Carbon black-gold nanoparticle (CB-AuNP) nanostructured sensor for electrochemical detection of phosphate in seawater samples

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Phosphate is an essential nutrient for plants, however at high concentrations it leads to a condition called eutrophication, a rapid growth of plant populations in aquatic environments (algal blooms), eutrophication which results in reduction or elimination of dissolved oxygen that is crucial for fish and other aquatic life. Herein, we report on a highly sensitive electrochemical sensor for detection of phosphate levels in seawater samples. The method is based on measuring phosphomolybdate complex formed by a reaction between phosphate and molybdate which is subsequently detected on the electrode surface. To enhance the sensitivity of the sensor and lower the detection limit, a modified screen-printed electrode was used. Screen-printed electrodes modified with carbon black decorated with gold nanoparticles (CB-AuNP) successfully increased the detection of phosphomolybdate complex reduction at + 64 mV vs. Ag/AgCl. Analytical figures of merit including reagent concentration, working potential, flow rate and concentration of CB-AuNP on electrode surface were optimized. Results show a linear range at low phosphate concentrations from 0.05 – 50 µM with detection limit of 0.05 µM phosphate, calculated as three times the standard deviation of the blank divided by the slope of calibration curve. Work is in progress to assess accuracy and selectivity.

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