ABSTRACT

Wastewater released from hospitals, research laboratories and industries without treatment may contain a variety of hazardous chemicals which pose a long-term risk to human health or environment. There is an increasing threat to human health from exposure to new forms of invisible, more systemic pollutants and chemicals present in the effluent released by health care establishments. Their specific effects such as carcinogenic, mutagenic and teratogenic, endocrine disrupting or neuro-toxicity are not yet studied in adequate way through assessment methods.

Our study is an attempt to provide an initial assessment of gentoxicity of raw (untreated) effluents released by the hospitals and diagnostic laboratories and to evaluate the efficacy of wastewater treatment plants (WWTP) of two hospitals. In the present study, combination of three tests were used, one for bacterial gene mutation (Ames test), second for DNA breakage (SOS Chromotest) and third for chromosomal aberrations in mammalian bone marrow cells.

The data obtained from physico - chemical quality analysis as well as genotoxicity estimation of health centers wastewater samples in the present study reported that untreated wastewater from GH, DL-I and DL-II laboratories are releasing (without any treatment plant) into the city sewerage system are hazardous enough. The treated influents collected from PH-I and PH-II are less toxic as compared to filtrate and untreated effluents. Thus, as per present findings health centers wastewaters are unacceptable for disposing directly into environment in terms of inadequate compliance with physico - chemical standards.

The Salmonella Ames assay being the standardized and most common method of genotoxicity evaluation was performed with collected samples from all five health centers. In this assay, Salmonella typhimurium viz strains TA 98, TA 100 and TA 102 were used to determining frame - shift mutagens and base - pair substitution mutagens, respectively in health centers wastewater. A comparison between untreated and treated effluent from PH-I and PH-II hospitals were representing statistically significant difference (p<0.05) at each concentrations for three strains with and without of S9 mix which further indicates that there was a
significant difference existing in terms of number of revertants colonies produced with the samples before and after treatment.

In SOS-Chromotest test, employing a genetically engineered *E. coli* PQ37 bacterium strain, without metabolic activation which was able to detect genotoxic material that causes damage to DNA of the cell. Based on the Induction Factor obtained, untreated sample of GH, PH-I and II value >1.5 were showing significant SOS inducing activity with high genotoxicity while the Induction factor obtained from filtrate, treated effluents and diagnostic laboratories samples exhibited no significant effect on *E. coli*. The maximum IF of untreated effluents of GH was 11.8 to 2.7 and PH-I and II was 8.5 to 4.6. Turning towards lower concentrations, these samples produced lesser induction factors depending on the dilution of the sample. Thus, according to this assay, the untreated wastewater samples of GH, PH-I and II hospitals were significantly and strong genotoxic at higher concentration.

Chromosome Aberration was used to evaluate the extent of DNA damage in peripheral blood lymphocytes of Swiss albino mice. The animals of negative control group were given distilled water. The animals of positive group were treated with Cyclophosphamide. Maximum structural chromosome aberrations have been observed after exposure of untreated wastewater of GH, PH-I and II at the duration of 48 hours and 72 hours. A significant increase (P ≤ 0.01) in the chromosomal aberration in untreated sample of GH, PH-I and PH-II were observed as compared to control animals indicating mutagenic behavior of health centers wastewater. While the filtrate, treated and diagnostic laboratories effluent did not cause any significant changes in chromosomes. The result of present study revealed that health centers wastewater is both mutagenic and cytogenetic.

The findings of present study it is suggested that all the Health centers; hospitals and diagnostics laboratories should released their wastewater effluents after proper treatment, so the contamination of environment may be avoided.

**Keywords:** Health care establishments, *Salmonella* strains, WWTP, Ames test, SOS-Chromotest, Chromosome aberration, Mutagenicity, Genotoxicity