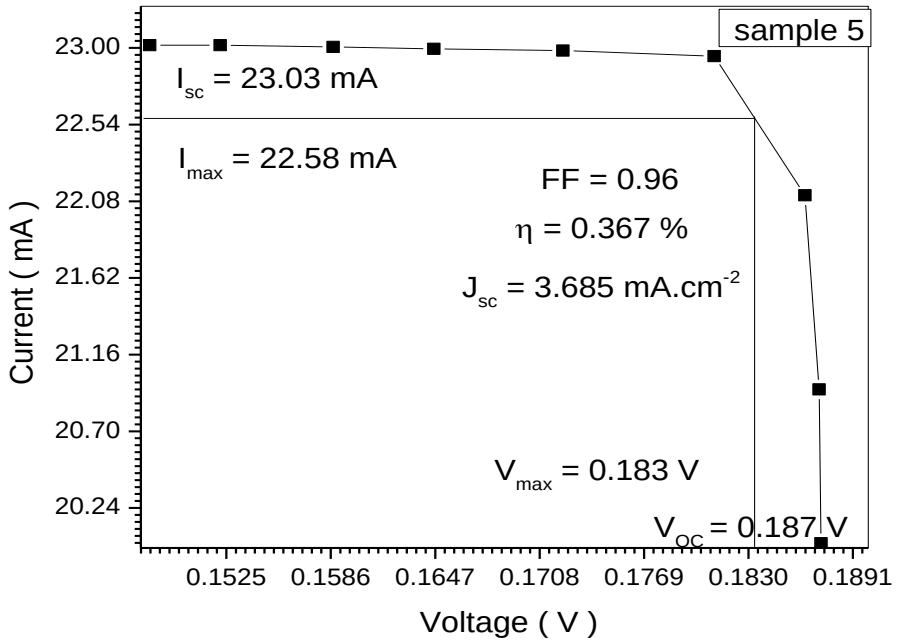

FIG. 5. **I-V characteristics for sample 5 cells.**

TABLE. 6. **I-V reaction for sample 6.**

Voltage (V)	Current (mA)
0.14298	25.96862
0.16625	25.96862
0.19567	25.94751
0.22505	25.94751
0.26216	25.94751
0.29875	25.90704
0.3237	24.64897
0.32817	23.02669
0.32928	20.59326

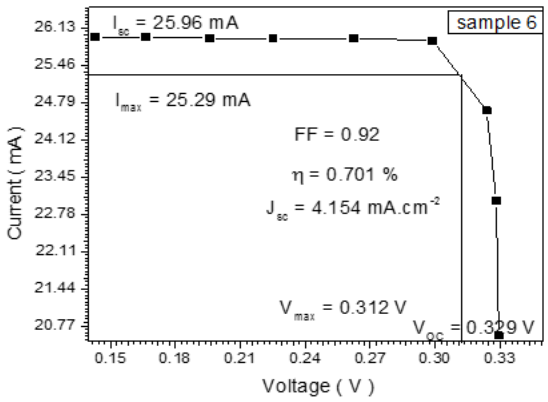

FIG. 6. **I-V characteristics for sample 6 cells.**

TABLE 7. **I-V reaction for sample 7.**

Current (mA)	Voltage (V)
25.06891	0.16547
25.09003	0.17148
25.09003	0.17866
25.09003	0.19031
25.09003	0.20252
25.09003	0.21785
23.50821	0.22813
20.91114	0.23027
19.57214	0.23027

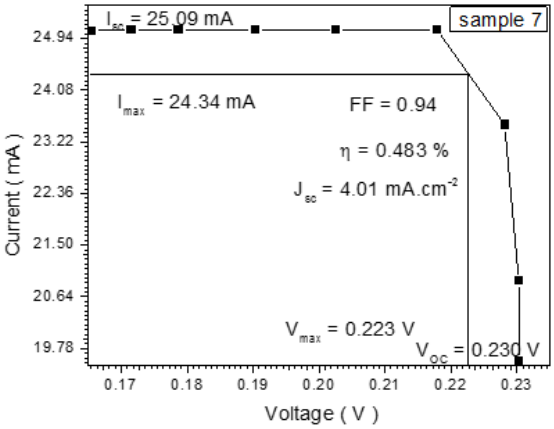

FIG. 7. **I-V characteristics for sample 7 cells.**

TABLE 8. **The parameters of the DSSCs sensitized with different concentration.**

Sample concentration (mg. L^{-1})	**I_{sc} mA**	**I_{max} (mA)**	**V_{max} (V)**	**V_{oc} (V)**	**FF**	**J_{sc} (mA/cm^2)**	**η %**
1.5	20.39	19.70	0.095	0.102	0.899	3.26	1.66
1.4	20.68	19.77	0.128	0.136	0.899	3.31	2.249
1.3	22.04	21.62	0.124	0.128	0.95	3.53	2.383
1.2	29.55	28.83	0.137	0.140	0.94	4.728	0.351
1.1	23.03	22.58	0.183	0.187	0.96	3.685	0.367
1	25.96	25.29	0.312	0.329	0.92	4.154	0.701
0.9	25.59	24.34	0.223	0.23	0.94	4.01	0.483

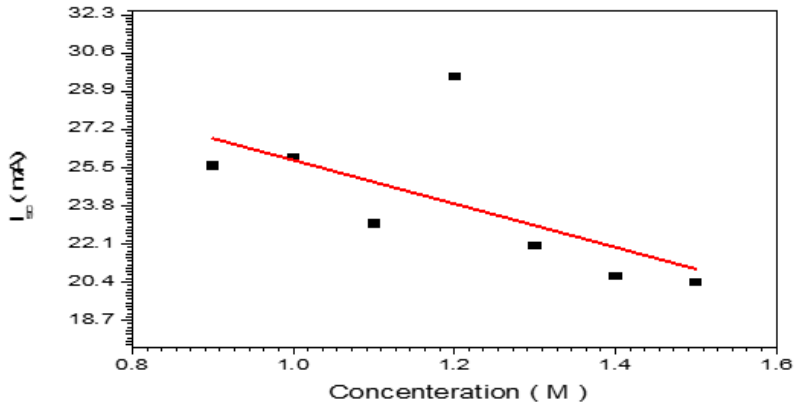

FIG 8. **The relationship between the concentration and $I_{sc.}$**

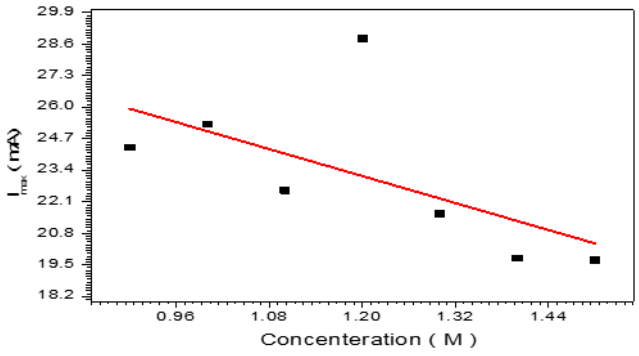

FIG. 9. **The relationship between the concentration and $I_{max.}$**

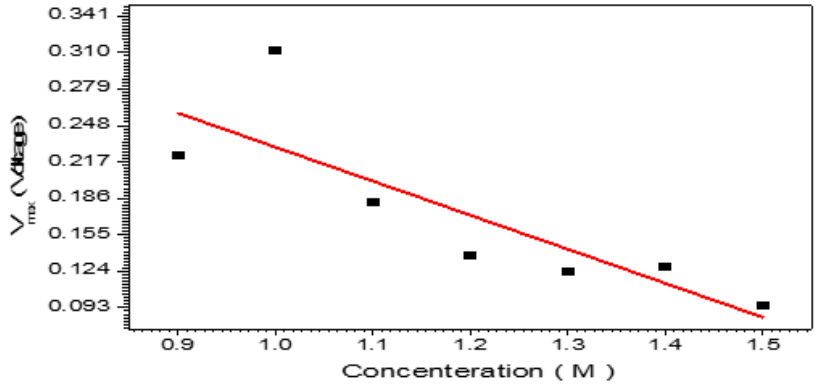

FIG. 10. **The relationship between the concentration and $V_{max.}$**

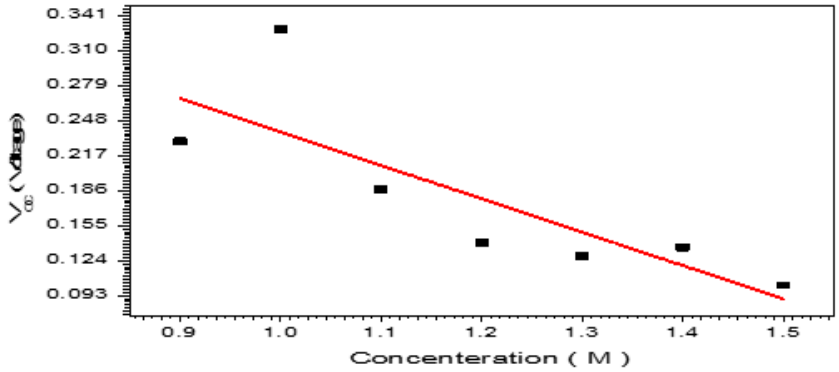

FIG. 11. **The relationship between the concentration and $V_{OC.}$**

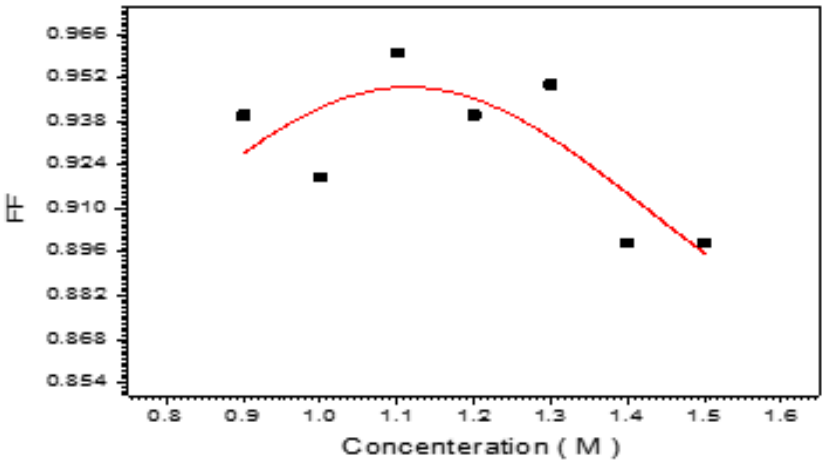

FIG. 12. **The relationship between the concentration and FF.**

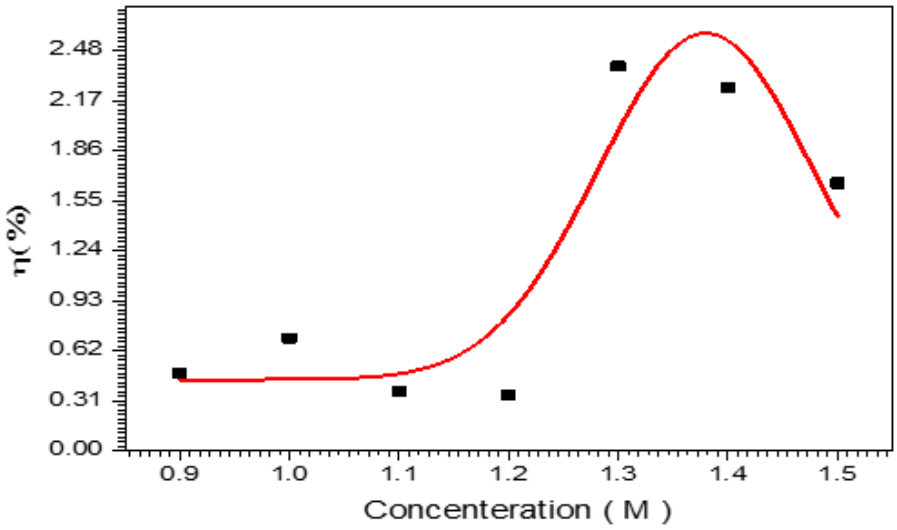

FIG. 13. **The relationship between the concentration and efficiency.**

Discussion

The percentage power conversion efficiency (PCE) or of any solar cell device is simply the ratio of power output (Pout) versus power input, (Pin), power input (Pin) depend upon the incident light flux (Io), and Power output implicit properties of the device itself ;namely the short- circuit current (Isc) open-sir cut voltage (Voc) and fill-factor (FF). The short-circuit current density (Jsc) is typically reported to allow comparison between devices whose dimensions may vary (Jsc=Isc/area). The FF is determined by the ratio maximum obtainable power/theoretical obtainable power where the theoretical obtainable power is the product Isc, Voc (Isc and Voc being zero at open-circuit and short-circuit condition respectively with grade A solar-cells typically having [4-8].

$$FF = \frac{\text{Imax Vmax}}{IscVoc} \% \qquad (1)$$

$$\text{PCE} = \eta = \frac{\text{Pout}}{\text{Pin}} \times 100 = \frac{IscVoc\ FF}{Pi\ A} \times 100 \qquad (2)$$

The performance of DSSC sensitizers (was fabricated by Alcian Blue 8GX dye different concentration and MEH-PPV polymer) was evaluated by I_{sc}, V_{oc}, fill factor (FF) from equation (1), and energy conversion efficiency (η) from equation (2). FIG. 1 to FIG. 7 shows the I-V curves of the DSSCs fabricated using was fabricated by Alcian Blue 8GX dye different concentration and MEH-PPV polymer. All the parameters of the DSSCs sensitized with different concentration are listed in TABLE 8. As displayed in TABLE 8, I_{sc} varied from 20.39 to 29.55 mA, V_{oc} changed from 0.102 to 0.329 V, and the FF of the fabricated DSSC ranged between 0.899 and 0.95. The best performance was obtained from the DSSC sensitized by 1.3 mg. L^{-1} concentrations, where the efficiency of both of the cells reached 2.383%, because it is more stable under concentration conditions and show the effect of concentration on all parameters in FIG. 8 to FIG. 13. The effects of concentration of Alcian Blue 8GX dye on the (I_{sc}, I_{max}, $V_{max,}$ and V_{OC}) decreased with concentration increased but FF and η expiation relationship.

Conclusion

In this research, DSSCs were assembled using depositing the polymer solution on ITO a glass manner Spin Coatingas Nano crystalline TiO_2 photo electrodes. Photovoltaic parameters of the fabricated DSSCs were determined under 180 W/cm^2 illumination. The best performance was obtained for the DSSC sensitized with the Alcian Blue 8GX dyes concentration (1.3 mg. L^{-1}) and MEH-PPV polymer, where the efficiency of the cell reached 2.383% because it is more stable under concentration conditions.

Acknowledgments

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Conflict of Interest

The authors declare no conflict of interest.

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