A study on variation of product ion and reactant ion during PKL electricity generation

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Abstract

The electricity generated from fossil fuels (like oil, coal, and gas) are conventional. The copper and zinc plates are used as electrodes anf PKL extract are used as an electrolyte. These sources are harmful for environment during electricity generation. After certain period it will be finished. Then, it will be needed different forms of energy sources. In this paper it has been discussed the variation of product ion and reactant ion during PKL electricity generation. The reactant ion is [Cu^{2+}] and the product ion is [Zn^{2+}] those have been measured by AAS (Atomic Absorption) machine. Furthermore, load voltage, load current and load power for PKL modules have been studied.

Keywords: AAS (Atomic Absorption) machine, load voltage, load current, load power, PKL extract, reactant ion concentration [Cu^{2+}] and product ion concentration [Zn^{2+}]

I. Introduction

It has been surrounded by happiness for different innovative technology. Innovation of Electricity is one of the most important technologies for mankind. No one can think in the house, educational institutes, offices and industries without electricity. It is the part of house, educational institutes, offices and industries. Almost all electric appliances are operated by the electricity. It will be shown that the house, educational institutes, offices and industries will face more demand of electricity over the coming decades. It may be shown that the use of electricity will be double globally and triple in developing countries by 2030. At present we need the reliable power generation technology. There are a lot of barriers to product reliable electricity. The use of renewable energy sources like solar, wind, biogas, biomass, hydro, wave and OTEC is safe and eco friendly, but still there is a lot of certain problems. In spite of that we have to harness new and innovative sources for electricity generation. The use of fossil fuels for electricity generation is the key challenges for power production due to environmental issues. To keep it in mind it has been taken this work in this paper.

II. Methodology

II.A Copper

Electrolytic refined copper cathodes having high purity must be used. The purity of the copper anodes must be pure. It is also available in the market. Copper works as a cathode and Zinc works as an anode.

II.B Zinc

Zinc has metallic bonds, which makes the Electrons free to move more than one atom. Zinc is the sacrificial conductor of electricity. Zinc works as an anode and Copper works as a cathode.

II.C Experimental Details:

Fig.1 Experimental set-up of PKL electricity production

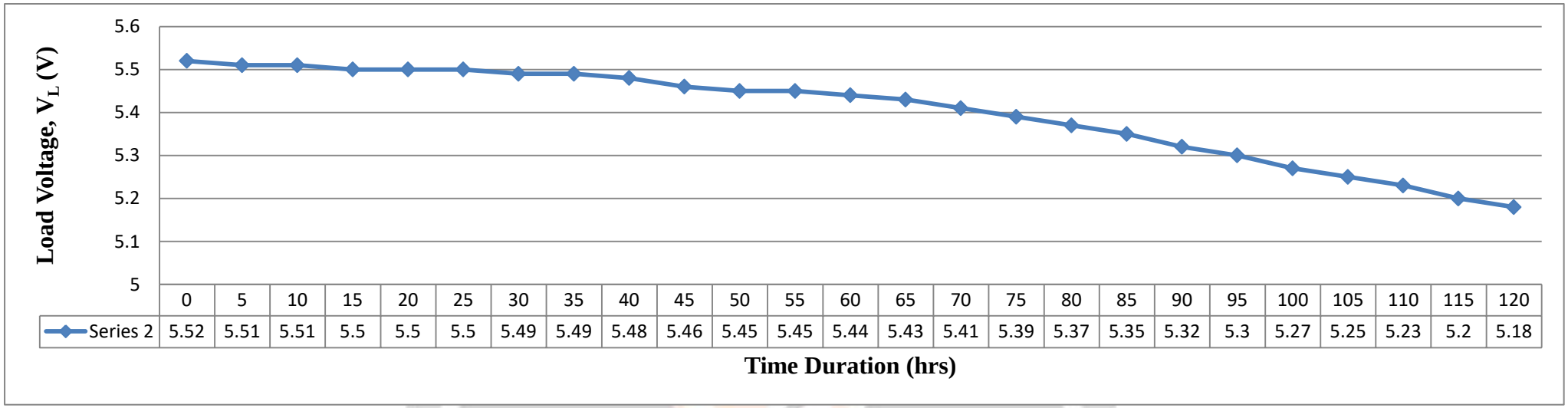
Fig.1 shows the experimental set-up of PKL electricity production. A tube light was used as a load. Copper and Zinc Plates were used as a cathode and anode respectively. Six cells were taken for this research. Copper is used as the cathode and zinc is used as the cathode. Length of the rod used is 20 cm and the diameter is 6mm.The electrodes are placed in series connection for the flow of electrons to produce electricity. The samples were collected by syringe to measure the reactant ion concentration [Cu^{2+}] and product ion concentration [Zn^{2+}]. The reactant ion concentration [Cu^{2+}] and product ion concentration [Zn^{2+}] were measured by AAS machine. The load voltage, load current and load power were measured by a calibrated multimeter.

II.D Electrolyte

Fig.2 PKL tree for getting electricity.

Fig.2 shows a PKL tree for electricity production. PKL extract was used as an electrolyte. Copper and Zinc are used as electrodes those are immersed into the PKL electrolyte. The PKL extract was made by a blender machine. The PKL extract was filtered by what man paper 41, 42 and membrane filter.

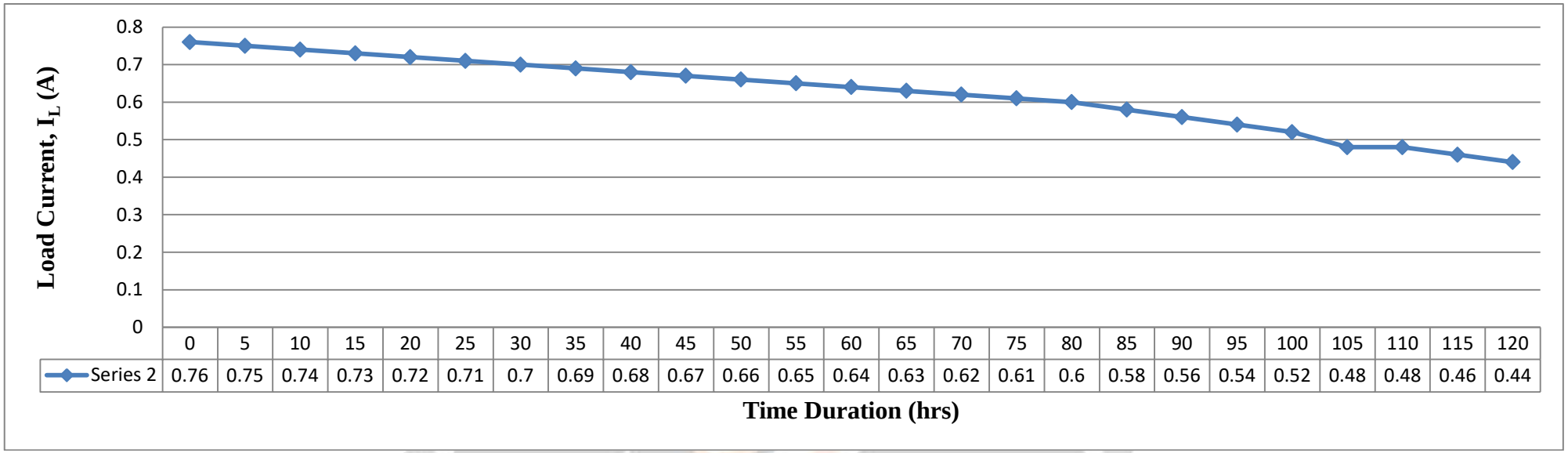
III. Results and Discussion



	0	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100	105	110	115	120
Series 2	5.52	5.51	5.51	5.5	5.5	5.5	5.49	5.49	5.48	5.46	5.45	5.45	5.44	5.43	5.41	5.39	5.37	5.35	5.32	5.3	5.27	5.25	5.23	5.2	5.18

Fig. 1: Load Voltage, V_L(V) Vs Time duration (hrs)

Fig.1 shows the variation of Load Voltage (V) Versus time duration (hrs) for Table-1. It is shown that the maximum load voltage is 5.52 volt and the minimum load voltage is 5.18 volt. So the difference between the maximum and minimum voltage is 0.34 volt. It is also shown that load voltage was almost constant up to 45 minutes then it decreases linearly up to 120 minutes.



	0	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100	105	110	115	120
Series 2	0.76	0.75	0.74	0.73	0.72	0.71	0.7	0.69	0.68	0.67	0.66	0.65	0.64	0.63	0.62	0.61	0.6	0.58	0.56	0.54	0.52	0.48	0.48	0.46	0.44

Fig. 2 of Load Current, I_L (A) Vs Time duration (hrs)

Fig. 2 shows the variation of Load Current (A) VS Time duration (hrs) for Table-1. It is shown that the maximum load Current is 0.7 A and the minimum load current is 0.4 A. So the difference between the maximum and minimum current is 0.3 A. It is also shown that load current decreases linearly up to 80 minutes and then it decreases exponentially up to 120 minutes.

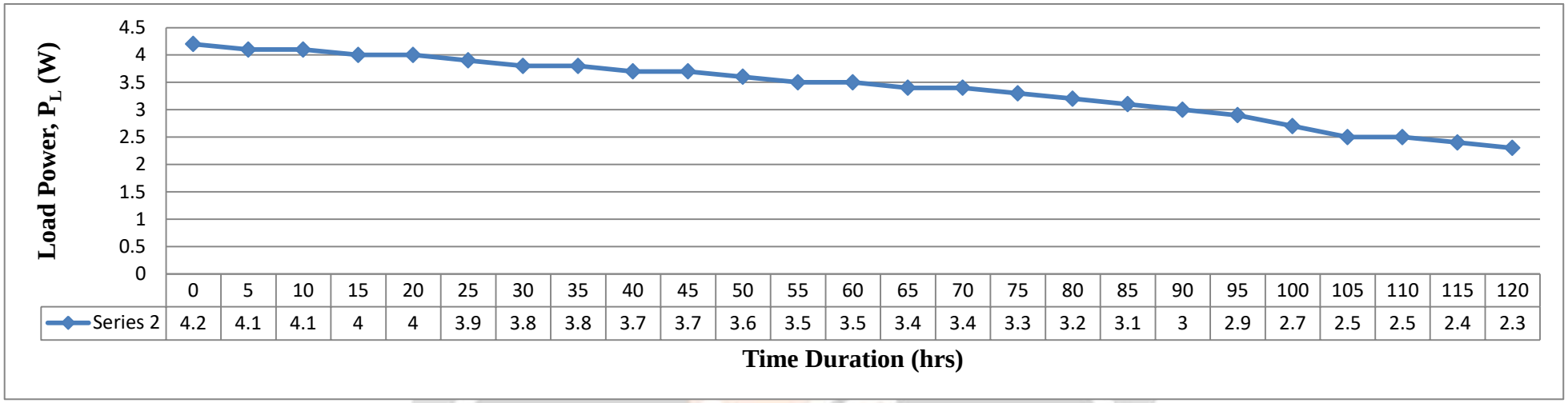


Fig. 3 Load Power, P_L (W) Vs Time duration (hrs)

Fig.3 shows the variation of Load Power (W) VS Time duration (hrs) for Table-1. It is shown that the maximum load power is 4.20 watt and the minimum load power is 2.30 Watt. So the difference between the maximum and minimum Load power is 1.90 watt. It is also shown that the load power decreases linearly up to 90 minutes and then it decreases exponentially up to 120 minutes. Few places it remains constant like in 15-20, 30-35 and 55-60 minutes.

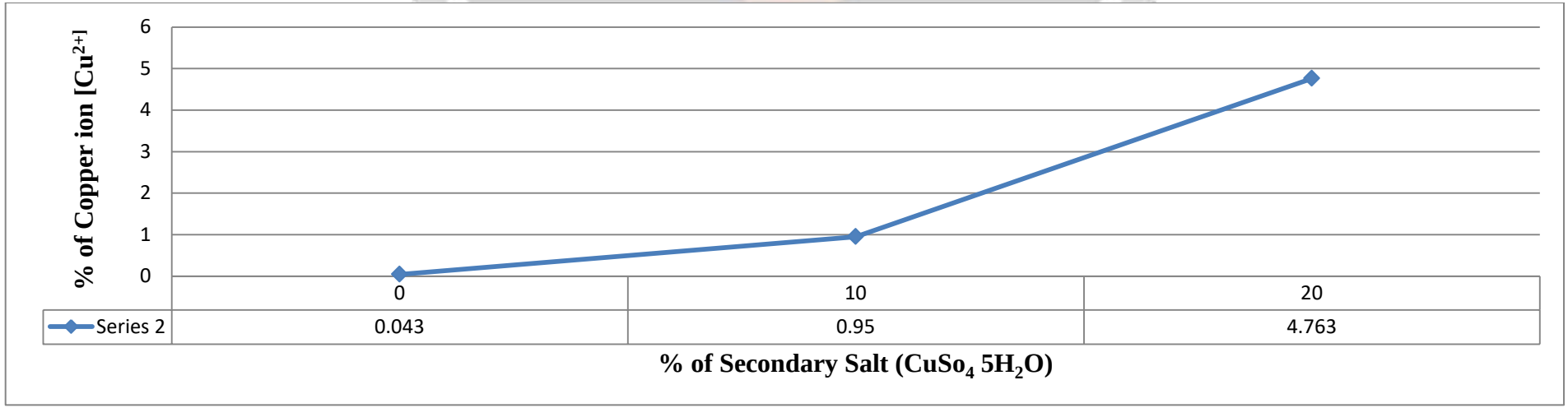


Fig. 4 % of the Copper ion [Cu^{2+}] (ppm) Vs % of secondary salt ($CuSO_4.5H_2O$)

Fig.4 shows the % of the Copper ion [Cu^{2+}] (ppm) Vs % of secondary salt ($CuSO_4.5H_2O$) for Table-2. It is shown that the maximum % of Copper ion (ppm) is 4.763 ppm and the minimum % of Copper ion is 0.043 ppm. So the difference between the maximum and minimum % of Copper ion is 4.72 ppm. It is also shown that the % of the Copper ion [Cu^{2+}] (ppm) increases linearly up to 10 and then it increases exponentially up to 20.

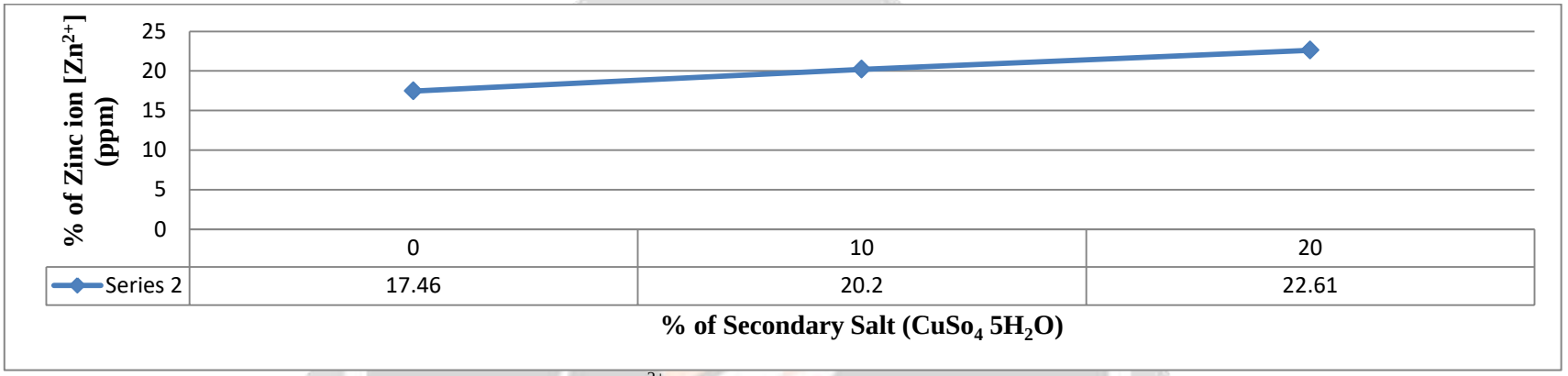


Fig. 5 of % of the Zinc ion [Zn^{2+}] (ppm) Vs % of secondary salt ($CuSO_4$ $5H_2O$)

Fig.5 shows the % of the Zinc ion [Zn^{2+}] (ppm) Vs % of secondary salt ($CuSO_4.5H_2O$) for Table-2. It is shown that the maximum % of Zinc ion (ppm) is 22.61 ppm and the minimum % of Zinc ion is 17.46 ppm. So the difference between the maximum and minimum % of Zinc ion is 5.15 ppm. It is also shown that the % of the Zinc ion [Zn^{2+}] (ppm) increases linearly up to 10 and then it increases exponentially up to 20.

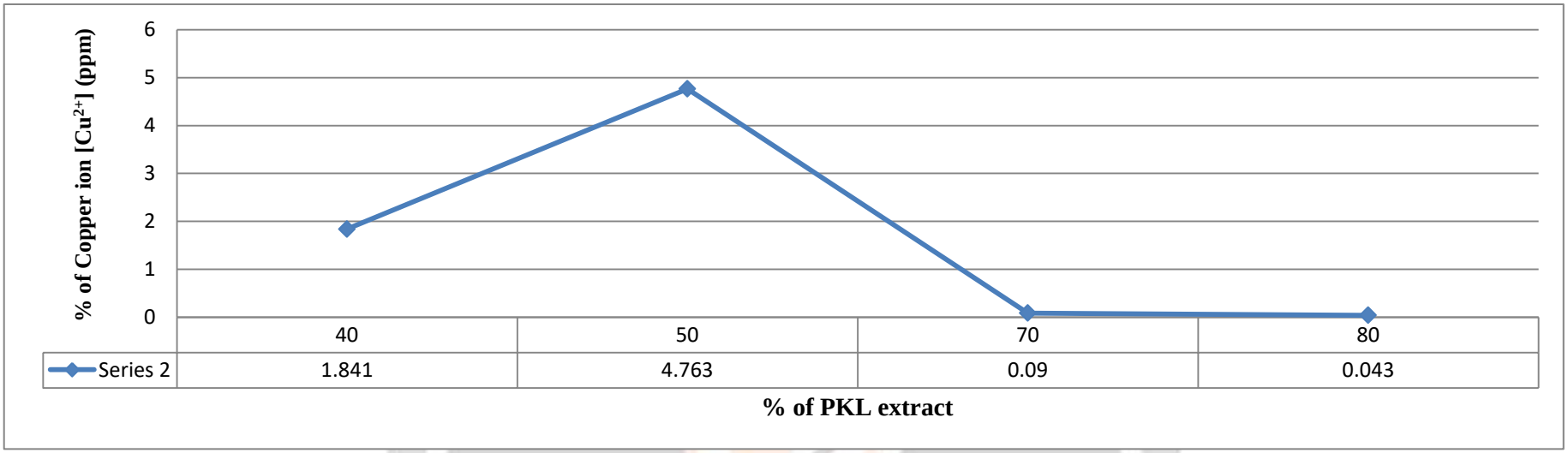


Fig. 6 % of the Copper ion [Cu^{2+}] (ppm) Vs % of PKL extract

Fig.6 shows the % of the Copper ion [Cu^{2+}] (ppm) Vs % of PKL extract for Table-3. It is shown that the maximum % of Copper ion (ppm) is 4.763 ppm and the minimum % of Copper ion is 0.043 ppm. So the difference between the maximum and minimum % of Copper ion is 4.72 ppm. It is also shown that the % of the Copper ion [Cu^{2+}] (ppm) increases exponentially up to 50 and then it decreases exponentially up to 70. Finally, it is shown that the % of Cu^{2+} ion (ppm) was almost constant up to 80.

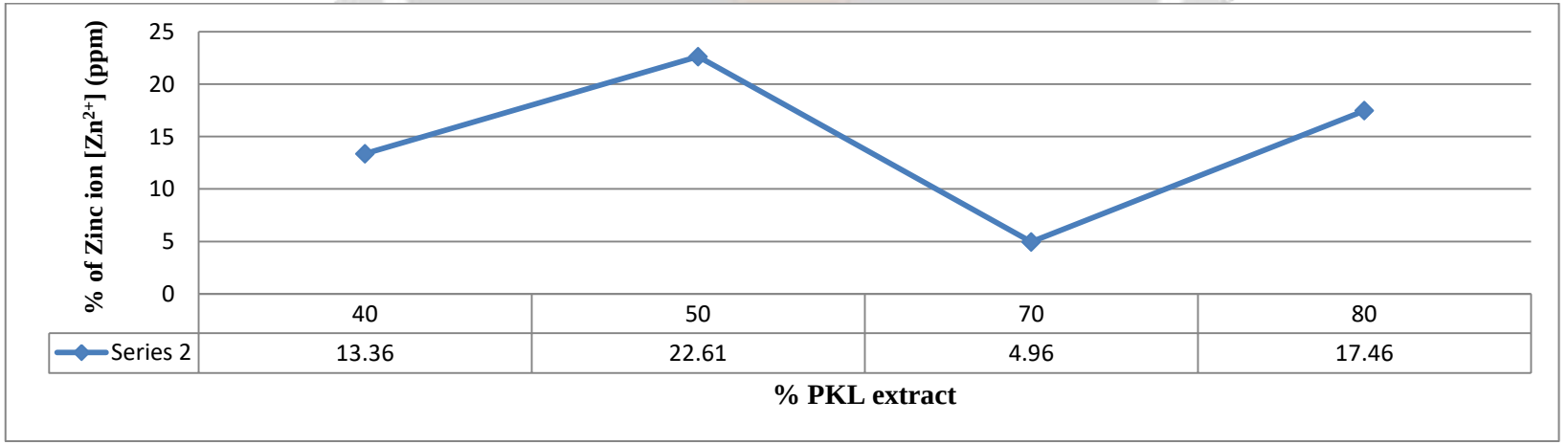


Fig.7 of % of the Zinc ion [Zn^{2+}] (ppm) Vs % of PKL extract

Fig.7 shows the % of the Zinc ion [Zn^{2+}] (ppm) Vs % of PKL extract for Table-3. It is shown that the maximum % of Zinc ion (ppm) is 22.61 ppm and the minimum % of Zinc ion is 4.96 ppm. So the difference between the maximum and minimum % of Zinc ion is 17.65 ppm. It is also shown that the % of the Zinc ion [Zn^{2+}] (ppm) increases linearly up to 50 and then it decreases exponentially up to 70. Finally, it is shown that the % of [Zn^{2+}] ion (ppm) increases exponentially up to 80.

IV. Conclusions

PKL tree was used as a source of biomass energy. In this research work we got electrical energy from chemical energy. Insertion of Copper and Zinc electrodes as a cathode and anode into the PKL extract we got electricity. The Zinc plate was used as a sacrificial electrode. It ionizes as a Zn^{2+} into the PKL extract and the electrons are on the Zinc rod. When the zinc rod is connected to the copper rod, hence the electrons are moved towards the copper rod and then electricity is produced. It is pollution free and eco friendly.

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