# Carboxyl-modified graphene oxide be used in early detection of potentially pancreatic cancer

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## Abstract

Graphene is a one-atom-thick two-dimensional carbon nanomaterial with extraordinary electronic, thermal, and mechanical properties [1]. The development of GO based biosensing can significantly improve the performance of biological sensors due to where are many carboxyl groups and good coupling influence of surface plasmon resonance (SPR) angle [2-3]. We will modified of graphene surface to transform epoxy (-O), hydroxyl (-OH), and ether functional groups to carboxyl groups (-COOH) by sodium hydroxide and chloroacetic acid [4-5]. Attributed to highly oxidized among graphene sheets, carboxylation of graphene oxide (GO-COOH) has a larger spacing compared with GO and possess abundant carboxyl (-COOH) and fewer hydroxyl (-OH) hydrophilic groups [6]. Outstanding feature of GO-COOH for biological is attractive from several advantages including large specific surface area, especially dielectric constant to couple SPR angle and abundant carboxyl functional groups on basal plane of graphene that employed to conjugate amino groups of biomolecules. Relative to GO, GO-COOH with more carboxyl functional groups to binding protein which are covalently immobilized and adsorbed but retained the advantage of GO. GO-COOH chip are further characterized with XPS measurements at Figure 1 suggest that carbons bonds C=C/C-C (285.9 eV) and oxygen atoms are bound to surface carbon through C−O (286.7 eV), C=O (287.4 eV), and O−C=O (288 eV) bonds. Carbohydrate antigen (CA 19-9) is a cancer marker for detection potentially pancreatic cancer [7]. In order to improve the additive assay of potentially pancreatic cancer, the novel material of GO-COOH with abundant carboxyl groups was deposition on biosensor chip which treated a binding layer to conjugate amine groups of CA 19-9 protein. In Figure 2 (a), the whole process of immobilized CA19-9 antibody in concentration of 200μg/ml with carboxylated graphene oxide-based SPR biosensor chip was been present. The mixture of 1-ethyl-3(3(dimethylamino)propyl)carbodiimidehydrochloride (EDC) and N-Hydroxysuccinimide (NHS) used as activator with the surface of chip. After immobilized antibody, the chip surface was blocked with ethanolamine (EA) solution, following we employed NaOH to remove the residue. After that, CA19-9 antibody has been employed to capture two different concentration of CA19-9 antigen those are 0.2KU/ml and 5KU/ml respectively through immunoassay which plotted at Figure 2 (b). The resuting express the novel material of GO-COOH capable be used in the detection of potentially pancreatic cancer and other clinical diagnosis.

## References

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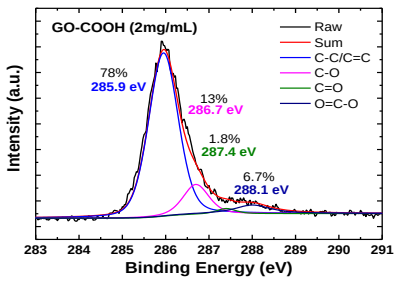
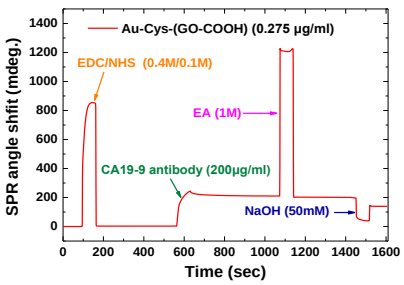
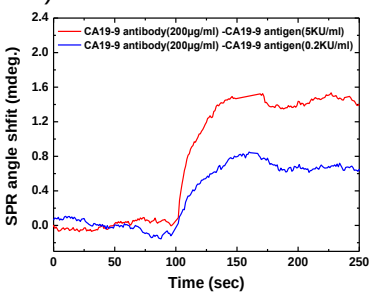



Figures 1. Characterized with XPS of GO-COOH




Figures 2 (a). The process of immobilized of CA19-9 antibody




Figures 2 (b). Immunization with CA19-9 antibody and antigen