



DRUGS UPTAKE BY LEUCAENA LEUCOCEPHALA IN AN ELECTROCHEMICAL ANALYSIS



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ABSTRACT

A study was conducted to determine the potential to uptake of two different medications by *Leucaena Leucocephala*: Acetaminophen and Naproxen. Procedures for treating the seeds were carried out and kept them in a controlled environment of growing up, then they were transferred to a hydroponic system with the necessary nutrients, UV light and oxygenation to improve their growth. For each drug, an electrochemical calibration curve was constructed that allows measure and comparing the concentration of each observation during experimentation. A determined amount of medicine was placed in each hydroponic planting and the variation of its concentration over time was measured. Finally, the decrease in the concentration of the drugs was determined on the third day, however, there were increases in the concentration of said drugs in all the samples on the fifth day; In this way, it is concluded that there are factors that influence the measurement results of the electric current in the process, requiring the refining of the method to establish coherent and statistically significant results.

INTRODUCTION

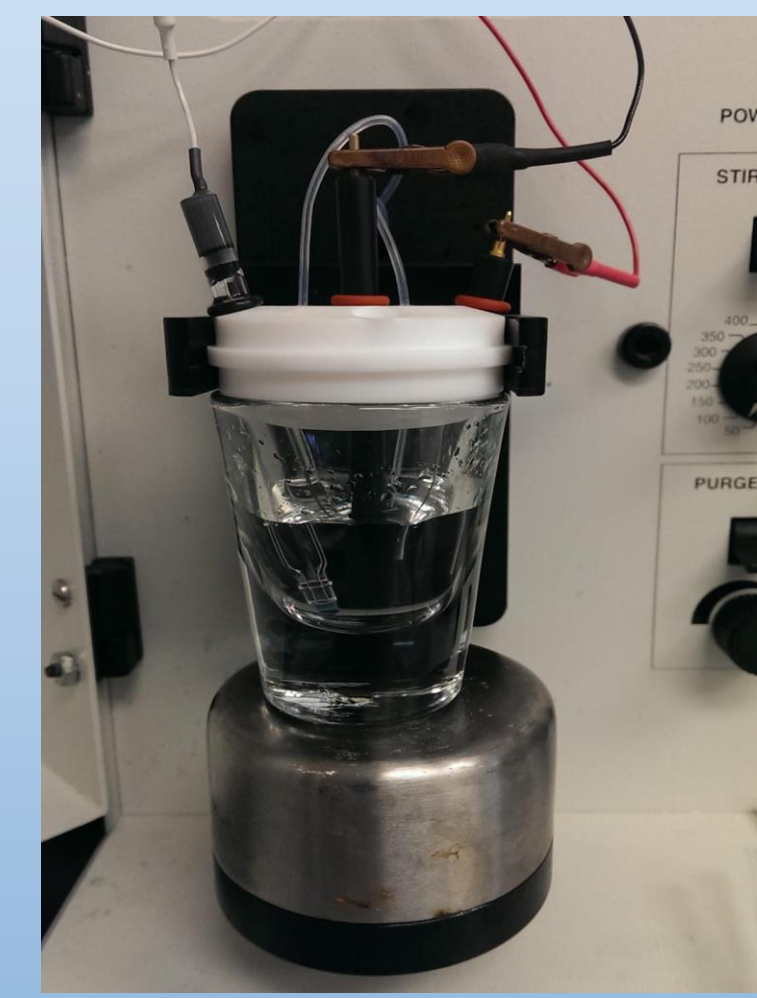
Leucaena Leucocephala is a weed of open, often coastal, or riverine habitats, semi-natural, disturbed, degraded habitats, and other ruderal sites. The fast-growing (nitrogen-fixing tree/shrub) *Leucaena Leucocephala* is cultivated as a fodder plant, for green manure, as a windbreak, for reforestation, and as a biofuel crop. The weed has been widely introduced due to its beneficial qualities but, it has become an aggressive invader in disturbed areas in many tropical and subtropical locations. Through the experimental procedure, the *Leucaena Leucocephala* specimen was submitted to exposure for a total of two different medications: Acetaminophen and Naproxen. Each one is acquired as a tablet or capsule dose and treated to produce a solution that was supplied to the plants. These drugs did not share a common treatment objective, meaning each is in the market for different conditions, from moderate pain to articulation disease. On another side, this investigation used the Cyclic Voltammetry technique (CV) that is considered the most informative electrochemical technique. The Cyclic Voltammetry technique can provide a wealth of information about an electrochemical system including details on the mechanisms and chemical reversibility of REDOX processes. The information related to the analyte concentration, electrode reaction kinetics, and diffusional contributions is contained in a cyclic voltammogram. The importance of knowing the interaction between the deposition of toxicological components and drugs in the vegetation is a direct indication of the contamination produced by these compounds, not only in living beings but in the general environment. This study, its findings, and what brilliant leaders infer about it determine a crucial issue for scientists, environmentalists, healthcare professionals, and government entities worldwide. In front of us, we have the tool that will raise awareness of a generation willing to build a better planet. Climate change affects our past actions, therefore in our hands falls the scientific responsibility to contribute the best for the community.

OBJECTIVE

- Determine if *Leucaena Leucocephala* plant absorbs Acetaminophen and Naproxen for future phytoremediation applications in order to decrease soil contamination.

METHODOLOGY

Leucaena Leucocephala plant seeds were grown in germination paper (incubation – 7 days)



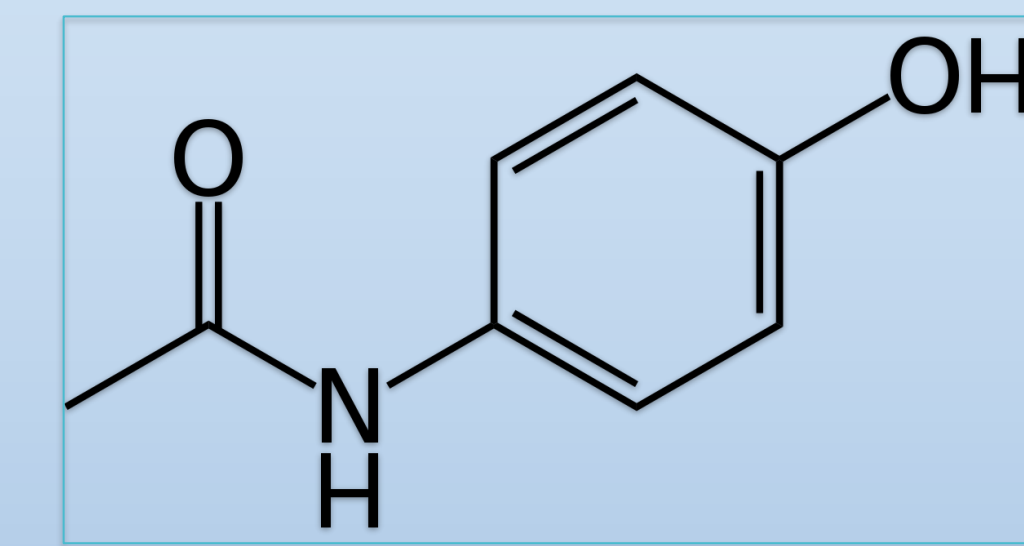
Plants were transferred to a hydroponic system in Hoagland solution, pH 5.4 (14 days)



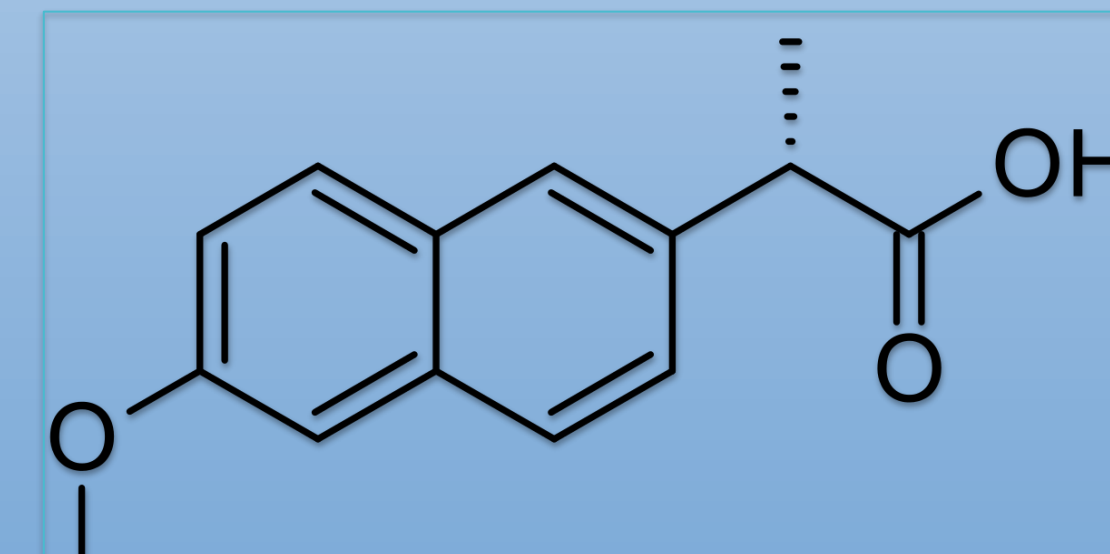
Plants were exposed to Acetaminophen and Naproxen at a concentration of 1.0×10^{-4} M (3 days)



Acetaminophen and Naproxen chemical structures.



Acetaminophen



Naproxen

The apparatus used to perform the cyclic voltammetry analysis was the machine: Epsilon System, Brand BASi - Bioanalytical Systems. Working Electrode: Glassy Carbon (GC); Auxiliary Electrode: Platinum Wire; Reference Electrode: Silver Wire in a solution of silver chloride.

CONCLUSIONS

- Plants are natural detoxifiers of the environment and due to this, they were the alternative chosen for the experimentation with commonly used drugs to investigate their decontaminating potential. *Leucaena Leucocephala*, a plant that is considered almost as a plague, gave researchers an opportunity to observe the phytoremediation potential of this species in the presence of Acetaminophen and Naproxen.
- The main objective of this experiment was to determine if the plants can remove the drug in the hydroponic system, where they were exposed, having UV light and oxygenation. Through the technique "Cyclic Voltammetry", the amount of absorbance of the drugs Naproxen and Acetaminophen could be compared.
- When observing the calibration curves between Naproxen and Acetaminophen, the points are after the other meaning that both drugs resulted in a linear relationship with low correlation factors close to one, meaning that this analysis was precise and accurate with its results. Therefore, this method can be validated since the plant did absorb the medication and gave reproducible results on the experimentation done. The data obtained in this experiment, leads to further investigations in the potential of plants to make phytoremediation possible on a larger scale, which is in a natural environment where variables are not controlled.

FUTURE WORKS

- Analyze samples by High Performance Liquid Chromatography (HPLC) to determine the identity the electroactive specie present in the samples.
- Repeat the procedure for a longer period of time to identify the maximum quantity of absorption and its effects of the development of the plant.
- Perform a toxicity analysis of the drugs effect on the plants.

RESULTS AND DISCUSSION

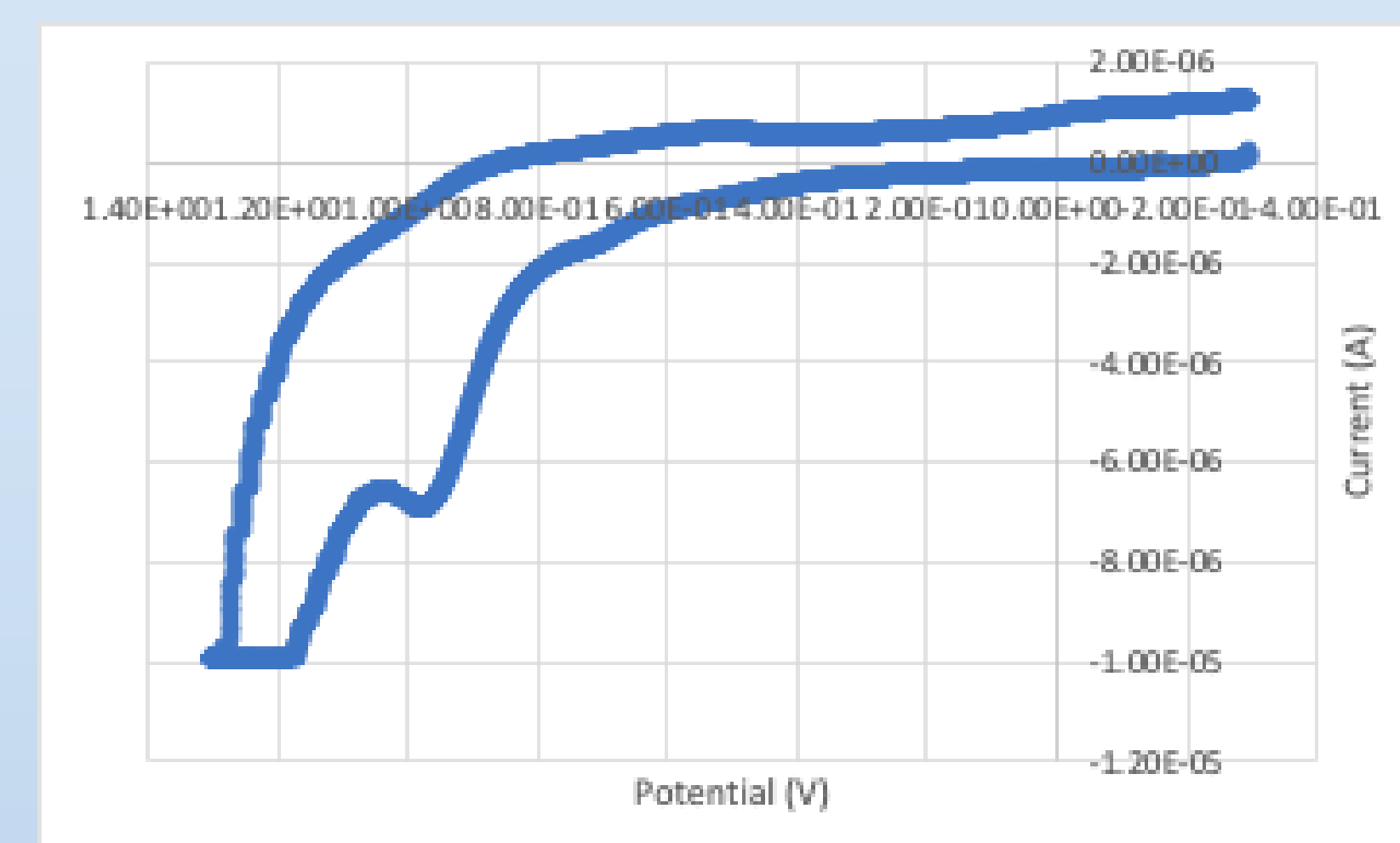


Fig. 1. CV iupac voltammogram for run 1 of Unknown A for day 1

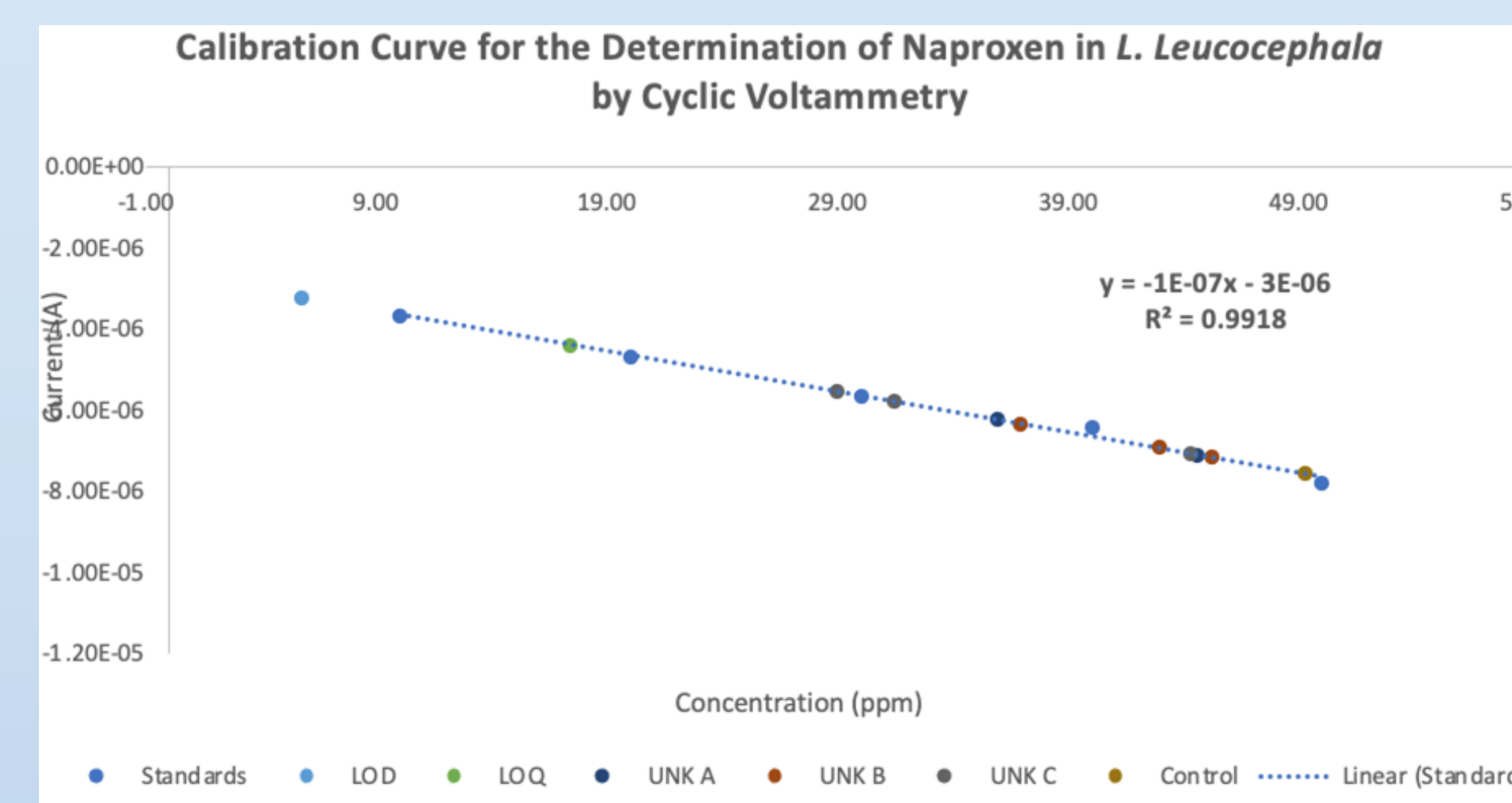


Fig. 2. Calibration Curve for the Determination of Naproxen in L. Leucocephala by CV

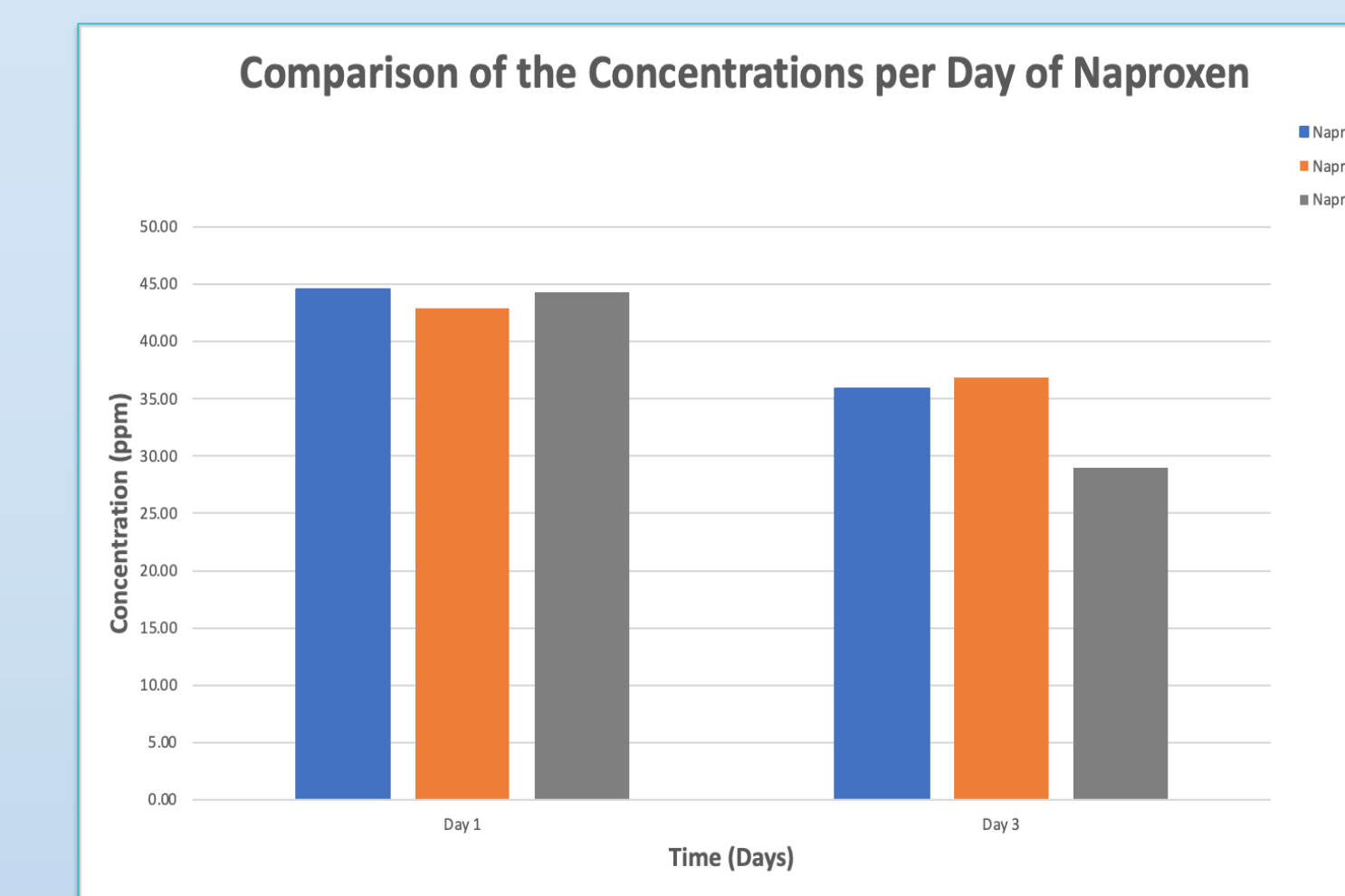


Fig. 3. CV response of Naproxen's uptake by L. Leucocephala for up to 3 days.

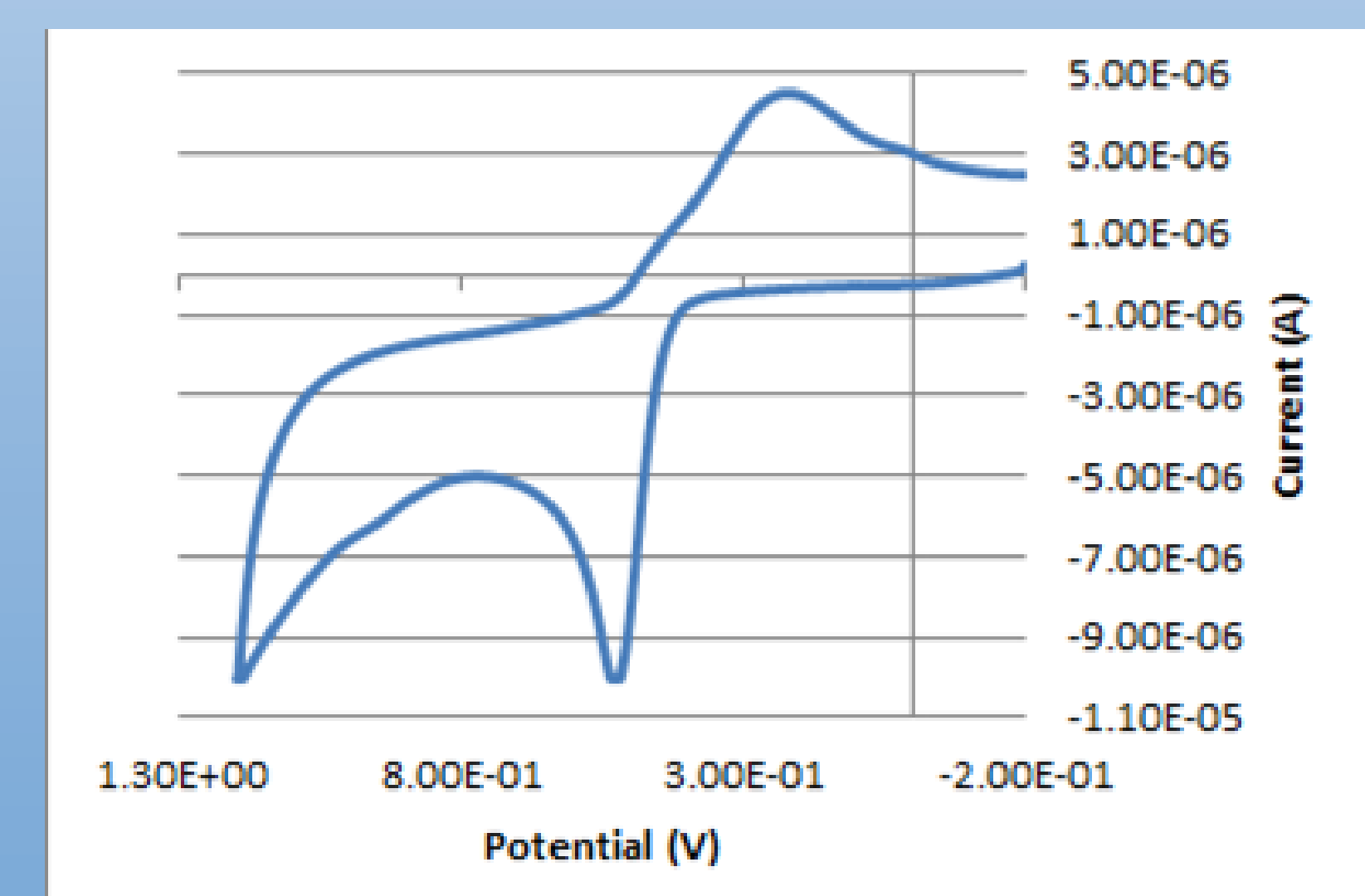


Fig. 5. CV iupac voltammogram for run 1 of Unknown A for day 1

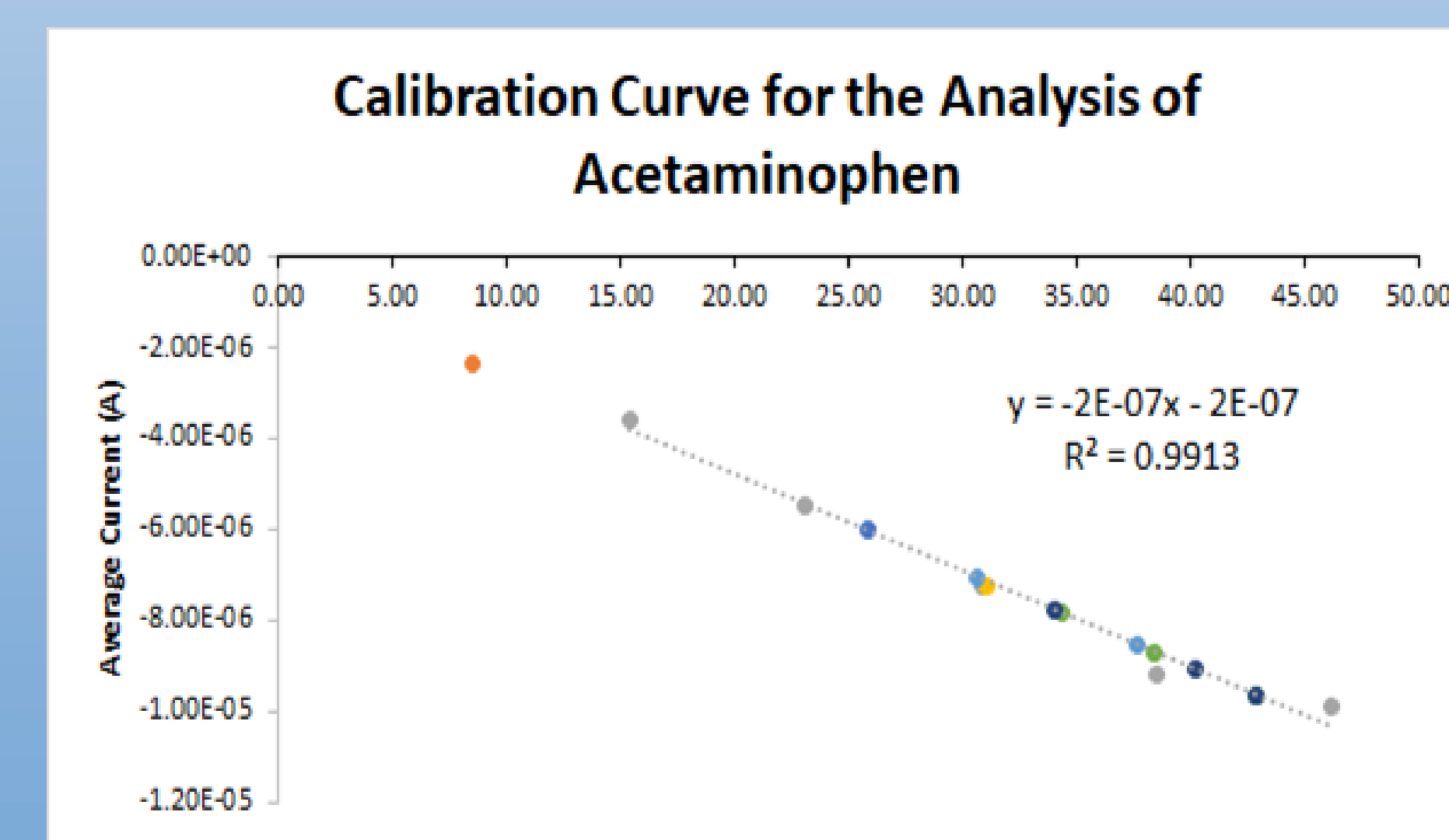


Fig. 6. Calibration Curve for the Determination of Acetaminophen in L. Leucocephala by CV

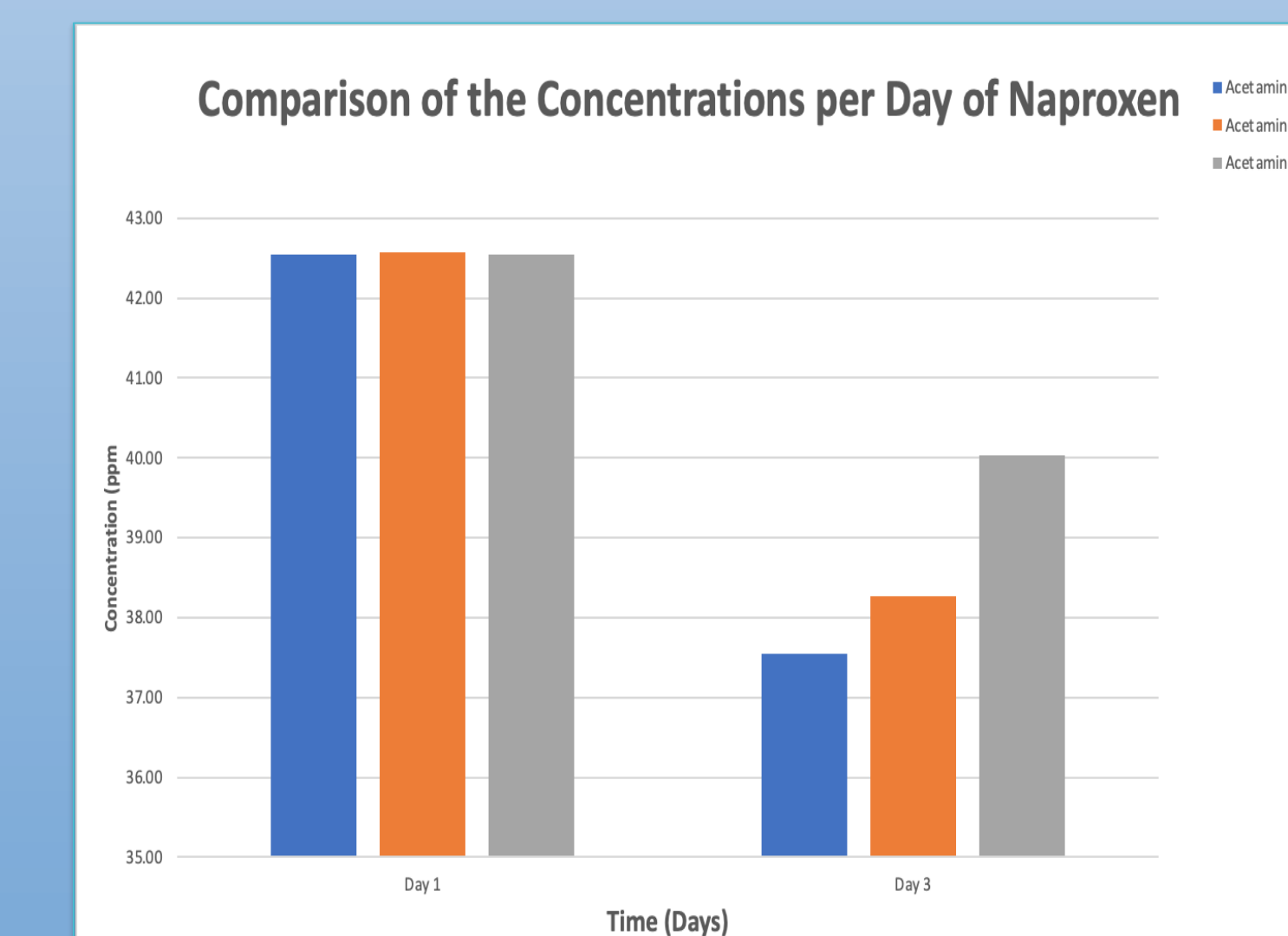


Fig. 7. CV response of Acetaminophen's uptake by L. Leucocephala for up to 3 days.

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