

Preliminary assessment of the ions sorption by polymethyl methacrylate for the further use as the seawater test containers

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1. Introduction – Polymethyl methacrylate (PMMP) was firstly synthesized about 1930 by R. Hill in England and W. Bauer in Germany [1]. From those times, it is known as Plexiglas, Perspex, Lucite, Oroglas and many other trade names. Currently the PMMP has applications in mechanical engineering, biomedicine, molecular separations, optics, polymer conductivity, pneumatic actuation, solar and sensors, nanotechnology and so on [2]. The unlimited prospects of the PMMP usage is proposed by the 3D printing technology that allow quick making any kind of specific facilities. The main objective of our work is an initial valuation of the Cu²⁺ and Zn²⁺ ions sorption by PMMP from the seawater, as the PMMP may be easily used for the test containers production. Although the modified PMMP with different additives is proposed as a specific sorbent [3, 4], its sorptive properties in the seawater is poorly studied.

2. Experimental – The containers of the total surface area of 850 cm² and volume of 60 ml were made by 3D printing from the PMMP, Anycubic® Photon SLA DLP 3D Printer. In April 2019, the natural seawater samples were taken in two sites: the Puente Romano and the Playa De La Vibora, Conjunto White Pearl Beach. The seawater samples were acidized and transported (1 hour) in glass containers to the laboratory. Trace metals in filtered seawater samples were analysed for the Cu²⁺ and Zn²⁺ concentrations immediately (control) and after 24 hours overexposure in the PMMP containers in three repeatability using the HI-83305-02 multi-parameter photometer, Hanna Instruments Ltd. The method of standard additions was used to eliminate matrix effects from the measurements.

3. Results and Discussion – The results of our study are presented in the Table I. The detected concentrations of the Cu²⁺ and Zn²⁺ have no significant differences between control and PMMP exposed seawater samples.

Table I. Cu²⁺ and Zn²⁺ concentrations in seawater after 24 hours PMMP overexposure (µg/L, average ± SD)

	Puente Romano		Playa De La Vibora	
	Control	PMMP	Control	PMMP
Cu ²⁺	0.31±0.08	0.30±0.09	0.49±0.16	0.43±0.18
Zn ²⁺	0.51±0.18	0.56±0.21	0.58±0.19	0.52±0.19

4. Conclusions – The preliminary data obtained testify the absence of significant sorption of Cu²⁺ and Zn²⁺ by commercially available polymethyl methacrylate from the seawater. In case of proof of minor sorption of ions in further research, the commercial PMMP has good prospects to be proposed

for 3D printing containers and facilities to be used in environmental analyses of seawater.

5. References

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