Óbuda University

Materials Science and Technologies Ph.D. School

7TH

Progress Presentation

Resorcinarene Based-Piezogravimetric Sensors: Towards Heavy Metals Ions Monitoring

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Outlines

- Research Topic
- Earlier Outcomes
- Main Findings
- Achievements
- Future work

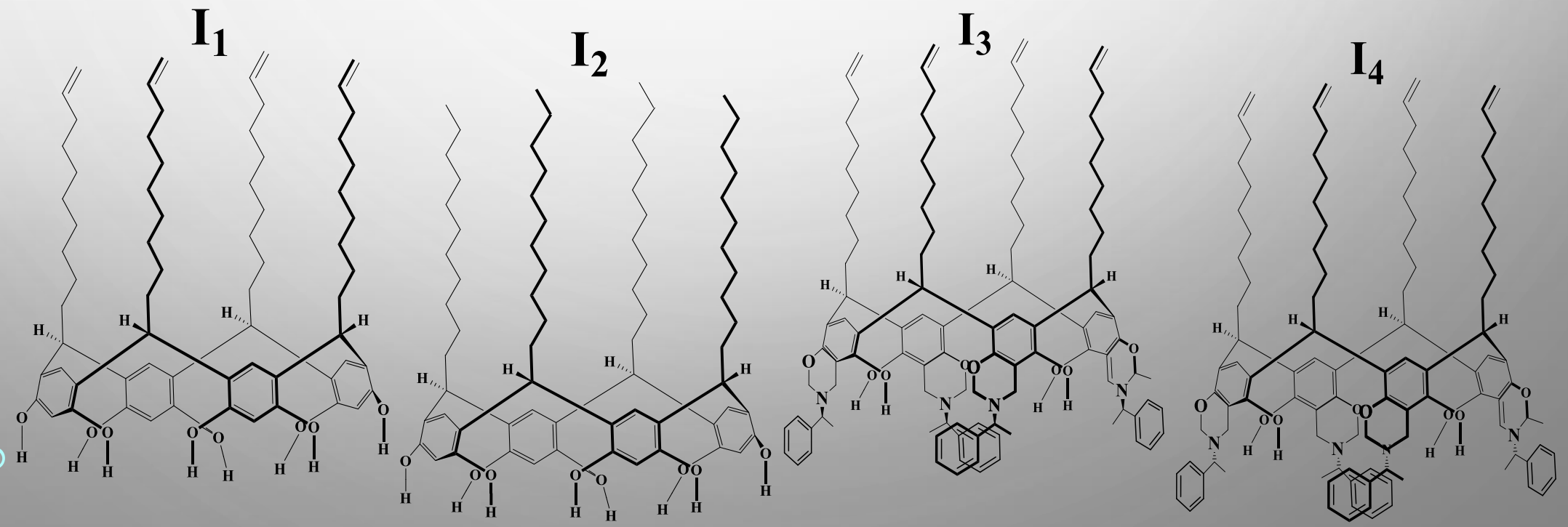
Research Topic

Resorcinarene Ionophores Based-Piezogravimetric Sensors: Towards Heavy Metals Ions Monitoring In Water Sources

Earlier Outcomes

The synthesis of macrocyclic resorcinarenes was successfully accomplished, namely:

- **C-dec-9-enylcalix[4]resorcinarene (I_1);**
- **C-undecylcalix[4]resorcinarene (I_2);**
- **C-dec-9-enylcalix[4]resorcinarene-O-(S-)-α-methylbenzylamine (I_3);**
- **and C-dec-9-enylcalix[4]resorcinarene-O-(R+)-α-methylbenzylamine (I_4).**



Earlier Outcomes

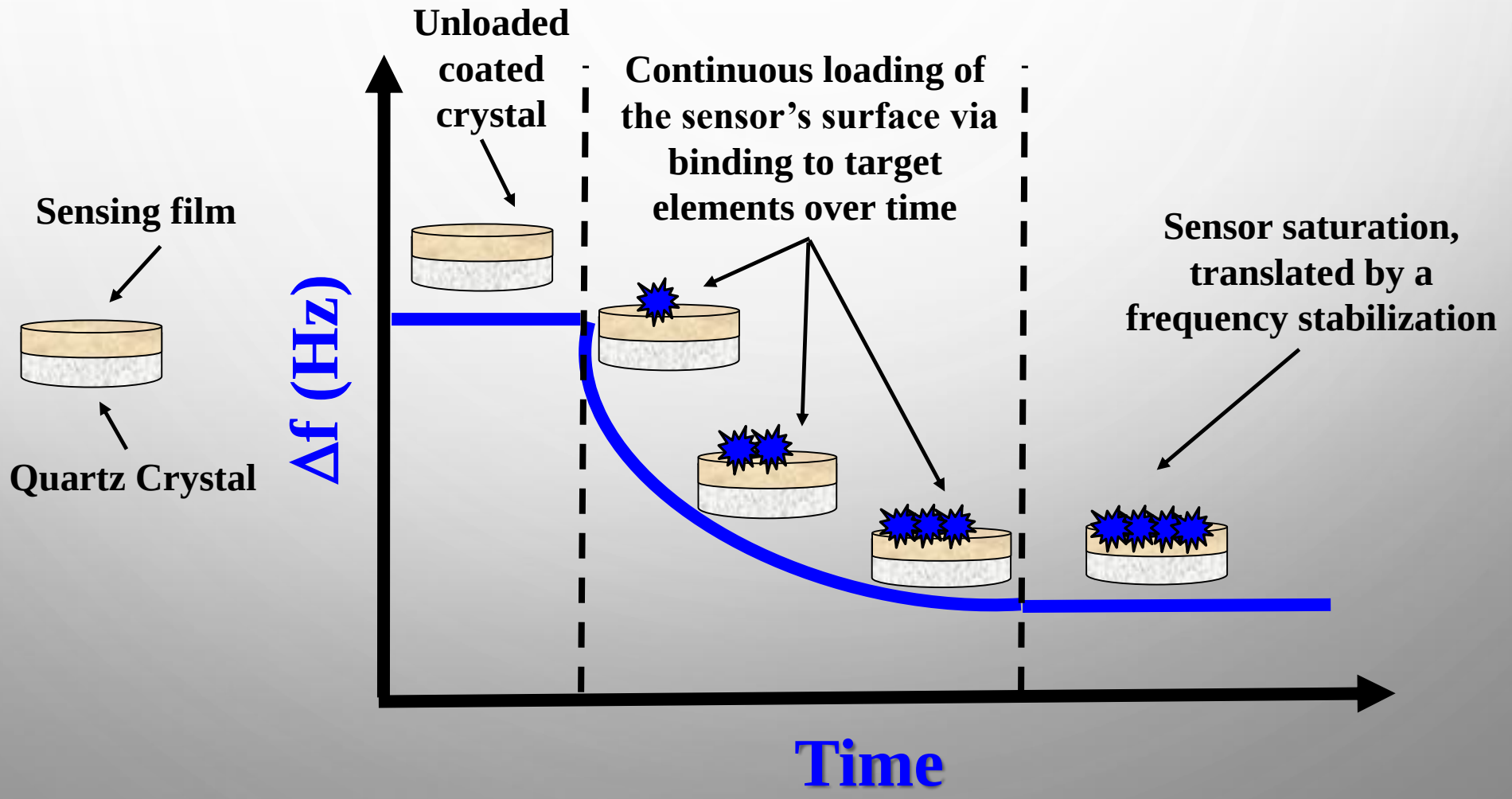
- **The detailed characterization via (FTIR, ^{1}H NMR, ^{13}C NMR, TG-DSC-MS and PXRD) was successfully accomplished;**

- **The ionophores' encapsulation properties towards heavy metals ions by means of Langmuir analysis, were appraised;**

- **The introductory exploitation of resorcinarene based-piezogravimetric sensors was highlighted.**

Main Findings

Impedance Analysis (FWHM And Frequency Variations)



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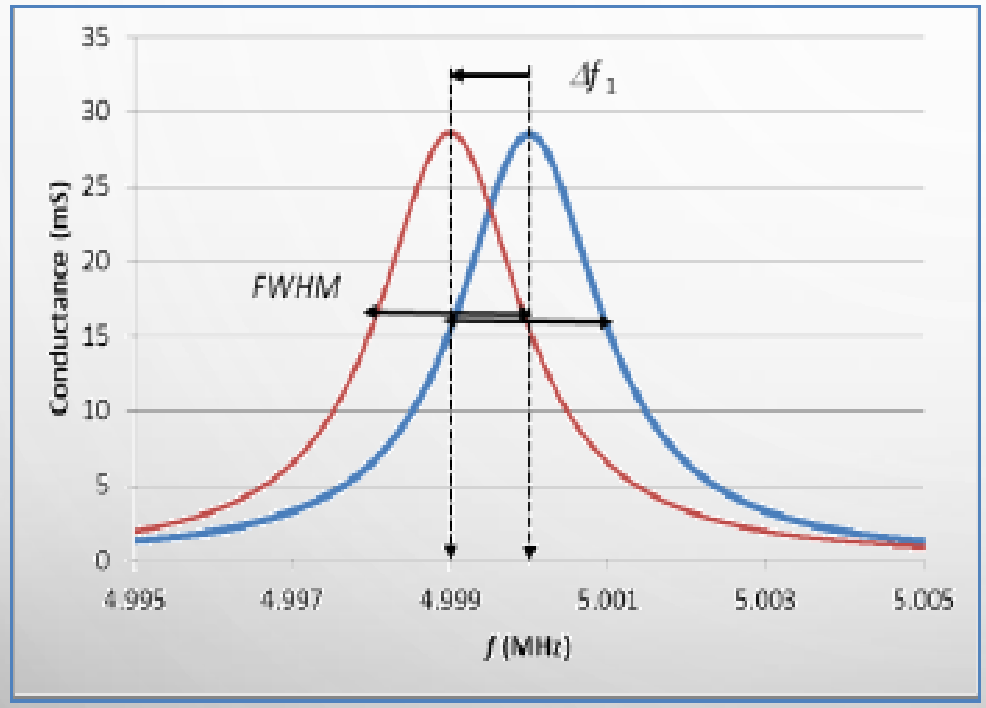

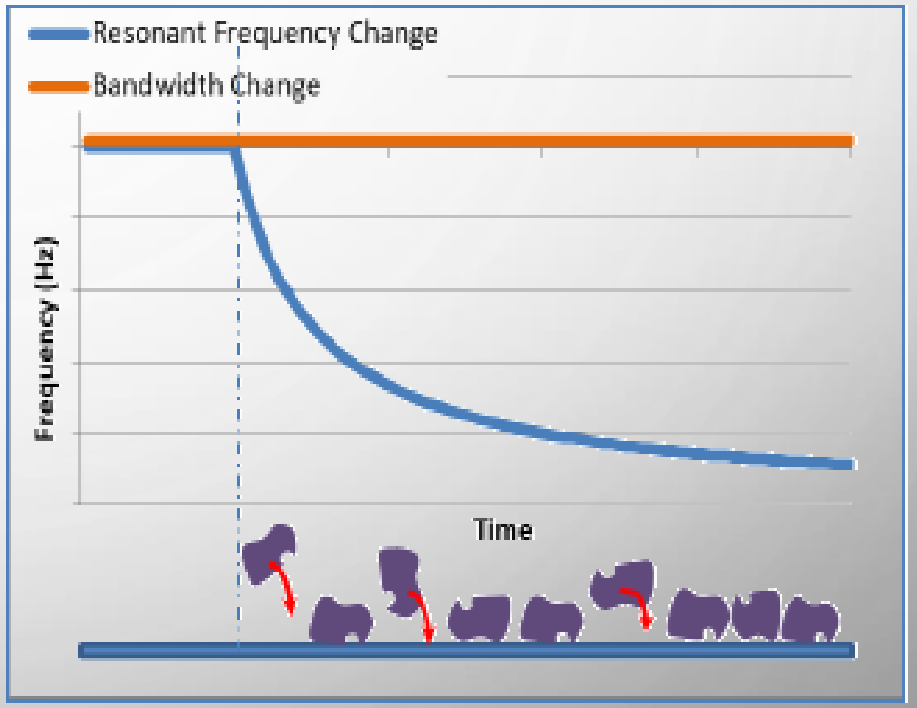

Diagrams of the change in conductance curve (n=1 for a 5MHz crystal), resonant frequency and bandwidth on deposition of a rigid film onto the sensor surface

Main Findings

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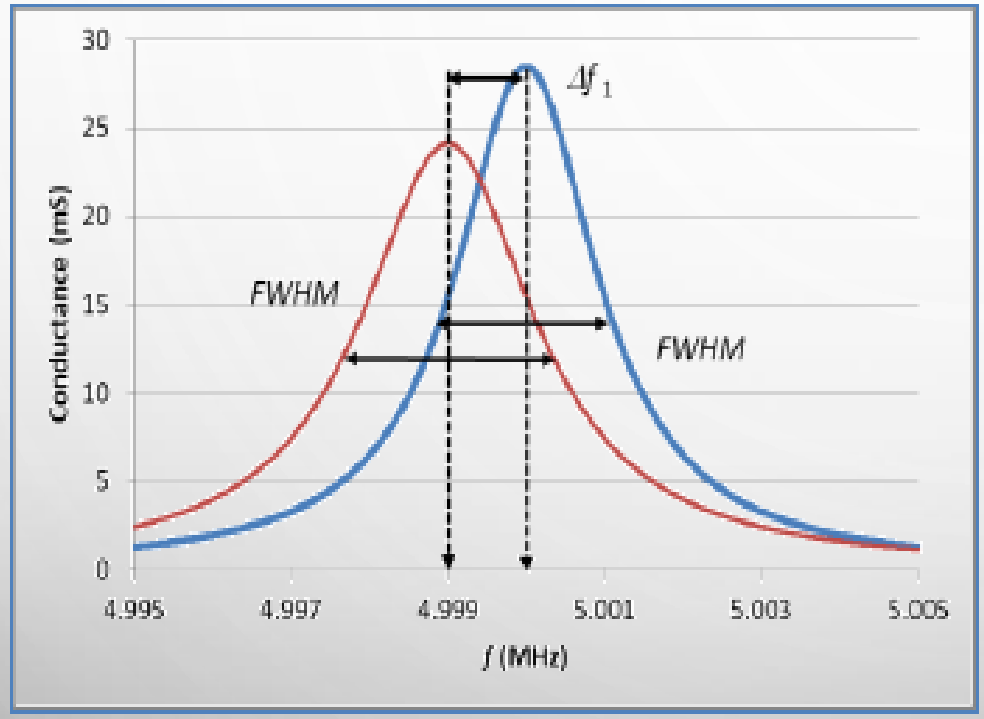

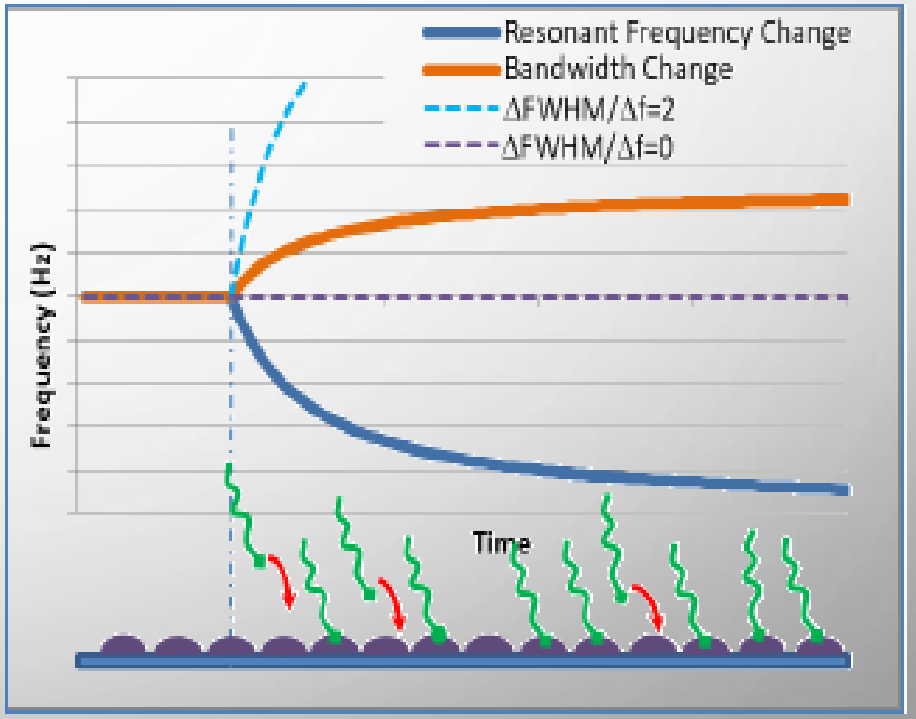

Diagrams of the change in conductance curve, resonant frequency and bandwidth for the deposition of a viscoelastic layer on the sensor surface.

Main Findings

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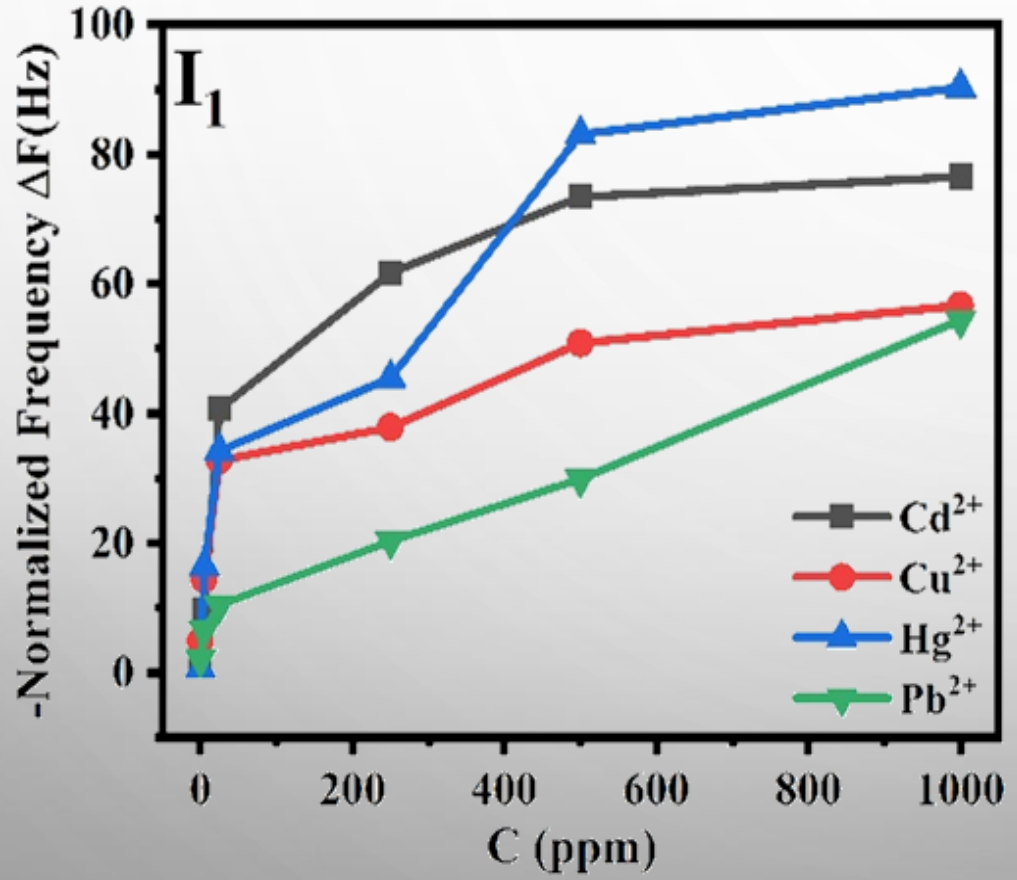

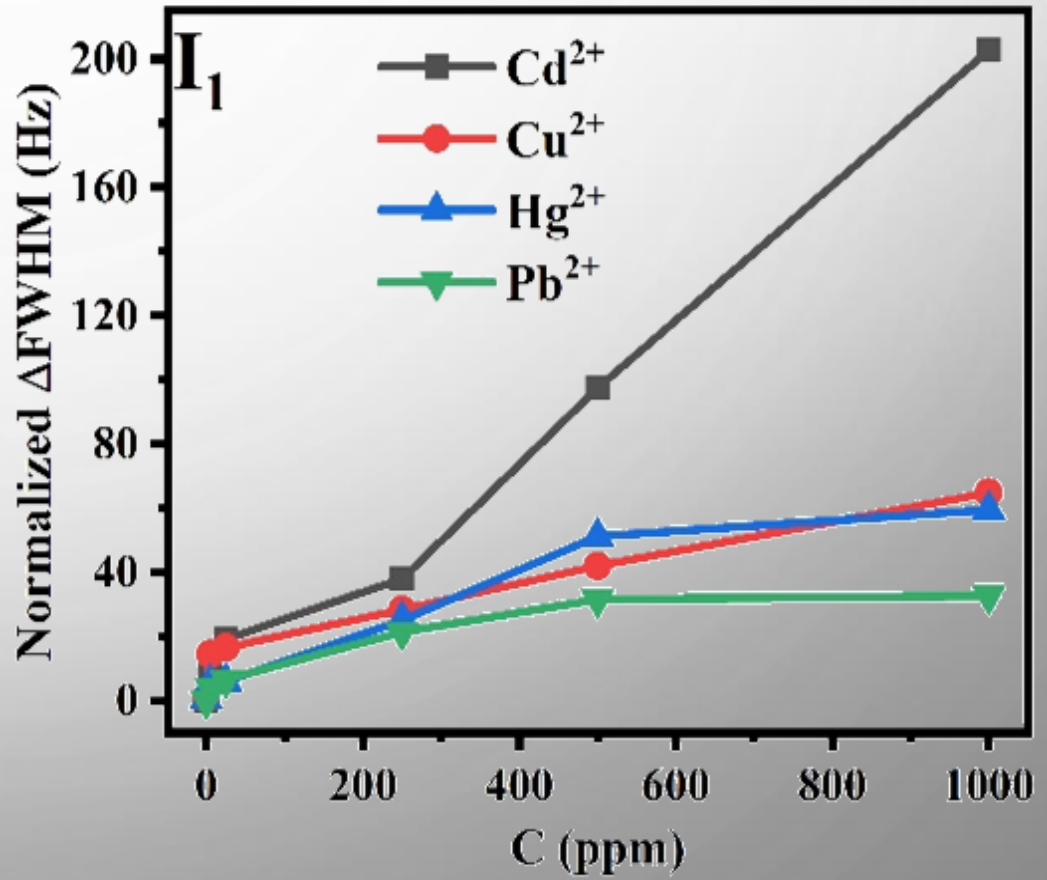

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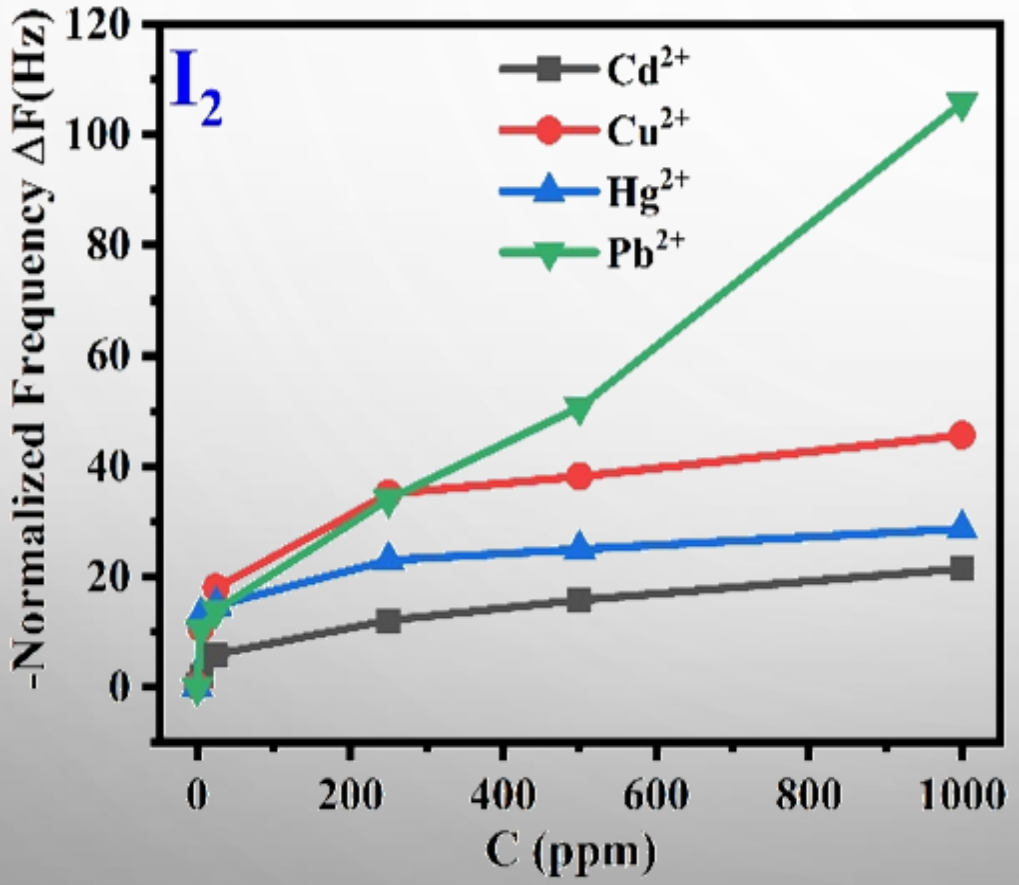

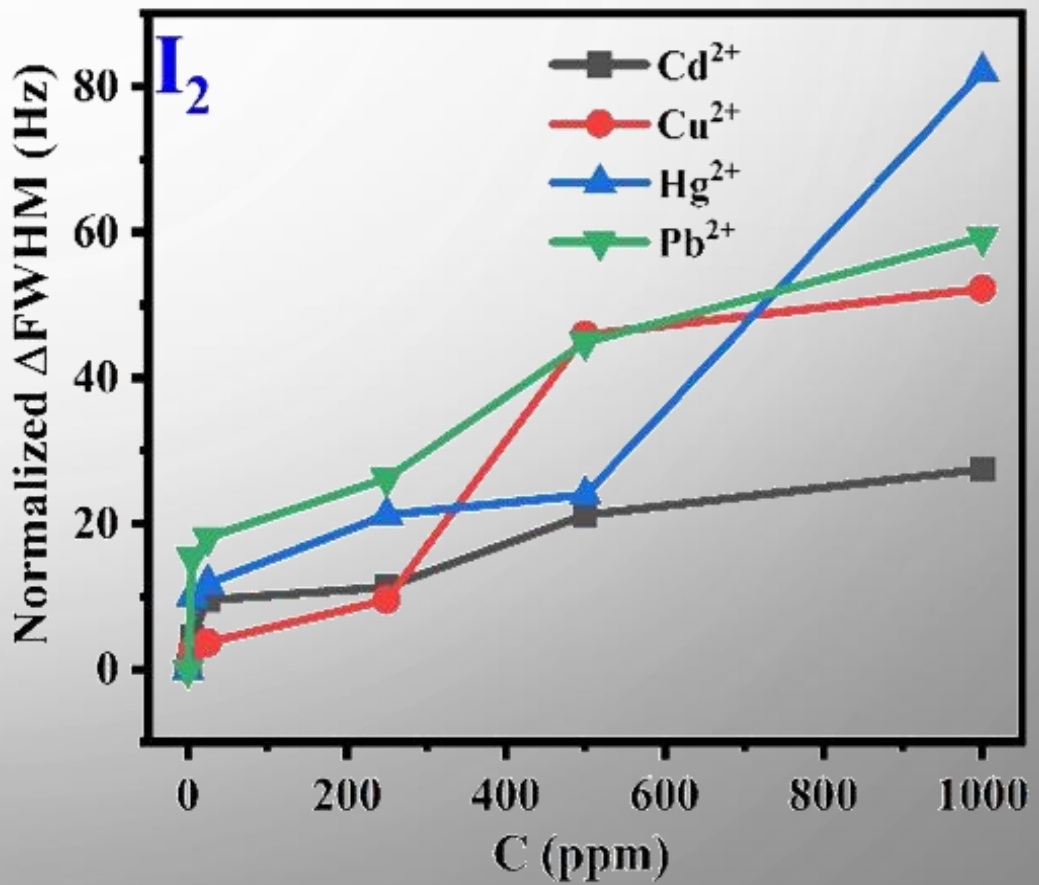

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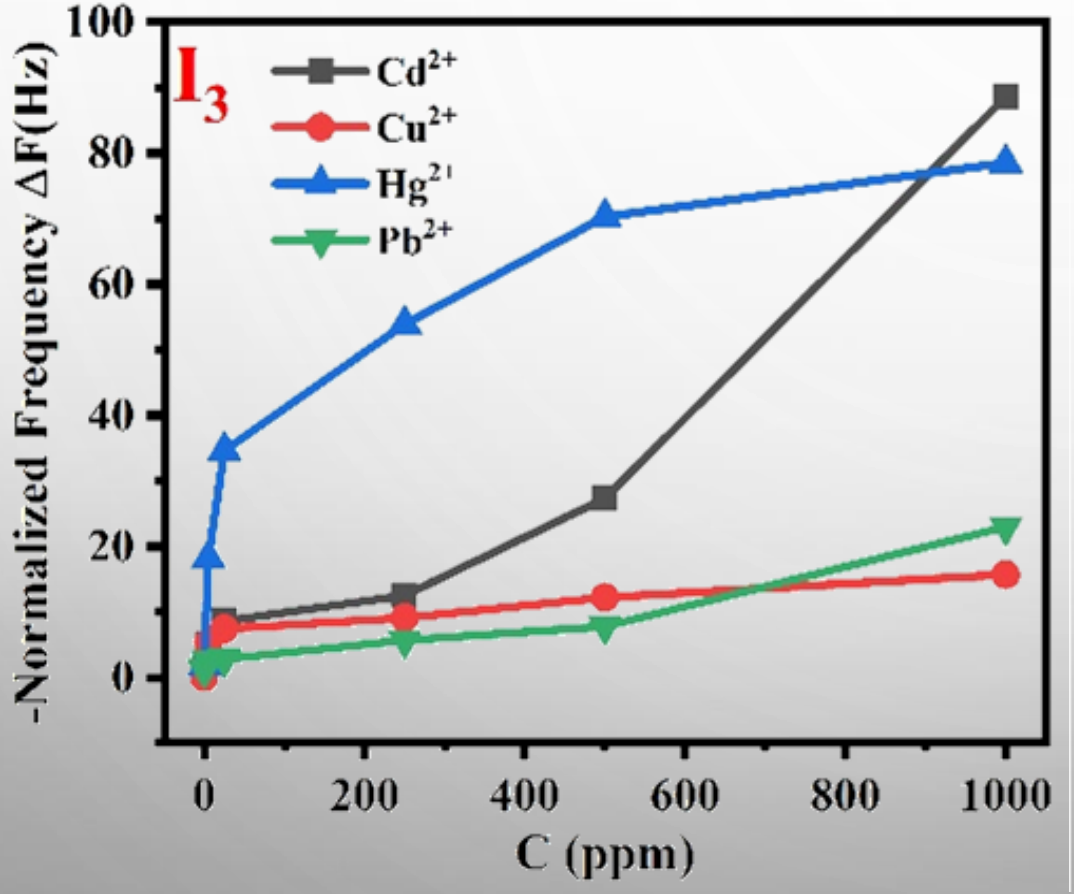

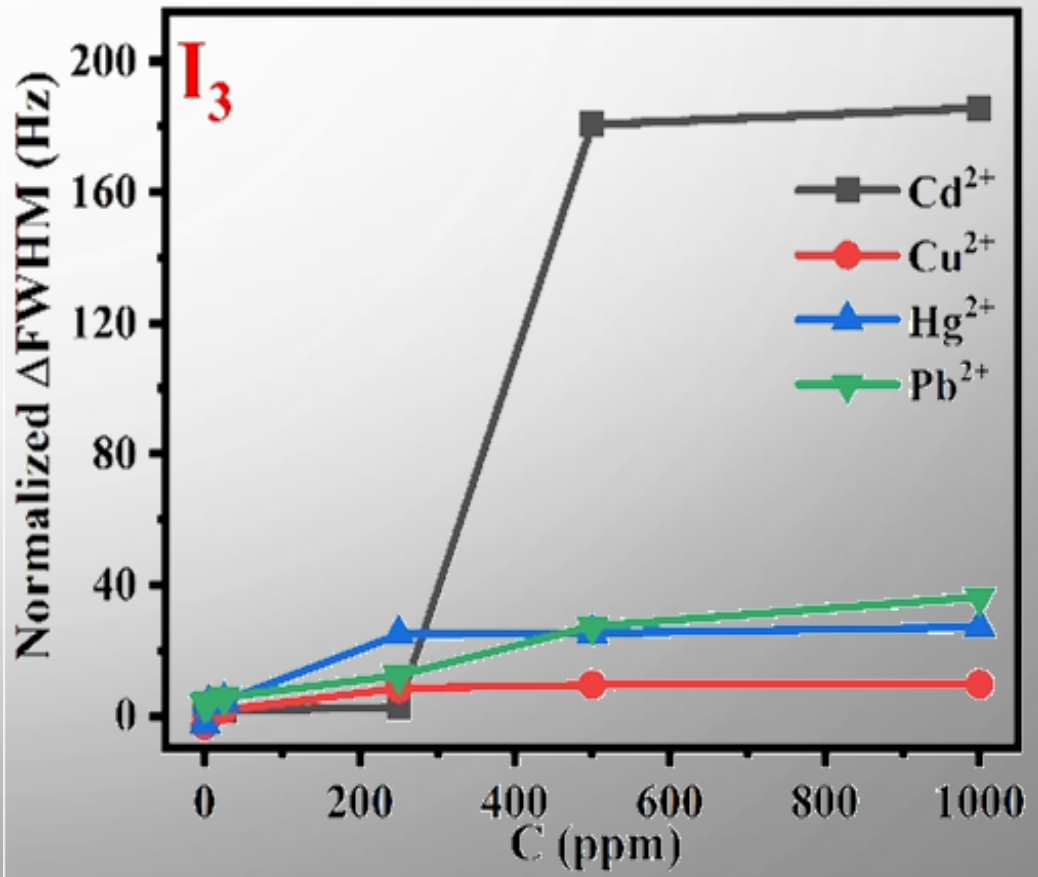

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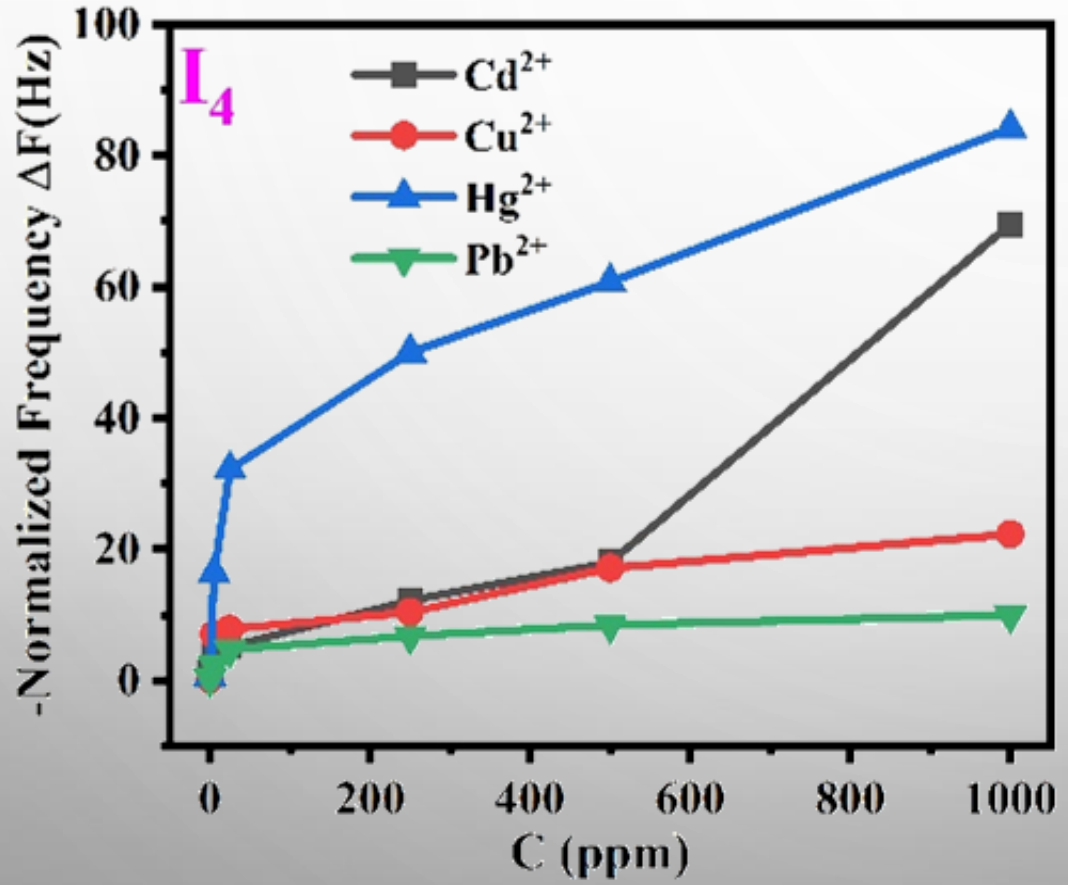

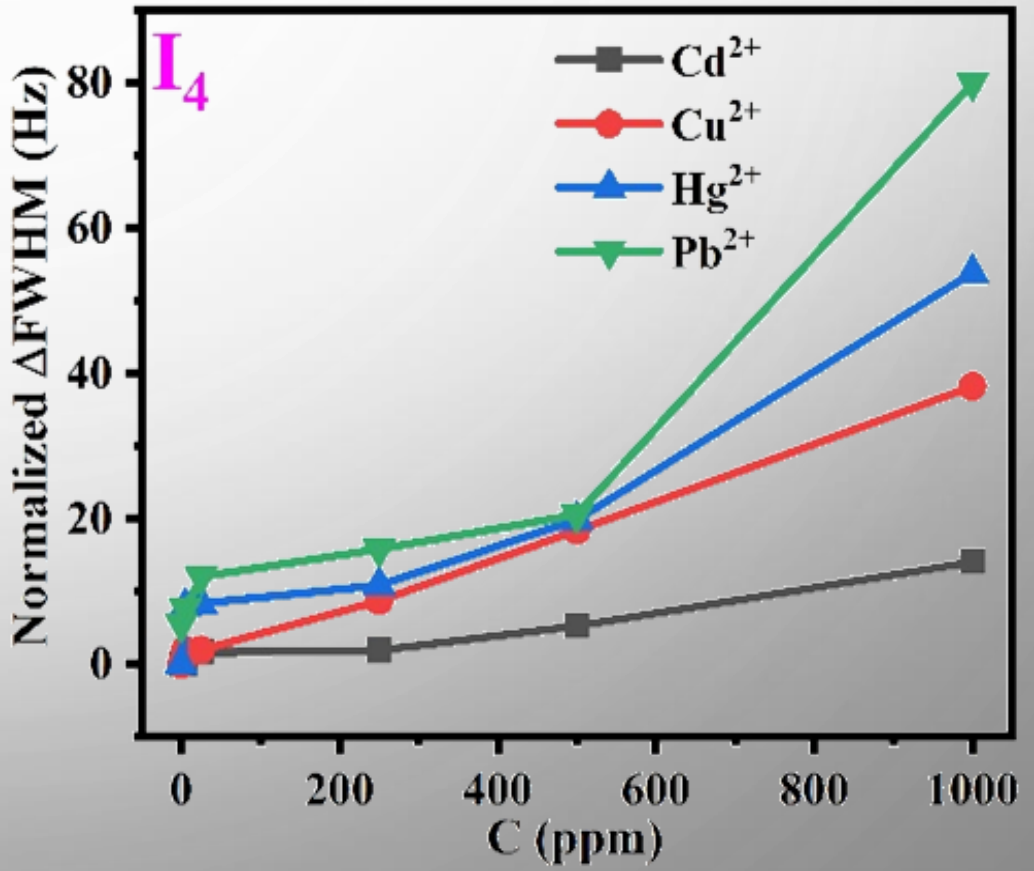

Main Findings

Ionophores	HM ions	Detection features based on $\Delta F_n/n$ LR (ppm)	S (Hz/ppm)	LOD (ppm)	LOQ (ppm)	Detection features based on $\Delta FWHM_n/n$ LR (ppm)	S (Hz/ppm)	LOD (ppm)	LOQ (ppm)
I_1	Cd^{2+}	2-25	1.571	0.61	1.83	250-1000	0.225	0.32	0.96
	Cu^{2+}	0.5-25	1.056	0.01	0.03	2-1000	0.052	0.57	1.71
	Hg^{2+}	3-25	1.215	0.88	2.64	1-500	0.093	0.37	1.11
	Pb^{2+}	2-1000	0.045	0.47	1.42	3-500	0.057	0.89	2.67
I_2	Cd^{2+}	5-25	0.215	1.82	5.46	5-1000	0.021	1.63	4.90
	Cu^{2+}	250-1000	0.554	0.87	2.61	1-250	0.028	0.18	0. 54
	Hg^{2+}	5-250	0.039	2.53	7.59	3-500	0.030	0.76	2.28
	Pb^{2+}	2-500	0.080	0.48	1.46	1-1000	0.048	0.20	0.60
I_3	Cd^{2+}	5-500	0.040	1.50	4.50	3-1000	0.009	0.89	2.96
	Cu^{2+}	5-1000	0.010	0.93	2.79	1-1000	0.038	0.20	0.66
	Hg^{2+}	3-25	1.171	0.99	2.99	0.5-1000	0.030	0.11	0.36
	Pb^{2+}	25-1000	0.008	0.45	1.35	5-1000	0.034	1.77	5.31
I_4	Cd^{2+}	0-500	0.027	0.03	0.10	4-250	0.009	1.10	3.66
	Cu^{2+}	0-1000	0.016	0.0019	0.0057	2-250	0.107	0.65	2.16
	Hg^{2+}	3-25	1.124	0.99	2.97	0.5-250	0.033	0.16	0.53
	Pb^{2+}	5-500	0.020	0.30	0.90	10-1000	0.067	3.14	9.42

Main Findings

Staying at home period

During the coronavirus lockdown, home-office tasks were in progress and others were accomplished, namely:

- **Literature reading;**
- **6^{th}, 7^{th} journal articles and dissertation writing.**

Achievements

7 Published Papers

No.	Date	Type	Journal	IF
1	March 2019	Conference paper	Proceedings of the 1st Coatings and Interfaces Web Conference	____
2	November 2019	Conference paper	Proceedings of the International Joint Conference on Environmental and Light Industry Technologies	____
3	January 2019	Journal article	Journal of Thermal Analysis and Calorimetry, (Springer Nature)	2.471
4	May 2019	Journal article (Review)	International Journal of Environmental Analytical Chemistry (Taylor & Francis)	1.267
5	September 2019	Journal article	Arabian Journal of Chemistry (Elsevier BV)	3.298
6	November 2019	Journal article	Water, Air and Soil Pollution (Springer Nature)	1.774
7	December 2019	Journal article	Electroanalysis (Wiley Online Library)	2.691

Achievements

Conference/ Seminar	Location/ Year	Oral/Poster presentation	Conference achievement
1st Coatings and Interfaces Web Conference	Italy March 2019	Oral presentation	Conference paper
ForMilk summer school (at the Research Centre for Natural Sciences)	Budapest, May 2019	____	____
Matrafured International Meeting on Chemical Sensors	Visegrad, June 2019	Poster presentation	Journal article
TTK AKI seminar (at the Research Centre for Natural Sciences)	Budapest, October 2019	Oral presentation	____
Workshop on Environmental Sciences and Engineering (International Joint Conference on Environment and Light Industry Technologies)	Budapest, November 2019	Oral presentation	Conference paper

Future work

- Sensors' surface visualization (AFM, ESEM);
- Heavy metals electrochemical detection based on the synthesized ionophores;
- Dynamic QCM, and coupled QCM-Electrochemical detection;
- Publication of two other journal articles, currently under preparation;
- Dissertation defense.

Many Thanks For Your Attention

Stay Safe

Happy To Answer Your Questions