

Supplementary Information for

Photogalvanics of the Copper and Brass working electrodes in the NaOH-Allura Red-D-Galactose-DDAC electrolyte for solar power generation

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1. Electrolyte composition variation for photogalvanics of Copper working electrode (0.3 cm × 0.2 cm)

The electrical parameters of the Allura Red-D-Galactose-DDAC-Copper photogalvanic system are observed by taking 35 ml of the total solution in each four cells. The concentration of each chemical is different in each of the four cells. The 1st cell has 0.05 ml of M/500 Allura Red (dye) with resultant concentration 0.28×10^{-5} M, 0.05 ml of M/100 D-Galactose (reductant) with resultant concentration 0.14×10^{-4} M, 0.05 ml of M/10 Didecyl Dimethyl Ammonium Chloride (surfactant) with resultant concentration 0.14×10^{-3} M and 1N NaOH of resultant pH 13.66. The 2nd cell has 0.1 ml of M/500 Allura Red (dye) with resultant concentration 0.57×10^{-5} M, 0.1 ml of M/100 D-Galactose (reductant) with resultant concentration 0.28×10^{-4} M, 0.1 ml of M/10 Didecyl Dimethyl Ammonium Chloride (surfactant) with resultant concentration 0.28×10^{-3} M and 1N NaOH of resultant pH 13.66. The 3rd cell has 0.5 ml of M/500 Allura Red (dye) with resultant concentration 2.85×10^{-5} M, 0.5 ml of M/100 D-Galactose (reductant) with resultant concentration 1.42×10^{-4} M, 0.5 ml of M/10 Didecyl Dimethyl Ammonium Chloride (surfactant) with resultant concentration 1.42×10^{-3} M and 1N NaOH of resultant pH 13.66. The 4th cell has 1.5 ml of M/500 Allura Red (dye) with resultant concentration 8.5×10^{-5} M, 1.5 ml of M/100 D-Galactose (reductant) with resultant concentration 4.28×10^{-4} M, 1.5 ml of M/10 Didecyl Dimethyl Ammonium Chloride (surfactant) with resultant concentration 4.28×10^{-3} M and 1N NaOH of resultant pH 13.66.

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2. Study of potential variation with time during illumination of the NaOH-Allura Red-D-Galactose-DDAC-Brass (0.3 cm × 0.2 cm) photogalvanic system

In the Allura Red-D-Galactose-DDAC-Brass photogalvanic system, the H-cell is filled with the known amount of the electrolyte solution (total volume 35 ml, 0.5 ml of M/500 dye, 0.5 ml of M/100 reductant, 0.5 ml of M/10 surfactant, 16 ml of 1N NaOH, and 17.5 ml of distilled water).

3. Electrolyte composition variation for photogalvanics of Brass working electrode (0.3 cm × 0.2 cm)

The electrical parameters of the Allura Red-D-Galactose-DDAC-Brass photogalvanic system are observed by taking 35 ml of the total solution in each five cells. The concentration of each chemical is different in each of the five cells. The 1st cell has 0.05 ml of M/500 Allura Red (dye) with resultant concentration 0.28×10^{-5} M, 0.05 ml of M/100D-Galactose (reductant) with resultant concentration 0.14×10^{-4} M, 0.05 ml of M/10 Didecyl Dimethyl Ammonium Chloride (surfactant) with resultant concentration 0.14×10^{-3} M and 16 ml of 1N NaOH with resultant pH 13.66. The 2nd cell has 0.1 ml of M/500 Allura Red (dye) with resultant concentration 0.57×10^{-5} M, 0.1 ml of M/100 D-Galactose (reductant) with resultant concentration 0.28×10^{-4} M, 0.1 ml of M/10 Didecyl Dimethyl Ammonium Chloride (surfactant) with resultant concentration 0.28×10^{-3} M, and 16ml of 1N NaOH with resultant pH 13.66. The 3rd cell has 0.5 ml of M/500 Allura Red (dye) with resultant concentration 2.85×10^{-5} M, 0.5 ml of M/100 D-Galactose (reductant) with resultant concentration 1.42×10^{-4} M, 0.5 ml of M/10 Didecyl Dimethyl Ammonium Chloride (surfactant) with resultant concentration 1.42×10^{-3} M, and 16 ml of 1N NaOH of resultant pH 13.66. The 4th cell has 1.5 ml of M/500 Allura Red (dye) with resultant concentration 8.5×10^{-5} M, 1.5 ml of M/100 D-Galactose (reductant) with resultant concentration 4.28×10^{-4} M, 1.5 ml of M/10 Didecyl Dimethyl Ammonium Chloride (surfactant) with resultant concentration 4.28×10^{-3} M, and 16 ml of 1N NaOH with resultant pH 13.66. It has been observed in this study that the electrical power output for the 2nd cell is highest. It has been observed in this study that the electrical power output for the 2nd cell is highest. In the 2nd cell the dye, reductant, surfactant and NaOH show highest cell performance at the optimal concentration of Dye 0.28×10^{-5} M, reductant 0.14×10^{-4} M, surfactant 0.14×10^{-3} M, NaOH pH 13.66.

4. Comparison of the photogalvanics of Copper, Brass, and platinum working electrodes

Each platinum based cell has 0.5 ml of M/100 D-Galactose (reductant) with resultant concentration 1.42×10^{-4} M, 0.5 ml of M/10 Didecyl Dimethyl Ammonium Chloride (surfactant) with resultant concentration 1.42×10^{-3} M, 16ml of 1N NaOH having resultant pH 13.66, 0.5 ml of M/500 Allura Red-D dye with resultant concentration 2.85×10^{-5} M, light intensity = 7.299 mWcm², diffusion length (DL) = 4.5 cm, pH = 13.66, and graphite counter electrode (cylindrical shape, length 4.1 cm \times diameter 0.3 cm). The experimental conditions for the platinum-based cells are same as for the copper and brass based cells (see sub-sections **4.1.1** and **4.2.1** for copper and brass electrodes-based cells).