Dosage device for potentiostat samples

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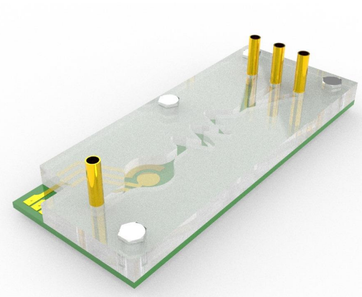
INTRODUCTION

Currently, in the Biomicrosystems laboratory, pipettes are being used with potentiostats for measuring the electrical properties of liquids. However, this approach relies heavily on manual manipulation, prompting research into the development of an automatic microfluidic system. This device aims to automate the mixing and measurement of three different substances using syringe pumps, providing a more convenient and faster alternative [1]

AIM

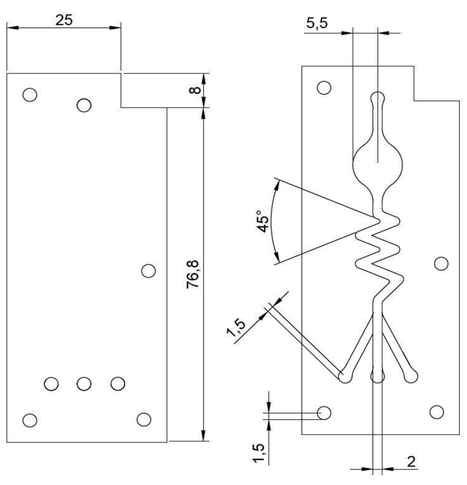
Automate the sample dosing process for potentiostat measurements by designing a device that allows the programmed manipulation of multiple samples.



METHODS

Design

The microfluidic system was designed with AutoCAD 2D for laser cutting in a 2.5mm plexiglass. It has three entrances and a curved zigzag channel for mixing the substances. Also, it was necessary to make a circle with the sensor shape for a correct measurement. Additionally, a new sensor was designed using AutoCAD and Altium Design for printing the PCB.



Assembly

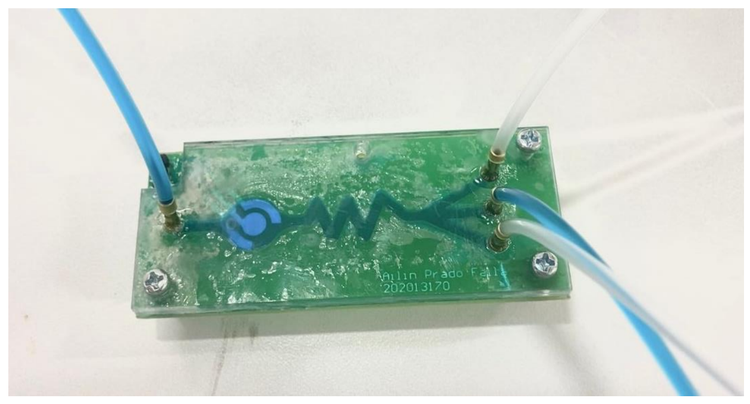
Afterward, methacrylate was employed to assemble the acrylic components. The PCB was connected using instant glue. Metal channels for entrances and exits were adhered to their respective holes, and screws were inserted.

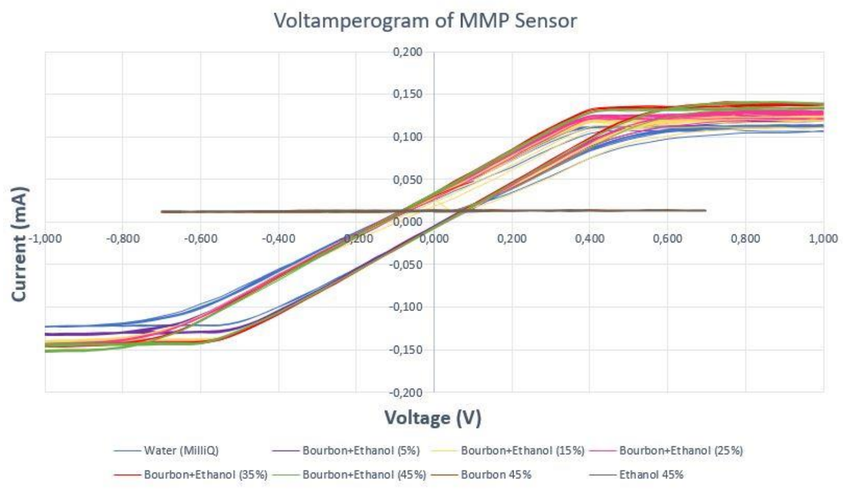
MAIN RESULTS

- Five different substances were characterised (MilliQ, methylene blue, Ethanol 45%, Bourbon 45%, Ethanol + Bourbon in concentrations between 5 and 45% v/v.
- Sensitivity to Ethanol + Bourbon of 0.0508 mA /% of concentration.
- For a concentration of 0% of Bourbon, a current peak of 0.119mA was found.
- Methacrylate was inaccurate as an adhesive for the PCB, as it melts the anti-solder and causes more leaks.
- In comparison with the standard sensor of the laboratory, it was found a higher maximum peak at **0.0905mA** for MilliQ because new sensors ratio is bigger.

RESULTS

The mixture of the substances was successfully tested, using methylene blue. Some leaks and air influence appeared during the process, which was a factor that complicated an accurate data recollection.





CONCLUSIONS

A design of a microfluidic system with three entries and a single output connected to a syringe bomb was successfully achieved. The main result was the sensitivity to the Ethanol-Bourbon at 45%.

The mixture of three substances was possible.

The method of sealing using methacrylate was not optimal.

FUTURE WORK

It is expected to improve the design of the sensor with a reorganisation of the counting and reference electrodes. Additionally, a new sticking method between the PCB and the acrylic pieces should be tested. It also should be developed a way to use it remotely, by a re-design of the syringe bombs.

REFERENCES

[1] CareFusion,” Bomba de Jeringa”, 2019. [En línea]. Disponible en: http://www.carefusion.es, 22 de febrero del 2019

[2] J. Arias, "Diseño e implementación de un sensor electroquímico, basado en un sistema microfluídico, para determinación de concentración de acetaminofén en agua." Tesis de pregrado, Universidad de los Andes, 2023.