Biosurfactant: Production and Application

Biosurfactants are amphiphilic compounds produced in living surfaces, mostly on microbial cell surfaces or excreted extracellular hydrophobic and hydrophilic moieties that confer the ability to accumulate between fluid phases, thus reducing surface and interfacial tension at the surface and interface respectively.

Biosurfactants are mainly classified according to their chemical structure and their microbial origin. The main classes of biosurfactants are glycolipids, phospholipids, polymeric biosurfactants and lipopeptides (surfactin). The best known glycolipids are rhamnolipids, sophorolipids and trehalolipids.

* **Advantages of biosurfactants**

**Biodegradability:** Biological surfactants are easily degraded by Microorganisms.

**Low toxicity.**

**Availability of raw materials:** Biosurfactants can be produced from very cheap raw materials which are available in large quantities. The carbon source may come from hydrocarbons, carbohydrates and /or lipids, which may be used separately or in combination with each Other.

**Physical factors:** Many biosurfactants are not affected by environmental factors such as temperature, pH and ionic strength tolerances. Lichenysin produced by *Bacillus licheniformis* strain was not affected by temperature ranges of up to 50°C, a pH range of 4.5- 9.0, and NaCl concentration of 50g/l and Ca concentration of 25g/l.

**Physiological role of biosurfactant in microorganisms**

Biosurfactants are produced by a variety of a microorganism; they are secreted either extracellular or attached to parts of cells predominantly during growth on water immiscible substrates.

* **Commercial Applications of Biosurfactants**

Biosurfactants have several applications in agriculture, medicine, petroleum and industry.

* **Application of Biosurfactants in Agriculture**

. in agriculture, surfactants are used for hydrophilization of heavy soils to obtain good wettability and to achieve even distribution of fertilizer in the soil. The rhamnolipid biosurfactant, mostly produced by the genus Pseudomonas possess potent antimicrobial activity. Fengycins possess antifungal activity and therefore employed in biocontrol of plant diseases.

* **Applications of biosurfactants in commercial Laundry Detergents**

Cyclic Lipopeptide (CLP) are stable over a wide pH range (7.0- 12.0) and heating them at high temperature does not result in any loss of their surface-active property . They showed good emulsion formation capability with vegetable oils and demonstrated excellent compatibility and stability with commercial laundry detergents favoring their inclusion in laundry detergents formulation.

* **Biosurfactants as Biopesticide**

Lipopeptide biosurfactants produced by several bacteria exhibit insecticidal activity against fruit fly Drosophila melanogaster and hence are used as biopesticide.

* **Application of biosurfactants in medicine**

several biosurfactants have strong antibacterial, antifungal and antivirus activity; these surfactants play the role of anti adhesive agents to pathogens making them useful for treating many diseases as well as its use as therapeutic and probiotic agent. example - biosurfactant produced by marine *B.* *circulans* that had a potent antimicrobial activity against Gram positive and Gram negative pathogens and Semi pathogenic microbial strains

including MDR strain.

**Anti-adhesive agents:** Biosurfactants inhibit the adhesion of pathogenic organisms to solid surfaces or to infection sites.

* **Application of biosurfactant in food processing industry**

Biosurfactants have been used for various food processingapplication but they usually play a role as food formulation ingredient

and anti-adhesive agents. It is also used to control the agglomeration of fat globules, stabilize aerated systems, improve texture and shelf -life of starch-containing products, modify rheological properties of wheat dough and improve consistency and texture of fatbased products.

* **Application of biosurfactant in cosmetic industry**

Biosurfactants are used as emulsifiers, foaming agents, solubilizers, wetting agents, cleansers,

antimicrobial agents, mediators of enzyme action, in insect repellents, antacids, bath products, acne pads, anti dandruff products, contact lens solutions, baby products, mascara, lipsticks, toothpaste.

* **Application of biosurfactant in petroleum**

biosurfactants play a major role in petroleum extraction, transportation, upgrading and refining and petrochemical manufacturing.

* **Application of biosurfactant in microbial enhanced oil**

 **Recovery**

Microbial surfactants are widely used in oil recoveryThe mechanism responsible for oil release is acidification of the solid phase. Certain microorganisms, such as *Bacillus subtilis, Pseudomonas aeruginosa, Torulopsis bombicola* utilize crude oil & hydrocarbons as sole carbon sources & used for oil spill clean-ups.