ABSTRACT

The present investigation deals with antioxidant and anti-cancer properties of exopolysaccharides (EPSs) from riverine-silt bacterial origin. Simultaneously, we emphasized on cellular feed-back mechanism in terms of cell signal regulation during disease recovery. Here, two non-identical EPSs were biosynthesized from a riverine-silt isolate *Bacillus megaterium* RB-05 [HM371417] in liquid fermentation using glucose mineral salts medium (GMSM) and in submerged fermentation using jute as substrate (JC). The strain was found to produce the maximum yield of EPS in GMSM (0.864-0.895 g/l) within 25-h of incubation period, whereas the EPS yield paralleled bacterial cellulase activity and was maximum (0.297 g/g substrate) after 72-h of fermentation. Partial structure elucidation and morphological characterization of the duly-purified polysaccharides were done using HPLC, FT-IR, GC-MS, $^{1}H/^{13}C$ NMR, and electron and atomic-force microscopy. The glucose media and JC-derived EPS differed in their molecular composition. Fucose, a deoxyhexose sugar residue, was identified as primary functional monomer (42 wt.%) of JC derived EPS, whereas, EPS synthesized in GMSM contained mostly galactose (37.6 wt.%) sugar residue. Arabinose, one of the major components of GMSM derived EPS, was absent in EPS from JC. In both the cases, amino sugar was present in the form of N-acetyl glucosamine. The EPSs, having average molecular weight of 170 and 128 kD, respectively, showed thermal stability up to 150-170 ^{o}C. Pseudoplastic rheology of these EPSs was found to induce their emulsifying activity in hydrocarbon media. EPS were shown to play a dose-specific dual role of being both anti and pro-oxidant. JC-derived high fucose content (HFC) EPS showed superior antioxidative property against hydrogen peroxide (300 µM)-induced stress in human embryonic lung fibroblast cells (WI38) by downregulating the level of intracellular reactive oxygen species (ROS). Unlike the previous, GMSM-derived low fucose content (LFC) EPS conferred a dose-specific anti-proliferative activity (maximum at 750 µg/ml) against human lung cancer epithelial cells (A549). Both the disease recovery involved regulation of mitochondria-associated proteins, Caspase family proteins, mitogen activated kinases (MAPKs), redox regulatory proteins, and downstream cytoprotective enzymes either at mRNA or protein level.

***Key words*:** Exopolysaccharide, glucose mineral salt medium, jute culture, fucose, antioxidant, anti-cancer, and cell signaling.