**A rapid colorimetric electronic tongue for detection of sulfur mustard poisoning using plasma composition analysis**

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Sulfur mustard is an oily liquid with a low evaporation coefficient. After absorption and solubility in body fluids, it undergoes intramolecular cyclization and creates an ionic intermediate of ethylene episulfonium. The cyclic intermediate molecule alkylates a wide range of biological structures with sulfhydryl, alpha-amino, and imidazole rings [1]. Exposure to this combination can cause various effects on the respiratory system, such as increased nasal secretions, sore throat, damage to the lungs and airways, and continuous and severe coughing. Depending on the concentration of inhaled gas, injured people can suffer pathological changes such as pseudomembranous laryngotracheitis, pseudomembranous obstruction of the right main stem bronchus, pseudomembranous bronchitis, lung abscess, bronchopneumonia or gangrene, and in acute conditions, they are dying in the period of 3 to 14 days [2,3]. Conventional methods for detection of this injury are generally time-consuming and expensive, and in some cases are invasive, so that the patient refuses to go to medical centers to perform the necessary analyzes in order to detect the severity of the disease. The use of sensors that provide the possibility for point of care diagnosis the disease in the shortest time can help the process of detection and treating this injury. For this purpose, this study has presented a sensor array based on colorimetric methods, which is made of copper-silver bimetallic nanoparticle functionalized with caffeic acid and 12 color detectors. This sensor interacts with the metabolites in the plasma sample. Since chemical injury causes a change in the concentration profile of victims compared to control people, the interaction of the compounds in the plasma sample with the sensor produced a unique color pattern for each group, individually. . In this study, 40 control subjects and 123 injured persons with different injury severity participated. The data obtained by the statistical analysis revealed that the sensor could discriminate the two study groups with an accuracy of 87%. Also, a good correlation between disease severity and the changes in the color of sensor array was observed with a Pearson coefficient of 0.992 and P\_value<0.001. Other factors such as age and diet, drug use, etc. had no effect on the response of the sensor array. Due to its user-friendliness and cost-effectiveness, this sensor can be a suitable alternative to common Chemical injuries detection methods.

**Keywords**: Chemical injuries, Electronic tongue, bimetallic nanoparticles, Biofluid sample, Metabolites

**References**:

[1] Guthrie F. Ueber einige Derivate der Kohlenwasserstoffe CnHn. Ann Chem Pharm 1860; 113:266–288.

[2] Koch WD. (). Direkte Kriegserkrankungen durch Einwirkung chemischer Mittel. In: Aschoff L, ed. Handbuch der ärztlichen Erfahrungen im Weltkriege 1914/1918 Band VIII. Pathologische Anatomie. Germany: J.A. Barth Leipzig, 1921; 526–536.

[3] Tang, F.R. and Loke, W.K., Sulfur mustard and respiratory diseases, Critical Reviews in Toxicology, 2012; 42(8): 688–702.