

Biosensors. Concept of bioremediation of water, bioprocess engineering and bioprospecting

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Biosensors

- A biosensor can be defined as a “compact analytical device or unit incorporating a biological or biologically derived sensitive recognition element integrated or associated with a physio-chemical transducer”.
- There are three main parts of a biosensor:
 - (i) the biological recognition elements that differentiate the target molecules in the presence of various chemicals.
 - (ii) A transducer that converts the biorecognition event into a measurable signal.
 - (iii) a signal processing system that converts the signal into a readable form.

- The molecular recognition elements include receptors, enzymes, antibodies, nucleic acids, microorganisms and lectins.
- The five principal transducer classes are electrochemical, optical, thermometric, piezoelectric, and magnetic.

WORKING OF BIOSENSOR

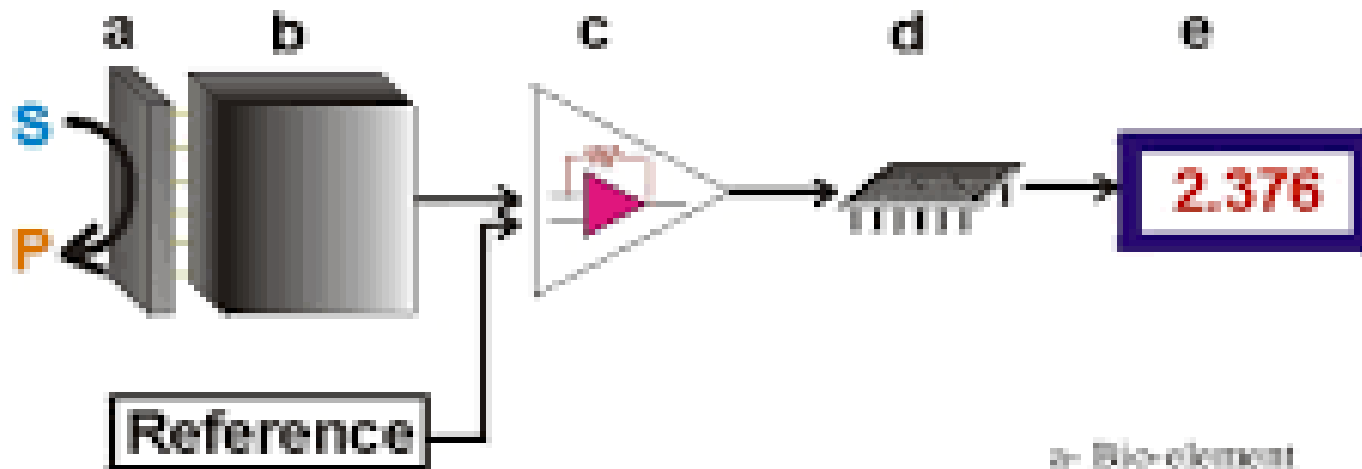


Figure. Schematic Diagram of Biosensor

a- Bio-element

b- Transducer

c- Amplifier

d- Processor

e- Display



Bioremediation of water

- Bioremediation is an emerging innovative technology in the field of environmental science and engineering for low energy consumption, high efficiency, and environmental safety. In this technology, microorganisms are employed to destroy or reduce the concentration of hazardous wastes on a contaminated site such as water, soils, sludges, and waste streams from various processes due to increased population, industrialization and urbanization.

- It comprises rhizoremediation (plant and microbe) and phytoremediation (plants).
- Phytoremediation consists of mitigating pollutant concentrations in contaminated soils, water, or air, with plants whereas rhizoremediation involves the removal of specific contaminants from contaminated sites by mutual interaction of plant roots and suitable microbial flora. Because bioremediation seems to be a promising alternative to conventional clean-up technologies, substantial research is increasing in this field rapidly.

- This is termed **biostimulation**. Biostimulation can be achieved through changes in pH, moisture, aeration, or additions of electron donors, electron acceptors or nutrients.
- Another bioremediation approach is termed **bioaugmentation**, where organisms selected for high degradation abilities are used to inoculate the contaminated site [3]. These two approaches are not mutually exclusive- they can be used simultaneously.

Bioprocess engineering: Introduction

- **A bioprocess is any process that uses complete living cells or their components (e.g., bacteria, enzymes, chloroplast) to obtain desired products.** This process is commonly referred to as Fermentation. The entire process can be divided in three stages.

- **Stage I : Upstream processing** which involves preparation of liquid medium, separation of particulate and inhibitory chemicals from the medium, sterilization, air purification etc. Upstream processes include selection of a microbial strain characterized by the ability to synthesize a specific product having the desired commercial value.

- **Stage II: Fermentation** which involves the conversion of substrates to desired product with the help of biological agents such as microorganisms.
Technique is for large-scale production of microbial products.

- **Stage III: Downstream processing** which involves separation of cells from the fermentation broth, purification and concentration of desired product and waste disposal or recycle.

Bioprospecting

- **Bioprospecting** is the process of discovery and commercialization of new products based on biological resources. These resources or compounds can be important for and useful in many fields, including pharmaceuticals, agriculture, bioremediation, and nanotechnology, among others. Between 1981-2010, one third of all small molecule new chemical entities approved by the U.S. Food and Drug Administration (FDA) were either natural products or compounds derived from natural products. Despite indigenous knowledge being intuitively helpful, bioprospecting has only recently begun to incorporate such knowledge in focusing screening efforts for bioactive compounds.