Supplementary Material

Detection of mercury (II) in from aqueous media using the bodipy-functionalized magnetic fluorescent sporopollenin

Melike Bayrak[a], Aysel Cimen[a] , Ali Bilgic[b1]

[a] *Department of Chemistry, Kamil Ozdag Science Faculty, Karamanoglu Mehmetbey University, 70100, Karaman, Turkey*

[b] *Vocational School of Technical Sciences, Karamanoglu Mehmetbey University, 70100, Karaman, Turkey.*

[1] Corresponding author. E-mail: alibilgic100@hotmail.com (Ali Bilgic)

Address: *Vocational School of Technical Sciences, Karamanoglu Mehmetbey University, 70200, Karaman, Turkey*

Tel: *+90 338 226 21 69,* ***Fax:*** *+90 338 226 21 66.*

1.1. Characterization

A Vertex 70 FT-IR spectrophotometer (Bruker, Karlsruhe, Germany) was used to research the surface functional groups of the materials prepared at each stage with a wavelength range of 4000–400 cm^{-1}. TGA analysis was carried out on a TG thermogravimetric analyzer (SEIKO EXSTAR SII TG / DTA 6300) at a heating efficiency of 10 °$Cmin^{-1}$ between 25 °C and 700 °C in air. The composition of the materials prepared at each stage was determined by X-ray diffraction (Bruker D8 ADVANCE with DAVINCI (Billerica, MA, USA)). The surface morphology of the materials prepared at each stage was investigated by the Hitachi SU-5500 SEM (Hitachi, Tarrytown, NY, USA), meanwhile, the element distribution was measured using energy dispersive X-ray spectroscopy (EDX). pH measurements in studies were recorded on a Mettler Toledo digital pH–meter (Zaventem, The Netherlands). The spectrofluorimetric studies have been performed on a Cary Eclipse fluorescence spectrophotometer (Agilent Technologies, Inc., Santa Clara, CA, USA).

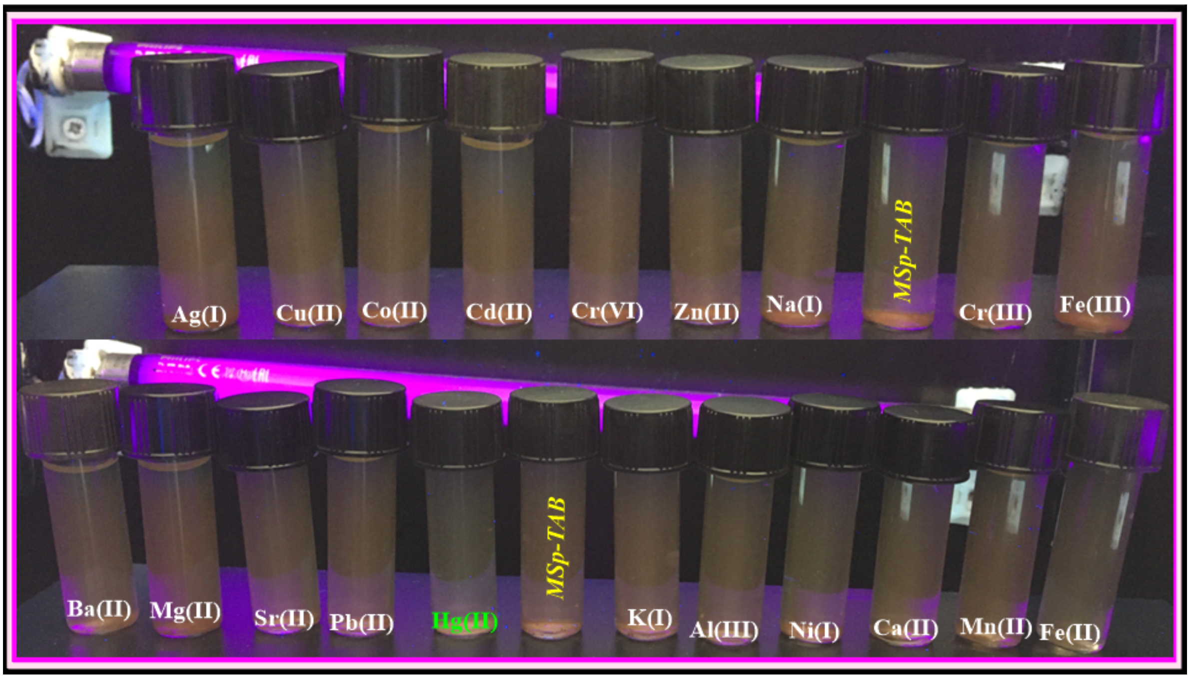

Fig. S1. The photographic image: Changes in color caused by different interference cations added to the reaction solutions.

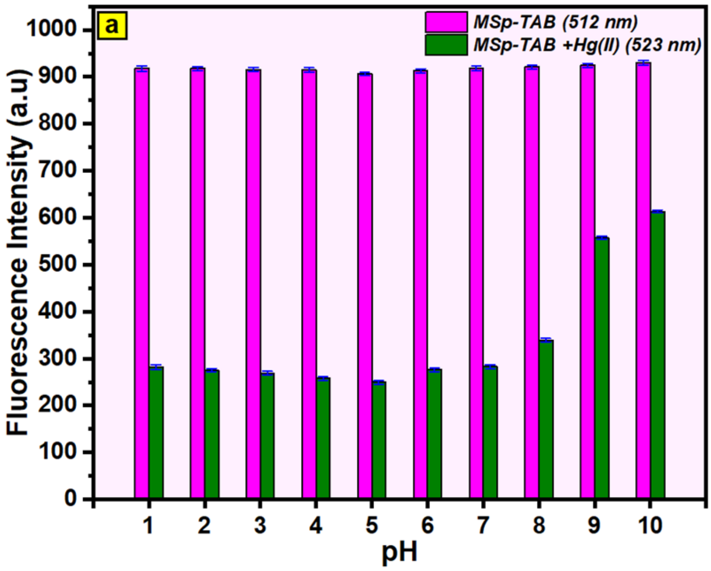

Fig. S2a. The changes in the fluorescence intensity at the range 512-523 nm of ***MSp-TAB*** and ***MSp-TAB*** + Hg(II) (0.15 g/L EtOH/H_2O; 30/70, each; response time: 120 min, temperature: 25 °C) suspension mixtures at different pH (1.0-10.0).

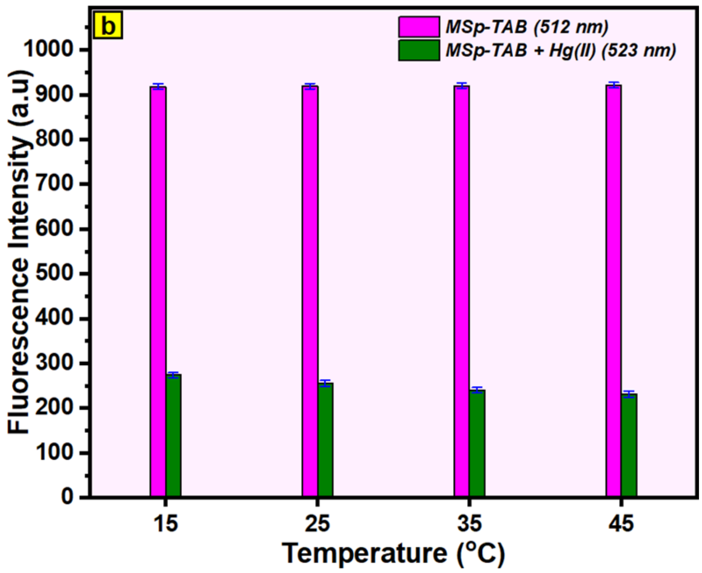

Fig. S2b. The changes in the fluorescence intensity at the range 512-523 nm of ***MSp-TAB*** and ***MSp-TAB*** + Hg(II) (0.15 g/L EtOH/H_2O; 30/70, each; pH: 7.0, and response time: 120 min) suspension mixtures at different temperatures (15-45 °C).

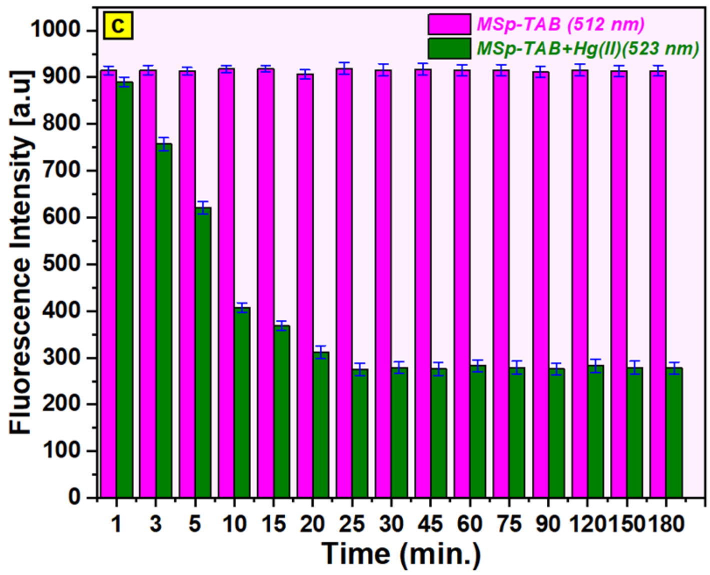

Fig. S2c. The changes in the fluorescence intensity at the range 512-523 nm of ***MSp-TAB*** and ***MSp-TAB*** + Hg(II) to determine response times. (Experimental conditions: 0.15 g/L EtOH/H_2O; 30/70, each, pH: 7.0, and temperature: 25 °C).

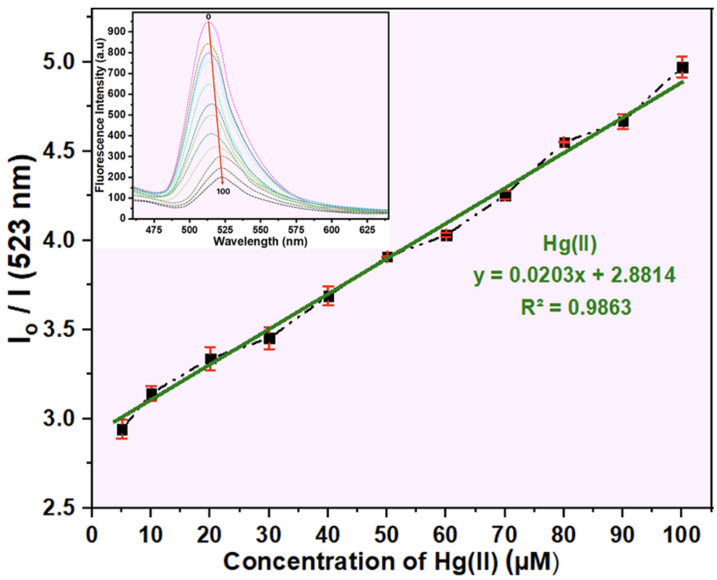

Fig. S3. The linear calibration plots for Hg (II) at 5–100 μM concentration.

As done in our previous study [1-2], to evaluate the reusability of the magnetic fluorescent ***MSp-TAB*** hybrid material, the fluorescence change of ***MSp-TAB*** coordinated with Hg(II) was carried out repeatedly for 4 cycles using EDTA-2Na (0.001 M) as the chelating agent, and the results obtained for Hg(II) metal ions are given in Fig. S4. According to this result (Fig. S4), the fluorescence intensity of the magnetic fluorescent ***MSp-TAB*** hybrid material decreased significantly with the addition of EDTA-2Na, which resulted from the addition of more Hg(II) per cycle. These results indicate that the prepared magnetic fluorescent ***MSp-TAB*** hybrid material can be applied to the detection of Hg(II) in aqueous media with at least 4 cycles of reusability.

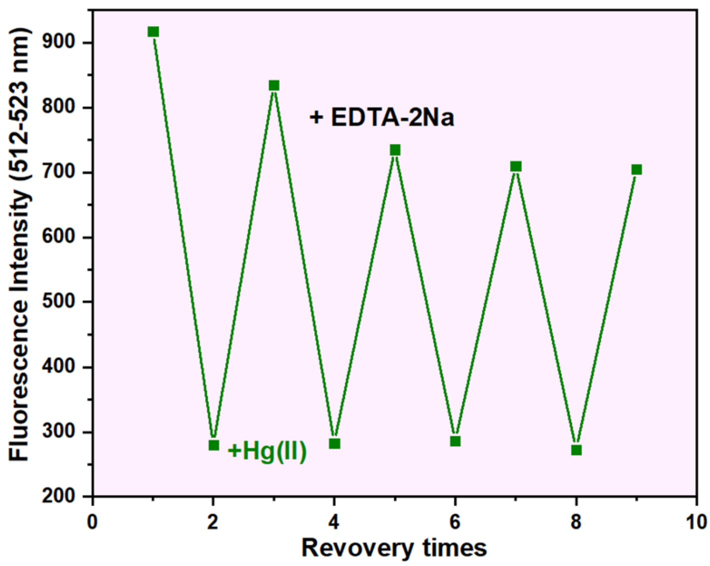

Fig. S4. The reversibility of the magnetic fluorescent ***MSp-TAB*** hybrid material

Table S1. The application of the magnetic fluorescent ***MSp-TAB*** hybrid material for Hg(II) in tap water samples.

Water sample	Hg(II)		
	Added (μM)	**Found (μM)**	**Recovery (%) ± SD**
Tap water 1	5.00	4.76	95.2 ± 1.36
	10.00	9.83	98.3 ± 1.24
	15.00	14.79	98.6 ± 1.17
Tap water 2	5.00	4.93	98.60 ± 1.29
	10.00	9.87	98.7 ± 0.83
	15.00	14.10	94.0 ± 1.07
Tap water 3	5.00	4.81	96.2 ± 1.37
	10.00	9.73	97.3 ± 0.88
	15.00	14.91	99.40 ± 0.96

References

[1] Bilgic, A., Cimen, A., Bayrak, M., & Kursunlu, A. N. (2024). A new eco-friendly fluorescent microcapsules for effective and selective detection of Hg (II) &Cu (II). *Journal of Photochemistry and Photobiology A: Chemistry*, *448*, 115346.

[2] Bilgic, A. (2021). Novel BODIPY-based fluorescent Lycopodium clavatum sporopollenin microcapsules for detection and removal of Cu (II) ions. *Colloids and Surfaces A: Physicochemical and Engineering Aspects*, *631*, 127658.