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Editorial Open Access

The Interference of Bioenergetics in Photosynthesis and the Detection of Heavy Metals

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Photosynthesis is one of the most prominent bioenergetics processes, where the energy from the sun is trapped and converted into carbohydrates. The process occurs in autotrophic organisms, such as plants, algae, and cyanobacteria not only producing O_2 through light reaction, but fixes CO_2 to produce carbohydrates in dark reaction [1]. Tapping on 1% of the total light energy from the sun that reaches earth, photosynthesis fuels the energy needed by living organisms on earth.

First step in photosynthesis, the light from the sun is captured by chlorophyll and other photosynthetic pigments. When the light is absorbed, electrons are promoted to higher orbital, thus increases the possibility of these electrons to be transferred to other acceptors. The moving of electrons from one acceptor to another is a continuous oxidation-reduction chain reaction, which at the end, the energy received from the light is converted into chemical energy- carbohydrate.

However, not all the energy captured by photosynthetic pigments is channeled into carbohydrate synthesis. A portion of the energy is converted to heat and been released into environment [2] on the other hand a small amount of energy dissipated in the form of fluorescence emission. All the channels that the photosynthetic organisms used to dissipate the energy absorbed from the sun affect each other e.g. reduce in photosynthesis might causes the increase of fluorescence emission [3].

The presence of heavy metals interferes photosynthesis pathway through several mechanisms [4-7]. Although a few heavy metals e.g. Cu and Zn are required in low concentration to maintain the normal metabolism of the photosynthetic organisms, the inhibition of photosynthesis is obvious at high concentration of heavy metals.

The inhibition of photosynthesis can be indicated by reduce in oxygen production and the increase in fluorescence emission. Both of these physiological changes have been utilized by scientists as indicators of the presence of heavy metals in environment [8-12].

These biological integrated indicators are commonly being referred as biosensor. Biosensor is defined as analytical tools combining biological component, transducer, and reader together [13]. The biological components ranges from cells to biological molecules e.g. amino acids and deoxyribonucleic acids, which responses to specific target compounds, with the transducers responsible to translate the biological responses to electronic signal that can be captured and displayed through the readers.

To date, several cell-based biosensors has been developed, with the interference of bioenergetics in photosynthesis has been utilized as signal-generating parameter. Nevertheless, the connection of photosynthesis to the sensing application has become one of the important stepping stones in the exploration to use other bioenergetics pathways to serve the sensing purposes.

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