# A bioactive microbial compound having various biotechnological activities: biosurfactant.

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Biosurfactants are surfactants of biological origin. Microorganisms like bacteria, yeasts, and fungi are known to produce various types of biosurfactants. Biosurfactants are amphipathic molecules belonging to a structurally diverse group of surface active molecules. Recently biosurfactants have gained much attention because of their versatile properties. The unique properties of biosurfactant such as biodegradability, relative ease of preparation and widespread applicability, make it different from chemical synthetic surfactant. Presently it has become an important product of biotechnology for industrial and medical applications for replacement of chemical synthetic surfactant.

Few advantages of biosurfactant as compare to chemically synthesized surfactants are listed below:

- Biodegradability: It is easily biodegradable as compare to the chemical surfactant.
- Biocompatibility and digestibility: These properties allow their application in cosmetics, pharmaceuticals and food ingredients.
- Specificity: Biosurfactant are more specific in action, as these have specific organic functional group which impart more variability in structure and function of molecule.
- Use in environmental control: Biosurfactants can be efficiently used in handling industrial emulsions, control of oil spills, biodegradation and lowering the toxicity of industrial discharges and in bioremediation of polluted soil.
- Easy availability of bacteria and raw materials: Biosurfactant producing microorganism can be isolated from many pristine as well as polluted ecosystems like natural water bodies and soil besides waste like oil/hydrocarbon contaminated soil, or municipal waste. The raw materials require for production of biosurfactant are also easily available.

Most importantly, they are biodegradable, making them environmental friendly "green" chemicals.

Surfactants can be classified according to the nature of the charge on individual polar moiety. Anionic surfactants are negatively charged usually due to a sulphonate or sulphur group. Cationic surfactants are characterized by a quaternary ammonium group which is positively charged. Non-ionic surfactant does not have charge group. Amphoteric surfactants have both positively and negatively charge moieties.

In general, biosurfactant structure includes a hydrophilic moiety consisting of amino acids, peptides anions or cations, mono-, di-, or polysaccharides, and a hydrophobic moiety consisting of unsaturated or saturated fatty acids. Biosurfactants can have a positive, negative or a neutral charge and this is determined by their hydrophilic moieties.

Due to their amphipathic properties, surface-active molecules concentrate at the interface of a solution with their hydrophobic regions aligned away from the polar liquid and the hydrophilic ones immersed. This then alters the physical forces governing the arrangement of liquid molecules, by influencing the formation of hydrogen-bonds, and results in a reduction in surface tension - the force required to keep a water droplet spherical.

Biosurfactants find their application in various fields like pharmaceutical and cosmetic industry, food industry, petroleum industry for oil recovery (microbial enhanced oil recovery, MEOR), heavy metal remediation, degradation of polycyclic aromatic hydrocarbons [1,2], antimicrobial and anti-fouling [3]. Biosurfactants are also used as anticancer agents [4].

The biosurfactants seem to enhance the solubilization and emulsification of the contaminants. Both organic and inorganic contaminants can be treated through desorption or biodegradation processes. In addition, there is the potential for *in situ* production, a distinct advantage over synthetic surfactants. This needs to be studied further. New applications for the biosurfactants regarding nanoparticles synthesis are developing. Future research should focus on the stabilization of the nanoparticles by biosurfactants before addition during remediation procedures. Biosurfactants can inhibit growth and biofilm formation capacity of most pathogenic bacteria. This unique capability of biosurfactants to inhibit biofilm formation can be a significant breakthrough in combating vital pathogens. Due to their biodegradability and low toxicity biosurfactants such as rhamnolipids are very promising for use in remediation technologies.

Though biosurfactants have huge applications, their uses are limited due to many reasons.

Some of the gap areas relevant to this work are:

- Many bacteria produce biosurfactant naturally, but their yield is low.

- Many different types of biosurfactants are reported but all are not well characterized.
- Applications like mineral flotation, larvicidal effect, cytotoxicity effect etc. are less studied may be due to non-availability of well characterized biosurfactants in significant amount.
- Bulk availability of biosurfactant for industrial testing is still limited. Scaling-up of biotechnological production is needed.
- Biosurfactant even if available in market are costly chemical.

So in future we should focus to resolve these problems.

## References

1. Bustamante M, Dura´n N, Diez MC. Biosurfactants are useful tools for the bioremediation of contaminated soil: a review. J Soil Sci Plant Nutr. 2012;12:667–87.
2. Zhang J, Yin R, Lin X, et al. Interactive effect of biosurfactant and microorganism to enhance phytoremediation for removal of aged polycyclic aromatic hydrocarbons from contaminated soils. J Health Sci. 2010;56:257–66.
3. Pradhan AK, Pradhan N, Sukla LB, et al. Inhibition of pathogenic bacterial biofilm by biosurfactant produced by Lysinibacillus fusiformis S9. Bioprocess Biosyst Eng. 2013;37(2):139-49.
4. Jemal A, Siegel R, Ward E, et al. Cancer statistics. CA Cancer J Clin. 2009;59:225–49.

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