The Synthesis of Au-Fe3O4 Nanoparticles for the Purpose of Nonenzymatic Dopamine Sensing

Bernabe, Jillian (School: Camdenton High School)

This year alone, 1 million Americans suffer from Parkinson's Disease (PD); 5 million from Alzheimer's (AD); and 400,000 from Multiple Sclerosis (MS). Neurodegenerative diseases affect the neurons of the human brain, causing neuron deterioration. Bodily functions like heart function, balance, and speech are then hampered. Recent studies demonstrate that dopamine can act as a reliable metabolic parameter for the early diagnosis of neurodegenerative disease. Therefore, the determination of dopamine concentrations in the body is of great importance. Current methods of dopamine detection involve analytical, spectroscopic, and electrochemical techniques. However, electrochemical detection of dopamine poses as the most effective due to its sensitivity and selectivity. Dopamine detection occurs through its oxidation into polydopamine on the electrode surface, but there are various bodily substances that may interfere with the oxidation current. Hence, gold-ferric oxide nanoparticles were utilized for an increase in sensitivity, conductivity, and selectivity during dopamine detection. In this study, Au-Fe3O4 nanoparticles were synthesized through a one-pot synthesis. The nanoparticles were deposited on carbon cloth substrates. The prepared electrodes were then subjected to cyclic voltammetry (CV), under a three-electrode setup to determine their dopamine-sensing capabilities. The electrodes were tested in several concentrations of dopamine starting with 5μM and ending with 200μM. Data graphs displayed that the anodic current increased substantially in the presence of dopamine, which signified the occurrence of dopamine detection. Therefore, the synthesis of Au-Fe3O4 nanoparticles has the potential to detect neurodegenerative disease through dopamine sensing.

Awards Won:
Fourth Award of $500