The increased urbanization and industrialization has led to the discharge of untreated wastes into environment. Textile industries are playing havoc with the natural aquatic ecosystems. Textile wastewater comprising recalcitrant azo dyes contaminate the freshwater because of their coloring potential and formation of toxic, mutagenic, and carcinogenic aromatic amines. Textile dyes are aromatic compounds, very resistant to degradation. Bioremediation is one of the cost-effective and eco-friendly achievements of biotechnological novelty that may be used to manage industrial effluents. In the present study, *Klebsiella pneumoniae* GM-04, isolated from industrial wastewater, has been used for the decolorization of disperse blue 284 (DB-284) dye. Bacterial isolate was characterized on molecular basis using 16SrRNA gene. For this, 16S rRNA gene was amplified and sequenced by using 936F and 1392R universal primers. Under optimum conditions, *K. pneumoniae* decolorized 95% of DB-284 at 200 ppm concentration within 24 hrs. An increase in temperature and dye concentration resulted in a decrease of decolorization effiency of bacterial isolate. Dye degradation into different metabolites was confirmed by UV-Vis and FTIR analysis. Azoreductase is the bacterial enzyme mainly involved in the bioremediation of textile azo dyes. The azoreductase (*AzK*) gene of locally isolated *K. pneumoniae* was amplified using gene-specific primers. The amplified gene was cloned into pTz57R/T cloning vector. The *AzK* gene sequence was submitted to NCBI under accession number MT758472. The gene was subcloned into expression vector pET21a and transformed into *E.coli* BL21C^{+}. *AzK* gene expression was confirmed though SDS-PAGE. An ovexpressed protein band of ≈22kDa was observed in protein profile of transformed bacteria with 0.5 mM IPTG. The protein expression and decolorization was optimized by using Response Surface Methodology (RSM). The optimum expression was abtained with 1.5% inoculum in the presence of 0.5mM IPTG for 6 hrs. The AzK enzyme was purified from the crude extract of *E.coli* BL21C^{+} by ammonium sulfate precipitation and size exclusion chromatography. The heterologous azoreductase was used for effective degradation of DB-284, Remazol Red R (RRR) and Acid Blue 29 (AB-29) textile dyes. The crude extract showed 60%, 48% and 43 % decolorization of DB-284, RRR and AB-29 while it was 98%, 96% and 93% with purified enzyme, respectively. For enzyme activity of azoreductase, variable concentrations of RRR textile dye were usedin the presence of 7 gm/ml NADH. The K_m and V_{max} value of azoreductase enzyme were 0.058 and 1416 for RRR textile dye, respectively. HPLC and GC-MS analysis showed that RRR was effectively degraded by azoreductase into 2-[3-(hydroxy-amino) benzene-1-sulfonyl, while AB-29 was degraded to aniline and 3-nitrosoaniline.The microalgae *Chlamydomonas mexicana* GU732420 and activated sludge (ACS) were also used for the decolorization and degradation of textile dyes. Microalgae showed 62%, 31%, and 26% decolorization of Red HE8B, while 39%, 38%, and 23% decolorization of RG-27 and 64%, 51% and 28% decolorization of AB-29 at 5, 25, and 50ppm concentration respectively. Whereas ACS showed 52%, 43%, and 27% decolorization of Red HE8B; 39%, 38%, and 23% for RG-27, while 54%, 29%, and 27% decolorization of AB-29 at 5, 25, and 50 ppm concentrations, respectively. The consortium of *C. mexicana* and ACS showed 75%, 56%, and 49% of Red HE8B; 79%, 49%, and 27% of RG-27 and 75%, 63%, and 34% decolorization of AB-29 at 5, 25, and 50ppm concentrations, respectively.

The above results show the biodegradation potential of *K. pneumoniae* azoreductase, microalgae and ACS for different textile dyes. This is an ecofriendly and sustainable approach for the removal of textile dyes from industrial wastewater. The ACS and microalgae may be further used for the production of biofuels.