Immobilization of glucose oxidase on multi-walled carbon nanotubes

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Abstract

Recently, biofuel cells which use biocatalysts, enzymes or whole cells, to convert chemical energy stored in glucose into electrical energy draw great interests due to their advantages compared to conventional fuel cells[5]: Glucose which is much easier to handle with than gaseous hydrogen can be used as a fuel. Biofuel cells are easy and quick to charge without requiring external electricity sources, thereby, enabling the development of portable batteries. Miniaturized fuel cells can be developed and used being implanted inside living bodies using glucose dissolved in body fluids as fuel[2]. Glucose oxidase, peroxidases, and laccase are the key enzymes in the development of biofuel cells[3,4]. Various types of materials immobilized with enzymes have been used as electrodes. Some examples are surface modified gold, graphite powder, carbon cloth, conductive polymer films, or sol-gel materials. In our study we investigated the possibility of using carbon nanotubes as electrode material for biofuel cells. Carbon nanotubes first discovered in 1991 by Iijima are found in two types[1]; multi-walled carbon nanotubes composed of multiple concentric tubules ranging 2 to 25 nm in diameter and single-walled carbon nanotubes with a diameter of 1-2 nm. We optimized various conditions to covalently immobilize glucose oxidase on chemically functionalized multi-walled carbon nanotubes posessing COOH groups using 1-ethyl 3-(3-dimethylaminopropyl) carbodiimide (EDC) as a coupling reagent.

References

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