The physicochemical analysis of agricultural soil and treated tannery effluent used for irrigation revealed high BOD, COD, sulfate, sulfide and chloride concentrations in the test samples. The levels of Cr, Ni, Zn, Cd and Cu were found high in soil and tannery effluents samples. The tannery effluents and soil samples were found contaminated with different organic compounds particularly phthalate compounds like 1,2-Benzenedicarboxylic acid, diisooctyl ester (diisooctyl phthalate), bis (2-methoxyethyl) phthalate, hexatriacontane, dibutyle phthalate, 2,4-bis 1,1-dimethyl phenol, bis(2-ethylhexyl)phthalate, 10-methylnonadecane etc.

The bacteria isolated from soil and tannery effluents were tested for resistance against certain heavy metal ions i.e., Cr$^{6+}$, Cr$^{3+}$, Ni$^{2+}$, Cd$^{2+}$, Zn$^{2+}$, Cu$^{2+}$ and Hg$^{2+}$ and several commonly used antibiotics. The present study indicated that despite the toxic metal stresses, the bacterial isolates have evolved resistance to deal with metal toxicity. It is evident from the present study that the bacterial population in the test system responded to the long-term application of tannery effluents/wastewater by an increase in resistance to multiple heavy metals and maintained physiological traits that could benefit microbial maintenance and survival in contaminated environments. Correlation between metal and antibiotic resistance is evident in some strains. However, in most of the strains there is lack of co-resistance.

The results presented in this study demonstrate that there is a link between chromate resistance and its reduction to less toxic trivalent form by bacteria. The chromate-resistant isolates (Exiguobacterium sp. ZM-2, Stenotrophomonas maltophilia ZA-6 and Staphylococcus gallinarum W-61 and Bacillus sp. W-70) described here were efficient chromate reducers, whereas chromate-sensitive isolates (Pantoea sp. KS-2 and Aeromonas sp. KS-14) were poor in chromate reduction activity. The constraints presented by chromate toxicity can be mitigated, if not avoided entirely, by using resistant bacteria. Therefore, the chromate resistant isolates mentioned above could be exploited for remediation of wastewaters contaminated with hexavalent chromium.

The biosorption and bioaccumulation studies on chromium clearly suggested that the selected bacteria were efficient in removing this metal from aqueous solution. A fair amount of adsorbed chromium ions were recovered through desorption process. Based on these findings, the selected isolates could be used for the removal of chromium from the spent industrial effluents before discharging it into the environment, and the biosorbent can be reused again and again for the removal of metal ions.
The present study confirmed that the tannery effluent contains certain compounds having mutagenic and genotoxic activity. The extraction procedure is an indispensable stage in the evaluation of mutagenicity of such effluents using Ames *Salmonella* test or other *in vitro* assays. TA98 proves to be the most sensitive in terms of mutagenic index in detecting mutagens in extracts followed by TA97. In other words, tannery wastewaters predominantly contained frame-shift mutagens. The findings of the present investigation point out that the treatment carried out for tannery effluent is not as efficient as it should be in removing hazardous organic contaminants from spent tannery water. Thus, better processes and methods must be adopted for the treatment of complex effluents originating from tanneries. In the light of the findings, it is suggested that tannery effluents should be used cautiously for irrigation of agricultural lands.