Electrochemical Determination of Highly Carcinogenic Hydrazine in Wastewater

Stephen N. Mailu[a,b], Priscilla GL. Baker[b] and Emmanuel I. Iwuoha[b].

[a]Machakos University, P.O Box 136-90100, Machakos, Kenya.

[b]SensorLab, Department of Chemistry, University of the Western Cape, Bellville, 7535, South Africa.

Cell phone number: +254 719765804 Email: smnzioki2007@gmail.com

ABSTRACT

Water is very key to human life. Its sustainable use and management is paramount to the survival of the human life. Most of the water resources are exploited and polluted thus raising concerns to social, pure and applied scientists. One of the major water pollutants is hydrazine. Hydrazine is neurotoxin in nature and has been classified as human carcinogen by the Environmental Protection Agency (EPA). It causes damage to liver, kidney, lungs and respiratory tract system and has long-term effects on the central nervous system when people are exposed to air containing 10 ppb hydrazine.It is also a hepatotoxic substance with adverse health effects on the brain and capable of causing DNA damage. Due to these side-effects, it is highly desirable to fabricate portable, economical, sensitive and rapid methodologies for the determination of hydrazine. In this work, a highly sensitive, rapid and simple electrochemical method for the detection of hydrazine has been developed. The electrocatalysis of hydrazine oxidation on Pt(100)Rh nanoalloys modified glassy carbon electrode (Pt(100)RhNPs/GCE) was investigated in aqueous medium using cyclic voltammetry (CV). An increased current density and decreased oxidation overpotential was observed. A mechanism for electro-oxidation of hydrazine on Pt(100)RhNPs/GCE demonstrated an irreversible diffusion-controlled electrode process and a four-electron transfer involved in the overall reaction. The experimental results showed that the mediated oxidation peak currents of the hydrazine were linearly dependent on the concentration of hydrazine in the range of 4.0×10^{-6} to 1.0×10^{-3} M. The detection limit was found to be 3.3 μM.

Keywords: Hydrazine, Nanoalloys, Carcinogen, Overpotential