Light enhances the blood glucose monitoring with naked eye

Enzymes play an important role in the body of a plant or animal. Natural enzymes have been extensively investigated and widely applied in industry because of their excellent properties, including high substrate specificity and catalytic efficiency. However, high costs of preparation, purification and storage restrict their widespread applications. In recent years, the artificially synthesized nanomaterials, such as gold nanoparticles, graphene, *etc.*, have emerged as enzyme mimics. Hybrid nanostructures, composed of two or several components, have attracted extensive attention due to their much higher enzymatic activity compared to their individual components. Two is better than one. Therefore, it is very important to develop some new enzyme mimics with assembled structures.

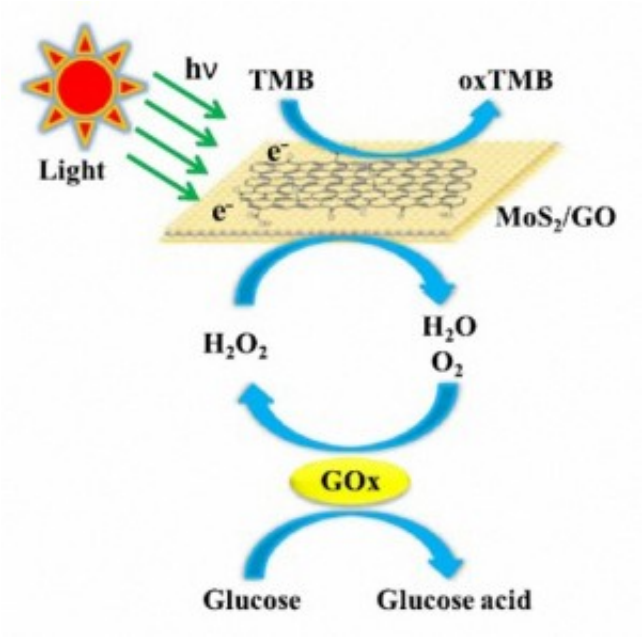

Fig. 1. Colorimetric detection of glucose by MoS2/graphene-catalyzed reactions with light irradiation.

Two-dimensional hybrid MoS_2/graphene demonstrated higher peroxidase-like activity to decompose hydrogen peroxide. A compound, 3,3',5,5'-tetramethylbenzidine (TMB), was added into the reaction to track the decomposition of hydrogen peroxide because it can be oxidized with a color change from colorless to blue. Therefore, we can detect hydrogen peroxide with naked eye. It is very interesting that visible and near-infrared lights could enhance the peroxidase-like activity of hybrid. These excellent performances are attributed to the high electron transfer rate of MoS_2/graphene and the synergistic interaction of two components. Hydrogen peroxide will be produced during the oxidation of glucose. Therefore, the hybrid was further used to detect glucose

in human serum samples with naked eye. Blood glucose monitoring is a way of testing the concentration of glucose in the blood, which is particularly important in the care of diabetes mellitus. Improved technology for measuring blood glucose is rapidly changing the standards of care for all diabetic people.

The kinetics and thermodynamics of H_2O_2 decomposition by MoS_2/graphene indicate that it was superior to the other reported catalysts and nature enzyme horseradish peroxidase (HRP). Furthermore, the electrochemical experiments show that an interleaved electron transfer highways could be built up in MoS_2/graphene to improve the activity of the hybrid. Therefore, the excellent peroxidase?like activity of MoS_2/graphene could be attributed to the high conductivity and the synergistic interaction of two components.

The most interesting thing here is that the peroxidase?like activity of MoS_2/graphene could be further enhanced under the irradiation of visible or infrared light. This biosensor system is used for visual detection of glucose in real serum samples. MoS_2/graphene, as a novel peroxidase mimetic, show several advantages over natural enzymes and other existing alternatives, such as ease of preparation, low cost and light-enhanced activity. This finding will cause an important impact on the application of sunlight to improve the blood glucose monitoring with naked eye for point-of-care diagnosis of diabetes mellitus in the future.

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