National Agri-Food Biotechnology Institute, Mohali

Developing Multifunctional Nanomaterial based Biosensor to Detect Food Borne Bacteria

Food borne diseases are a major health concern and can add tremendous financial burden to our health care systems. Conventional strategies to **Detect Food Borne Bacteria** like plating and enzyme-linked immunosorbent assay (ELISA) are time consuming and difficult, while quick identification of bacterial species in food is essential to ensure food safety.

Progress in nanotechnology has led to development of new diagnostic tools for sensitive and fast discovery of pathogens and toxins. Nanomaterials like gold nanoparticles (AuNPs) and graphene oxide (GO) have unique optical properties and surface chemistry which make functionalization very easy. Graphene oxide coating has been done to increase the sensitivity and selectivity of the prepared nanobiosensor which results in a visible color change with specific bacteria without any complex instrument.

To increase sensitivity and selectivity, scientists at National Agri-Food Biotechnology Institute, Mohali have developed carbohydrate, antibody and aptamers-based biosensors against different food borne pathogens. In the antibody-based sensors, Polyethylene glycol (PEG) attached Graphene Oxide coated AuNPs were conjugated with different types of antibodies. The Antibody colorimetric biosensor can detect upto 10^3 cfu of food borne bacteria like *Escherichia coli, Salmonella typhimurium* visibly and upto 10^2 cfu when characterized by different techniques and have also shown bacterial killing when NIR (Near-Infrared) laser is given.

To further increase the sensitivity, aptamer (ssDNA) molecules were specially designed for the detection due to its cost-effective synthesis. Here, aptamers were generated against different whole cells bacteria, *Salmonella enterica* Serotype Typhimurium and *Escherichia coli* by Cell-SELEX and used for detection in food samples. Aggregation assay was developed to detect bacteria using aptamer fabricated Graphene oxide coated Gold nanoparticles. Fluorescent assay was also designed for the detection.

Another approach to detect bacteria is by using multivalent glycan modified nanoparticles. In contrast to weak monovalent binding multivalent interaction result in high specificity and in thermodynamic and kinetic stability. The nanoglycoclusters showed significant enhancement in binding affinity compared with the corresponding monovalent ligands. These approaches will contribute in the development of new food borne pathogen biosensor.

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