Contribution ID: **257** Type: **Invited Speaker**

Nanomaterials for analytical detection

Tuesday 29 November 2016 11:15 (20 minutes)

Nanomaterials have received unceasingly consideration for decades. Profuse utilizations have been afforded to raise the efficacy of research in numerous scientific fields since their discovery. This novel supplies trigger the versatility of materials properties in which diversely expedite the applications in analytical research. Due to exceptional features derived from indigenous of particles in nanometer-size, they have received abounding attraction in environmental, food, clinical analysis. Particularly, medical detection based on nanomaterials as signal amplification has been positively subjected as crucial keys towards conceptual biomedical analytical tools because nanomaterials process biocompatible property. For these reasons, many research groups have proposed various strategies engaging nanomaterials for detection of biological targets. Our group also resembles an interest of nanomaterials use and characteristic. However, we exclusively highlight the reinforcement of excellent properties of graphene in electrochemical detection, also nanoparticles as probe for optical detection.

The outstanding physical, chemical, and electrical features compel an adaptation of graphene (G) in many means of electrode modification. Its magnificent electrons conductivity arises from layer of carbon atoms packed closely into a two-dimensional honeycomb arrangement. Consequently, our groups have adopted graphene in numerous clinical sensing applications including cholesterol and glucose. In our works, graphene was consolidated with polyaniline (PANI), a conducting polymer, on the electrodes. The integrity of geminate materials improved the sensitivity in electrochemical detection substantially. Following a thorough investigation of electrochemical properties, the composite nanomaterials were electro-sprayed onto screen-printed carbon electrode (SPCE) and applied for cholesterol detection. The results demonstrated clearly that the signal was improved and more-well defined. The limit of detection proposed in this work was as low as 1 μM after optimization. Another work has confirmed the advantages of G-PANI by casting the working electrode in the electrochemical compact disk (eCD) platform prior detection of glucose. Wide linear dynamic range (1-10 mM) was obtained with low detection limit of 0.29 mM. Both methods were applied in real serum and blood samples showed satisfied results validating with the standard methods. In addition, recently our groups have reported methodology for detection of human papillomavirus (HPV) using SPCE surface modified with G-PANI. The signal was distinctly increased as a great function of G-PANI, while the selectivity was achieved from the PNA probe.

Nanoparticles are particles in nanometers range which dominate the extra unique properties contrasting from their bulk materials. Numerous prestige is inscribed for optical features of nanoparticles. Therefore, applications based on colorimetry and spectrophotometry of nanoparticles are extensively introduced. Our groups also developed a superior methodology for detection of metal ions in blood samples on facile and cheap paper-based analytical devices (PADs). The etching reaction between silver nanoplates (AgNPls) and metal target was attributed to the resulting color change. From pink to colorless, the detection of copper ions (Cu2+) was successfully achieved. On the other hands, nanoparticles occupied high surface area to volume ratio which benefits the electrons transferring among surface of conducting materials. A comprehension of this behavior accomplished our skilled electrochemical works on enzymatic cholesterol detection using silver nanoparticles (AgNPs) electroplating incorporating with cholesterol oxidase (ChOx) on boron doped diamond (BDD) electrode. The enhancement of H2O2 signal was obtained from AgNPs depositing on the surface of working electrode, whereas ChOx provided the selectivity for this reaction. In this works, not only the sensitivity was increased, but the cathodic peak also displayed more well-defined compared with bare electrode. This work demonstrated that cholesterol as low as 0.25 mg dL-1 can be detected in real serum samples with the involvement of AgNPs.

Keywords: Graphene, Nanoparticles, Electrochemical detection, Optical detection, Paper-based analytical devices (PADs)

Author: Prof. CHAILAPAKUL, Orawon (Electrochemistry and Optical Spectroscopy Research Unit (EOSRU), Department of Chemistry, Faculty of Science, Chulalongkorn University, 254 Phayathai Road, Patumwan, Bangkok 10330, Thailand / Center for Petroleum, Petrochemicals and Advanced Materials, Chulalongkorn University, 254 Phayathai Road, Pathumwan, Bangkok 10330, Thailand)

Presenter: Prof. CHAILAPAKUL, Orawon (Electrochemistry and Optical Spectroscopy Research Unit (EOSRU), Department of Chemistry, Faculty of Science, Chulalongkorn University, 254 Phayathai Road, Patumwan, Bangkok 10330, Thailand / Center for Petroleum, Petrochemicals and Advanced Materials, Chulalongkorn University, 254 Phayathai Road, Pathumwan, Bangkok 10330, Thailand)

Session Classification: Heron 2

Track Classification: Nano-medicine & biotechnology