**Preparation of Test Strips for Naked Eye Dedection of Peroxide Type Explosives**

***Veyis KARAKOÇ1\*, Erol ERÇAĞ2, Ayşem UZER3, Reşat APAK3***

*1Eldivan Vocational School of Health Services, Cankiri Karatekin University, Cankiri, Turkey*

*2 Department of Chemistry, Arts and Science Faculty, Namık Kemal University, Tekirdağ, Turkey*

*3 Istanbul University, Faculty of Engineering, Department of Chemistry, Avcilar 34320 Istanbul, Turkey*

**Abstract**

Peroxide-based explosives are energetic materials that have the R-O-O-R functional group which contains O2 required for a very rapid explosion. The explosion occurs very quickly thanks to the weak -O-O- bonds. Peroxide type explosives are preferred and used very frequently by terrorists because they can even be prepared from materials used at home easly. However, since they do not have chromogenic or fluorogenic group or any other functional group, it is not possible to detect them via classical analitical methods. TATP, the most important and common usage of the peroxide type explosives, does not leave any post-explosion residue like nitro aromatic class explosives frequently used in military activities. Detection of peroxide-type explosives has become even more important after the 2005 London Metro terrorist attack and the 2015 Paris suicide bomber attempts. Since the detection of TATP is difficult, methods have been developed for the detection of H2O2 which is the product of the degradation of TATP in an acidic medium. Different analysis methods such as spectrophotometric, chromatographic, electrochemical and fluorometric methods have been developed for H2O2 analysis[1,2]. Among these, colorimetric detection has been received great attention in recent years due to its simple usage, low cost, portability, that it can be applied in a short time without a trained person, and even allows analysis without a device with the naked eye [3]. In this study, we developed a polymer based colorimetric sensor for the naked eye detection of TATP. We synthesized 2-hydroxyethyl methacrylate (HEMA) based tranparent polymeric film for quantitative and qualitative colorimetric analysis of TATP by using CUPRAC methods. The Cuprac method, is a method used in the total analysis of many reducing agents, was developed in the laboratories of Istanbul University Cerrahpaşa. The method is based on the spectrophotometric measurement of the colored complex of Cu(I)-Nc formed as a result of the interaction of copper(II)-neocuproin (Cu(II)-Nc) reagent and H2O2, at 454 nm[4,5]. In this study, Cibacron Brilliant Yellow 3G-P reactive dye containing negatively charged sulfanyl-SO3H groups covalently bonded to the synthesized poly (HEMA) films in order to electrostatically attach the (Cu(II)-Nc) complex. The colored complex turning from light yellow to brown as a result of interaction was measured in UV spectrophotometer. As a result, polymer-based test strips were developed that allow rapid, inexpensive analysis of TATP with naked eye in non-laboratory environments[6].

**Keywords:** Colorimetric sensor, explosive dedection, polymeric test strips, Triacetone triperoxide (TATP)

***Acknowledgements***

*This research was funded by TUBITAK BIDEB’s “2218-National Postdoctoral Research Fellowship Programme”*

**Reference**

1. Eren S, Uzer A, Can Z, Kapudan T, Erçağ E, Apak R. (2010). Determination of peroxide-based explosives with copper(II)-neocuproine assay combined with a molecular spectroscopic sensor. Analyst.;135(8):2085-91
2. Gökdere B, Üzer A, Durmazel S, Erçağ E, Apak R, (2019).Titanium dioxide nanoparticles–based colorimetric sensors for determination of hydrogen peroxide and triacetone triperoxide (TATP),Talanta, 202, 402-410, <https://doi.org/10.1016/j.talanta.2019.04.071>.
3. Choodum A., Keson J., Kanatharana P., Limsakul W., Wongniramaikul W.,(2017). Selective pre and post blast trinitrotoluene detection with a novel ethylenediamine entrapped thin polymer film and digital image colorimetry,. Sensors and Actuators B: Chemical, 252, 463-469, <https://doi.org/10.1016/j.snb.2017.06.030>.
4. Apak, R., Güçlü, K., Özyürek, M. et al. (2008). Mechanism of antioxidant capacity assays and the CUPRAC (cupric ion reducing antioxidant capacity) assay. Microchim Acta 160, 413–419 <https://doi.org/10.1007/s00604-007-0777-0>
5. Erçağ E., Üzer A., Apak R., (2009). Selective spectrophotometric determination of TNT using a dicyclohexylamine-based colorimetric sensor, Talanta, 78, 3,772-780, <https://doi.org/10.1016/j.talanta.2008.12.042>..
6. Fabregat V, Burguete MI, Galindo F, Luis SV. (2017). Influence of polymer composition on the sensitivity towards nitrite and nitric oxide of colorimetric disposable test strips. Environ Sci Pollut Res Int. 24(4):3448-3455. https://doi: 10.1007/s11356-016-8068-0.