Whole Cell Bioindicator Using Multi-Markers from Green Algae *Spirogyra* to Detect Lead, Calcium and Sodium

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ABSTRACT

Human activities have brought environmental pollutions that cause health problems to all living organisms. For continuous monitoring purposes, whole cell biosensors are good alternatives as they are portable, can be used for rapid detection and provide reliable results. In this research, the green algae *Spirogyra* collected from natural environment (Green Foliage Nursery, Air Hitam, Kluang, Johor) was used as biological components of the biosensor. The objective of this study was to determine the ideal markers including chlorophylls, carotenoids, superoxide dimutases (SODs) and alkaline phosphatases (ALPs) in *Spirogyra* for biosensor applications. The response of four markers towards different concentrations of heavy metal lead (Pb), light metals calcium (Ca) and nutrients sodium (Na) was investigated using spectrophotometric analysis with optical density (OD) measured at respective peak absorption wavelengths, which were 663 nm, 450 nm, 400 nm and 650 nm. The cell density was determined using cell count, which 0.5 mL of *Spirogyra* cell (in average of 0.512 million cells) were immobilized into 0.50 mL of agarose gel. The immobilized cells were next exposed to 0.001, 0.010, 0.100, 1.000 and 10.000 mg/L of Pb, Ca and Na for 1, 6, 24 and 48 hours. The best marker for Pb was chlorophylls while the best marker for Ca and Na was carotenoids. An increase of the four markers concentrations were observed with the increased of Pb, Ca and Na concentrations. The high R square values ($R^2 > 0.950$) for 0.001 to 0.100 mg/L of all metals' exposure showed that *Spirogyra* cells posed great potential for quantitative whole cell biosensor applications. Also, high slope values showed *Spirogyra* cell poses great sensitivity in different concentrations of metals detection.