# Thesis Abstract

Sophorolipid (SL), a glycolipid biosurfactant, is known to exhibit several interesting biomedical properties and has been considered recently as one of the most promising biosurfactant for industrial application. In this thesis, in order to meet the industrial demand for low-cost SL production, five different vegetable oils have been used as lipid precursor by *Starmerella bombicola* (MTCC1910). In the presence of cotton seed oil, 69.2 g/L of SL was produced in a shake flask. Specific growth rate (μ), specific yield (*Yg*) and specific substrate uptake rate (q) were determined for the cells grown in various vegetable oils. Yield of SL in a fermenter using cotton seed oil was 129 g/L with space-time yield (σp) of 1.093 g/L/h. The product yields with respect to substrate (Yp/s) and cell mass (Yp/x) were 1.19 and 4.77 g/g, respectively. The value of σp when SL was produced at an aeration rate of 0.8 vvm was found to be 3.6 times higher than that at 1.2 vvm.

*Candida albicans* causes superficial and life-threatening systemic infections. These are difficult to treat often due to drug resistance, particularly because *Candida albicans* biofilms are inherently resistant to most antifungals. In this study we investigated the effect of SL on *Candida albicans* biofilm formation and preformed biofilms. SL was found to inhibit *Candida albicans* biofilm formation and as well as reduce the viability of preformed biofilms. Moreover, SL, when used along with amphotericin B (AmB) or fluconazole (FLZ), was found to act synergistically against biofilm formation and preformed biofilms. Effect of SL on *Candida albicans* biofilm formation was further visualized by scanning electron microscopy (SEM) and confocal laser scanning microscopy (CLSM), which revealed absence of hyphae, typical biofilm architecture and alteration in the morphology of biofilm cells. We also found that SL down-regulates the expression of hypha specific genes HWP1, ALS1, ALS3, ECE1 and SAP4, which possibly explains the inhibitory effect of SL on hyphae and biofilm formation.

Cancer is also another main cause of death worldwide. Designing of the new anticancer drugs is remained challenging task due to ensure complexicity of cancer etilogy and continuously emerging drug resistance. Glycolipid biosurfactants (BSs) are known to have antimicrobial, anticancer, antiviral and many other bioactivities. In the present study, we tried to decipher the mechanism of action of the glycolipids (L-SL, Acidic-SL, Glucolipid and bolalipid) on breast cancer (MDM-MB 231), lung cancer (A549) and mouse skin melanoma (B16F10) cell lines. Scratch and fluorescence microscopy results showed that glycolipids inhibit cancerous cell migration possibly by inhibiting actin filaments. FACS analysis showed that L-SL and glucolipid both induces the reactive oxygen species (ROS) and also alters the mitochondrial membrane potential ($\Delta\Psi$) and finally leads to the cell death by necrosis. Furthermore, combinatorial effect of glycolipid (L-SL and glucolipid) on A549 cell demonstrated synergistic interaction as well as additive effects on MDM MB 231 and B16F10 cell lines. This study could be useful for developing new anticancer drugs using glycolipids alone or in combination with available marketed drugs.

In addition to this, we evaluated the potential of the SL based niosomal formulation of Amphotericin B (SL-AmB) against biofilm of opportunistic fungal pathogen *Candida albicans*. The entrapment efficiency of amphotericin B within SL-AmB niosome was found to be 67.50%. DLS, SEM, TEM, and CLSM techniques used for the characterization of the in-house prepared niosome. Moreover, the cytotoxic activity of SL-AmB on mature *Candida biofilm* was compared with an expensive, marketed drug i.e. Phosome (a liposomal formulation of amphotericin B) and found that SL-AmB exhibit similar effect. Conclusively, results of present study established affordable production of SL and using it as a carrier molecule for delivery of poorly soluble AmB for Candidiasis infection.