Flow Electrochemical Sensor based on Carbon black-Gold Nanoparticle (CB-AuNP) Polylysine Nanostructured Sensor for Electrochemical Detection of Phosphate in water samples

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Phosphate is an important part of sea ecosystems as plant life needs it to survive, however it can lead to eutrophication, an overgrowth of plant life in seawater (algal blooms). This results in reduction or elimination of dissolved oxygen that is crucial for fish and other sea creatures. 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 dynamic 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. Accuracy was also assessed using recovery studies and by measuring phosphate in real water samples with good agreement with the spectrophotometric method. Results show great promise for a simple, low-cost method for real-time, on-site detection of phosphate in seawater samples.

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