26th Congress of SCTM

Sept. 20-23, 2023, Metropol Lake Resort, Ohrid, N. Macedonia

Fabrication of a Novel Colorimetric Paraoxon Ethyl Biosensor Using CUPRAC Reagent as a Chromogenic Reagent

S. Ayaz,[a] S. Uluçay,[b] A. Üzer,[c], Y. Dilgin,[a*] and R. Apak[c]

[a]*Çanakkale Onsekiz Mart Univ., Faculty of Science, Chemistry Dept., Canakkale, Turkey*

[b]*Çanakkale Onsekiz Mart Univ., Faculty of Engineering, Chem. Eng. Dept., Canakkale, Turkey*

[2]*İstanbul Univ.-Cerrahpaşa, Faculty of Engineering, Chem. Dept. İstanbul-Avcılar, Turkey*

**ydilgin@comu.edu.tr*

Copper(II)-bis-neocuproin complex ($[Cu(Nc)_2]^{2+}$), which was first developed by Apak et al. in 2004 and known as CUPRAC reagent, has been used as a useful chromogenic reagent in many colorimetric sensor studies.[1-3] However, according to our literature search, a paraoxon ethyl (POE) biosensor using the CUPRAC reagent based on acetylcholine esterase (AcHE) inhibition has not yet been reported. First, an enzymatic reaction takes place between AcHE and its substrate, acetylthiocholine (ATCh), followed by a colorimetric reaction between the enzymatically produced thiocholine (TCh) and the CUPRAC reagent. While $[Cu(Nc)_2]^{2+}$ reduces to a yellow-orange cuprous complex ($[Cu(Nc)_2]^{+}$) which gives maximum absorbance at 450 nm, TCh oxidizes to its disulfide form. However, the absorbance of $[Cu(Nc)_2]^{+}$ is proportionally decreased depending on the increase in the concentration of POE due to the inhibition of AChE by POE. Based on this strategy, the linear response range of a colorimetric biosensor was found to be between 0.15 and 1.25 µM POE with a detection limit of 0.045 µM. The fabricated biosensor enabled the selective determination of POE in the presence of some other pesticides and metal ions. Acceptable recovery results were obtained from water samples spiked with POE.

Keywords: Acetylcholine esterase; Paraoxon ethyl; Colorimetric biosensor; CUPRAC

Acknowledgment: The authors thank the Scientific and Technological Research Council of TURKEY (*TÜBİTAK*) for financial support (Project number: 120Z963).

References

1. Apak, R., Güçlü, K., Özyürek, M., Karademir, S.E., *J. Agric. Food Chem.* **2004,** 52, 7970–7981.

2. Avan, A.N., Demirci-Çekiç, S., Apak, R., *ACS Omega* **2022,** 7, 44372–44382.

3. Avan, A., Karakaş, Ö., Demirci-Çekiç, S., Apak, R., *Enzyme Microb. Technol.* **2023,** 162 110137