Medical Science is advancing rapidly with ever increasing momentum providing best facilities to patients, but the waste generating from health care establishments has become a critical issue for the environmental protection and public safety, due to its infectious and hazardous character. Irregular disposal of health centers wastewater directly into the city sewerage system without pre-treatment, contaminate the surface and underground water table which may cause serious epidemic diseases like cholera, typhoid and enteric illness in the population.

Waste water discharged from health care establishments needs an urgent attention, because it is a complex matrix containing different types of toxins, which can pose serious threat to the human life, if directly dispensed into the environment. Health centers wastewater contains various genotoxic potent toxins, suspended solids, biodegradable organics, hazardous pollutants, anti neoplasm agents, anesthetic gases and other cytotoxic agents which can cause crucial damage to the natural environment.

This study is amongst the few initial studies in India attempting to measure and compare the genotoxicity and cytogenetic potential of untreated, filtrate and treated wastewater of health centers. It is probably the first study conducted to compare the efficacy of two onsite Hospital wastewater treatment plants with special reference to genotoxins. In the present research, a battery of short-term microbial assays for screening the possible genotoxicity of effluent released by health centers has been used.

In present study, an imperative assessment of physico - chemical characterization of health centers wastewater has been done as soon as the samples were procured from the collection sites. To our knowledge there are no standard values for physico - chemical parameters specified by any pollution control board or environmental agencies in India. The effluent of health centers that are directly discharged into public sewers or in environmental water bodies. Therefore, the results of these parameters were compared with General Indian Standards for discharge of Environmental Pollutants IS: 10500 (1986).
pH is the important biological parameter used to study the hydrogen ion activity for the measurement of acidity and alkalinity of aquatic ecosystem. Increase or decrease of pH value in wastewater may cause corrosion and damage of WTP. The pH values observed for different health centers wastewater were found to lie within standard limits (5.5-9.0). Other studies conducted previously (Ekhaise and Omavwoya, 2008; Abd El-Gawad and Aly, 2011; Mesdaghinai et al., 2009; Tahri et al., 2012; Ibeh and Omuruyi, 2011; Aziz et al., 2014) have also reported that pH of health centers wastewater is within acceptable pH limits and suitable for treatment in municipal waste water treatment plant. However, in the present study untreated sample collected from GH, PH-I and II in the month of May, August and November, 2012 have shown higher values as compared to filtrate and treated effluents of hospitals, while the values of effluents of diagnostic laboratories wastewater were observed under the standard permissible range. High alkaline pH observed in these samples may be due to treatment of effluents with disinfectants.

Temperature of water plays a vital role in the solubility of salts, metabolic activities and growth of microorganisms living in aquatic environment. The result obtained in the present study shows that the temperature fluctuated between in the month of May, August and November 2012 respectively are 43ºC to 56ºC, 31ºC to 34ºC and 26ºC to 31ºC of the health centers wastewater (Tables 5-10; Fig. 17). May be due to seasonal change. In winters, it might be due to the increase in the viscosity range led to decrease in the effectual rate of the settlement of solids particles present in wastewater. As the resistance develops led to increase in the viscosity rate which enhance the downward movement of solids particles. While in summer, it may be attributed as elevation in the temperature due to increase in the rate of evaporation and carbonate concentration of water. Thus, temperature values were found within acceptable limits and were in accordance with earlier studies (Ibeh and Omuruyi, 2011; Wyasu and Okereke, 2012; Gautam et al., 2007; Tahri et al., 2012; Sarafraz et al., 2007; Jayalakshmi et al., 2011).

With the increase of temperature, the rate of biochemical reaction and biological degradable activity of microorganisms increases 2-3 times. Temperature also showed a diverse relation with the consumption of dissolved oxygen in water.
As Metcalf and Eddy, 2003 suggested as continuous oxygen supply is required during the treatment of effluent in aerobic method of conventional system. Therefore, the data obtained in dissolved oxygen were found to be acceptable in accordance with earlier studies (Sarafraz et al., 2007; Metcalf and Eddy, 2003; Hunachew and Getachew, 2011).

Other studies conducted by Ekaise and Omavwoyo (2008) on hospital waste water reported lower value of dissolved oxygen (2.40-5.60), causes increase in the growth and proliferation of bacterial population which leads to the increase in the consumption of available oxygen.

The untreated wastewater of GH, PH-I and II have showed higher values of BOD$_3$ and COD which are unacceptable as compared to permissible range (Tables 11-16; Fig.20, 22 ). They would adversely affect the life of the microorganisms if it is directly discharged in the environment. The organic matter present in wastewater consists of oxidizable matters which require proper oxygen for their appropriate decomposition. High organic load causes increases in the growth of microorganisms which directly effects the utilization of BOD$_3$ and CODs reported by Shukla et al. (1980). Therefore, the study of BOD$_3$ and COD are very essential for evaluating the amount of organic content required for the biodegradability of sewage. High values of BOD$_3$ and COD obtained in the present study are reinforced by earlier studies (Emmanuel et al., 2002; Ibeh and Omoruyi, 2011; Tchobanoglous et al., 2004).

Variation of COD values from 115.2 mg/L to 61.75 mg/L and BOD$_3$ from 40 mg/L to 188 mg/L respectively was reported by Tahri et al. (2012). Similar study conducted by Clean Technology Consultant (1994) observed the BOD$_5$ and COD values in health center waste were 113mg/L and 232mg/L respectively.

As per the literature available there have been no specific standards available for Hardness, TS, TSS and TDS parameter in General Indian Standards for discharge of environmental pollutants IS: 10500 (1986).

In present study, TDS values for health centers effluent for untreated and treated (with the exception of TDS obtained for Diagnostic laboratories samples)
Discussion

were found slightly higher than WHO standard limits of 1ppt or 1000 mg/L (Tables 5-10; Fig.23). However, studies performed by Ojo and Adeniyi (2012) and Ekhaise and Omavwoya (2008) reported lower TDS values (327.6-552.4 mg/L and 36-147 mg/L respectively), which may be due to release of strong organic compounds in health centers wastewater.

Study conducted by Gautam et al. (2007) and Chitins et al. (2004) on hospital wastewater treatment plant reported highly reduced in chlorine residual values after the complete treatment. In present study, observed chlorine residual value in untreated health centers wastewater was higher than the filtrate and treated effluents (Tables 5-10; Fig.25). Emmanuel et al. (2004) reported that addition of 5% of sodium hypo-chlorinate in chlorination process in health centers wastewater treatment plant enhance the toxicity which has been studied in Daphnia magna and Vibrio fischeri (bioluminescent marine bacterium). Higher values of chlorine residual in untreated wastewater was reported in some studies (Adelowo et al., 2008; Schwartz et al., 2003; Amovei et al., 2012) which might be due to the potent organic chemicals present in health centers wastewater.

TSS value observed in untreated effluent of health center wastewater of PH-I was 411±2.5, after filtration and complete treatment it was reduced to 22.4±5.0 and 157±8.24 (Tables 5-10, Fig.24). These results are in agreement with other studies conducted by some authors Mahmond et al., 2012, Amovei et al., 2012 and Sarafraz et al., 2007;Wangsatmaja,1997; Moerisidik, 1993; on hospital wastewater treatment plant observed influents max-min value (218mg/L-740mg/L) and effluent value (15.8mg/L - 19.6 mg/L) are relevant with available standard. This might be due to an inorganic pollution that opposes the bacterial contamination of germs.

Total dissolved solids and total solids values obtained in the effluent of untreated wastewater were significantly higher than the standard range (Fig.27). It may bedue to the influence of the degradative activity of the microflora. The study conducted by Alessio et al., 2010 on hospital effluents recorded min - max value 66-300 mg/L which were acceptable as per the literature available in health centers wastewater.
The result obtained in physico-chemical characterization of diagnostic laboratories effluent were not found in high range except BOD₃ and COD; it might be due to the high organic pollutants causes increase in the growth of bacterial population which directly increase the utilization of BOD₃ and COD. Thus, diagnostic laboratories are also releasing significant amount of toxins in the environment.

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 results of present study on physico-chemical analysis are supported by some more previous studies (Mahvi et al., 2009; Abd El-Gawad and Aly, 2011, Mahmoud et al., 2012, Amovei et al., 2011 and Sarafraz et al., 2007) carried out in countries other than India. However, for different health centers different values were observed for each parameter. To our knowledge there are only two studies published regarding the physico-chemical parameters of health care establishment’s wastewaters in India till now (Vijay et al., 2014a and Gautam et al., 2007).

Present study has been an attempt to characterize physico-chemical parameters of effluents discharged from Indian health centers. Although this is a regional study representing only a part of India but the results of this study provoke a concern over the indiscriminate discharge of health centers waste water nationally and globally too.

Subsequently, the data obtained in three short term microbial bioassays namely Ames assay, SOS-Chromotest and Chromosome aberration assay revealed the findings that untreated wastewaters from studied health centers were highly genotoxic and cytogenetic. The results of these bioassays have been found to be more or less similar during in all sampling periods in terms of genotoxic response.

The results obtained with the Ames assay indicated that GH is discharging their wastewater with strongly and significant mutagenic potentials into city sewerage system without primary treatment. The result obtained showing significant mutagenic activity during the year 2012 with each strain (TA 98, TA 100 and TA
102) of *S. typhimurium* (Fig.27-35). Further, the addition of S9 mix enhanced the mutagenic potential of all untreated samples (Tables 11-16) (Fig.36 - 50).

Increase in the strength of number of revertants was generally measured after the addition of S9 hepatic fraction in all cases (either with treated samples or with untreated samples), indicating the actively binding of protein metabolites with liver detoxifying enzymes. These detoxifying enzymes help in the conversion of premutagen into actively protein metabolites which are mutagenic in nature (Mathur *et al*., 2005). It is difficult to illustrate about what type of effluents are discharged from these health centers. Many parameters are responsible which are impacting the genotoxicity of wastewater such as toxic constituents present in wastewater, composition of health center, type of medicine used, climatic conditions, ecological system etc. There is generally less number of studies available in literature regarding health centers wastewater.

Findings of present research work are comparable with earlier studies (Hartman *et al*., 1999; Jolibois *et al*., 2003; Jolibois and Guerbet 2005(a-c); Gupta *et al*., 2009 Sharma *et al*., 2013, Atasoy *et al*., 2012; Vijay *et al*., 2014b), which revealed that health centers wastewater possessed significant mutagenic activity. Hartman *et al*. (1999) reported out of twenty-five only two samples (8%) of hospital wastewater showed positively mutagenic in their study. 55% and 68% of tested hospital wastewater samples were found highly genotoxic by Jolibois *et al*. (2003). Jolibois and Guerbet (2005a-c) and Gupta *et al*. (2009) witnessed that untreated hospital wastewater effluents were significantly mutagenic and their results are in concomitant with results of our study.

In contrast, Ferk *et al*. (2009) detected no mutagenicity in any experiment when applied the Ames test with strains TA 98, TA 100 and TA 1535 while studying the gentoxicity of wastewater samples from an oncology ward of general hospital in Vienna (Austria). However, increase in the number of induced revertants were observed by them after adding hepatic S9 fraction.
Data obtained from the untreated (raw) effluents released by GH, PH-I and II and DL-I and II showed significantly mutagenic activity while moderate mutagenicity observed in filtrate, treated and DL-I & II effluents with S9 metabolic activation. The studies conducted by Jolibois and Guerbet (2005a-c) and Gupta et al. (2009) were in accordance who reported that the treatment plants were able to reduce the mutagenicity of effluents in comparison to untreated (raw) effluents.

Treated hospital wastewater in PH-II shows slightly genotoxic activity with TA 98 strain in *Salmonella* test with and without metabolic activation (Tables 11-16; Fig 27-35). The mutagenic activity obtained in effluent treatment plants could be due to the presence of chlorinated by-products, bactericides used in the health centers for cleaning, sterilization and disinfection purposes. Mutagenic activity have been observed by IPCS (2000) in health centers wastewater was due to presence of sodium hypo chlorinate (NaOCl) both in prokaryotic and eukaryotic cells *in vitro*. Emmanuel et al. (2004) reported that addition of 5% sodium hypo-chlorinate in chlorination process of health centers wastewater treatment plant enhances the toxicity which has been studied in *Daphnia magna* and *Vibrio fischeri* (bioluminescent marine bacterium).

Sodium and calcium hypo-chlorinate are the most commonly used chemicals in health centers, pharmaceutical industries, and research centers for sterilization purpose. Small quantity of NaOCl is required for inhibiting the growth of microorganisms in wastewater. NaOCl has a basic property like, as soon as it is dissolved in water, it starts reacting immediately with biological substances such as nucleus contents, proteins and amino acids. Therefore, due to highly reactive property it requires very small quantity to get mixed up with other effluents. It was used in dilution form with water (USEPA, 1989). There are some compounds which have been regularly detected in health centers wastewater and are hydrophobic, persistent, and toxin in nature and are released directly into the environmental water bodies.

Different disinfectants like FeCl₃, Calcium hypo-chlorinate can react with native compounds such as flavenols and organic acids which are generally exist in
water to produce a large number of reactive compounds having mutagenic and carcinogenic activity which have been studied by many workers (Daniel et al., 1993 & 1994; Glaze et al., 1993; De Marini et al., 1995; Saliona - Salonen, 1991). Thus, this toxicity can further be intensified when different disinfection by-products react with such organic acids in surface waters indicating the extent of harmfulness caused due to untreated hospital wastewater discharges.

Several compounds are present in a health centers wastewater. Hartmann et al. (1998) detected in wastewater of German health centers, ciprofloxacin a natural compound responsible for assessing the genotoxicity. Ciprofloxacin, cetirizine are the antibiotic, antihistamine drug mostly found in hospitals waste water when tested. Both drugs are measured below a human dose but the results are still alarming.

Moreover, it is evident by t-test analysis (Table.17-22) that untreated wastewater possesses higher level of genotoxicity from lower to higher concentrations indicating assessment of several medicinal, surgical, research, and diagnostic activities occurring among the health centers. Statistical significant p-value of GH vs. PH-I (Treated), GH vs. PH-II(Treated), (Untreated) PH-I vs. (Untreated) DL-I and (Untreated) GH vs. (Untreated) DL-II were 0.004, 0.018, 0.001 and 0.037 are less than 0.05 indicating significant difference with TA 102 strain without S9. Therefore, the study revealed that GH discharging strong genotoxic wastewater into city sewerage system while treated effluents of PH-I and II and DL-I and II are releasing slightly less genotoxic effluents in public sewer. Significant difference exists between samples PH-I and II before and after treatment in conjunction with concentration response curves and mutagenicity ratio declination which shows that genotoxicity was partially reduced after the filtration process and extremely removed after complete treatment process.

An important contemplation that should be taken into consideration while testing TA 98, TA 100 and TA 102 strains is relative sensitivity of a particular strain in detecting mutagenicity in a particular sample. Strain TA 98 and TA 100 differ greatly in their mutagenicity responses to a number of organic pollutants present in wastewaters. This work has identified the genetic background of TA 102 as better
choice than that of TA98 and TA 100 for carrying out the mutagenicity studies in health centers wastewater. In other words, it can be predicted that the mutagen more likely to be present in health centers wastewater are responsible for base-shifts and transverse mutation.

Thus, the Hospital WTPs treated effluents were effective in reducing the genotoxicity observed by TA 98 - S9. Potency of these effluents was observed in TA100 +S9 and TA102 +S9. The addition of metabolic activation (S9) with strains TA 98, TA 100 and TA 102 in health centers effluents led to increase in the strength of revertants to induced mutagenicity in both untreated and treated effluents. Potency of these strains has been explained by some workers (Sakamoto and Hayatsu, 1990; Doerger et al., 1992). The concentration response curve (Fig. 27-35) obtained in Ames assay with each strain showed a significant reduction in the number of mutant colonies in the treated effluent of PH-I and II hospital, emphasizing the importance of wastewater treatment plants. Similar, findings reported by Jolibois and Guerbet, (2005 a & b) and Gupta et al. (2009) also proved that the WTP in hospitals have effectively reduced the genotoxicity. According to the present findings, the WTP which is functional in both the Hospitals (PH-I and II) are efficient and able to remove genotoxic substances which are responsible for causing the mutagenicity from the effluent generated by the hospital.

The results of SOS chromotest in the present study revealed that the untreated health centers wastewater samples from government hospital, private hospital-I and II were highly genotoxic only at higher concentrations; 60µg/ml, 30µg/ml and 15µg/ml (Tables 17-22). At lower concentrations (1.87 µg/ml and 0.93 µg/ml), the results for this assay revealed negligible genotoxicity. Abdel-Massih et al. (2013) who witnessed 50% of the health centers wastewater was having positive genotoxicity with SOS Chromotest. Similar study conducted by Jolibois and Guerbet (2005a) who observed genotoxicity in 45% samples of hospital wastewater using SOS chromotest. Previously, Steger-Hartmann et al. (1997) and Hartman et al. (1999) have found similar results with the umu C assay observed 50% genotoxicity in Health centers wastewater, respectively.
A value of IF less than 1.5 was reported in filtrate and treated samples of PH-I and II and effluent of diagnostic laboratories effluent at higher concentrations. The maximum IF of untreated effluents of GH, PH-I and PH-II were 8.56 to 3.26, respectively. Results of present study indicate toxicity of untreated waste water was strongly genotoxic with \textit{E. coli} PQ37 strain at higher concentration; as the concentration decreased the reported IF was less than 1.5. It might be due to the inhibition of bacterial growth in the suspension, resulting in very low absorbance and low IF, in turn.

Treatment of wastewater effluents in PH-I and II greatly reduced the genotoxicity in terms of very low values of IF (Fig. 51-53). For untreated samples, IF was recorded between 9 to 8 whereas filtrate and treated samples produced IF below 1.5 at higher concentration showing negligible genotoxicity after treatment. This suggests the effectiveness of PH-I and II WTPs in combating the genotoxicity to a level that can be safe to discharge into municipal sewer.

Chromosome Aberration was used to evaluate the extent of DNA damage in peripheral blood lymphocytes of Swiss albino mice. 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 (Tables.29-30). While the filtrate, treated and diagnostic laboratories effluent did not cause any significant change in chromosomes (Fig. 58). The findings of present study revealed that health centers wastewater is both mutagenic and cytogeneic. Occurrence of chromosome aberration indicated the distortion of microtubule, kinetochore and formation of several macromolecules attached with centromere. Lagging of chromosomes is caused by the dysfunctioning of the mitotic apparatus. It might be due to the aneugenic activity of wastewater. These results are in agreement with study conducted by Alabi and Shokunbi (2011), who performed several bioassays like sperm count, sperm morphology, and micronucleus assay on Swiss albino mice by feeding hospital wastewater at different concentrations. The study revealed out that the hospital wastewater possess a
significant effect on mice at cellular level, causing chromosome aberration, micronucleus and effecting sperm morphology at different concentration. It was only a single study conducted on eukaryotic organism for evaluating the genotoxicological evaluation of hospital wastewater.

Feasible mechanism behind the induction of chromosome aberration requires the formation of free radicals via autooxidation or by oxidation of catalytic enzyme of strong organic compounds present in wastewater. These free radicals potentially react with lipids which cause lipid peroxidation of tissues present in cell membrane leading to breakage of DNA chains, nucleic acids resulting base substitution and eventually induce mutation. Other tenable mechanism may be that the wastewater absorbed by the cells of mice, causes change in the pH of the cell both endogenously and exogenously resulting into inhibiting the activity of enzymes and DNA structure.

Thus, the inference drawn from the results of bioassays is that an untreated wastewater of health centers contains potential health risks if it is discharged directly into the city sewerage system without any preliminary treatment. Although, the degree of genotoxicity may differ amongst health centers activity. Results of bioassays also established efficient working of WWTP installed in PH-I and II in terms of removal of genotoxicity. Proper treatment of health centers wastewater should be performed before their safe disposal at municipal sewerage system or in the aquatic environment. This study, further, infers that all bioassays performed are although not comparable in terms of their capability to prove an environmental contaminant such as health centers effluents as genotoxic but they can complement each other to form a battery of short-term bioassays which would surely be helpful in evaluating probable mutagenicity and genotoxicity of waste effluents.

The simultaneous use of the Salmonella Ames assay and SOS chromotest allowed carrying out an initial screening of complex mixtures like health centers wastewater for present work. These genotoxicity assays have shown sensitivity with different strains like TA 100 (base pair substitution mutation), TA 98 (frame shift mutations), TA 102 (transversion reversion), and genetically engineered E. coli (primary DNA damage in SOS chromotest).
In this study, the influence of pluviometry was not evident, as in Rajasthan, India, rainy season starts usually from 3\textsuperscript{rd} or 4\textsuperscript{th} week of July and samples for this study were collected in 1\textsuperscript{st} week of August. Secondly, rain water should not mixed with the effluents of health centers at significant volumes as the sewer chambers were usually covered in the health care establishments. Due to this reason, little or no seasonal fluctuation was observed throughout all sampling periods. Difference observed in the intensity of genotoxicity during various seasons as in summer, elevation in the temperature led to increase in the rate of evaporation and carbonate concentration of water.

Hence, the data observed in present research shows that the process such as filtration, aeration, activated carbon filter and chlorination used in the WTPs of hospital were helpful in removing the toxicity of wastewater.

Alabi and Shokunbi (2011) reported lethal effects of several hazardous contaminants present in health centers wastewater which may perilous to natural flora, fauna and human beings.

Effectualness of both the WTPs was studied in systematic order, on raw and treated effluents. Similar study performed by other workers in different health care establishments also showed similar results in complete removal of genotoxic compounds from raw wastewater. These results confirm that, due to the presence of perilous micropollutant in health centers waste water need to establish advanced and efficient on-site treatment plant for the treatment of health centers effluents is necessary for reducing the risk to the environment and human health may cause perilous effects liberating from toxic substances. It may suggest that treated water can be used for gardening, cleaning and sanitary washing purposes. In future, studies can done to evaluate which compounds are responsible for assessing the genotoxicity

These bioassays develop a preliminary configuration to assess the genotoxicity of health care establishments. The data obtained from physico - chemical quality assessment as well as genotoxicity evaluation of health center wastewater in present study indicates that the effluents released by GH, DL-I and II health centers are directly discharging their wastewater into the urban and municipal sewerage system.
These effluents not only contaminate the surface water but also percolates in the ground water. Contamination of these effluents causes it unfit for agricultural and drinking purpose.

Fastidious information is required to establish on urgent basis in health centers which lack proper WWTP to study the mutagenic characteristics of wastewater. Dilution of contaminated wastewater may be convenient way for removing the potency of poisonous substances present in wastewater until effectual monitoring and examination of these effluents were done (Abdel-Massih et al., 2013). In other words, assessment of the risk due to health center waste water could be based upon dilution. For example, in developing countries, large number of health centers wastewater are directly disposed off into the municipal sewerage systems which could be a source of greater risk to natural environment. The risk of health center effluents may become least after dilution process. In our nation, health care establishments have general practise of disposing their effluents directly into urban sewage and municipal system. This leads to develop a greater load on municipal treatment plant. Therefore, the dilution factor is not much effective.

Thus, to reduce genotoxicity, proper management and efficient treatment of HCWW should be done by following the guidelines and effective action administered by environmental agencies for the indiscriminate release of health centers wastewater directly into city sewerage. Health centers wastes are the source of causing severe health problems and environmental imbalance. Unsystematic release of untreated health centers wastewater not only create ecological imbalance but its effects are uncertain and perilous for mankind.

The efficiency of Waste Water Treatment Plants (WWTPs) which is helpful in the removal of poisonous substances from wastewater is based on various factors including the population served, precipitation loads, climatic conditions, geographical factors and nutrients. Chemical nature of particular substances delivered in sewage to WWTP may influence the treatment process. For instance, antibacterial, antibiotics and antitumor agents which are highly toxic in nature for the microbes present in
health center sewage not only reduce the efficiency of WWTP for their own removal, but can also hinder the removal of other substances (Daniel et al., 2006).

With the advancement in the medical facilities, there is continuous increase in the load of pollutants in the effluents of health centers. Municipal and Health centers wastes should not be treated together in any circumstances. There is an urgent need to formulate the policy of disposal and treatment of health center wastewater. Hospitals and diagnostic laboratories regularly use disinfectants to reduce the microbiological load. However, these germicides when mixed with city sewerage system may create adverse effects on the beneficial microbial population of municipal WWTP and also on the efficacy of its biological system. To maintain the efficiency of city WWTP either the mixing of the effluent from health care centers should be avoided or city sewage system should accept properly treated health care centers effluent. Therefore, it seems important to consider the effectiveness of treatment plant established in the health centers which can remove the genotoxicity of effluents before releasing into the municipal sewerage system (Emmanuel et al., 2001).

Indiscriminate dispensed of health centers wastewater is continuously posing risk to human life and environment. Therefore, tenacious efforts must be undertaken by health centers administration in terms to integrate the awareness towards the control measurement on wastewater by enhancing environment protection programs.

There is intense requirement in health centers for the imperative assessment towards the critical discharge of the wastewater directly into the environment both in developing and under-developing countries. In view of the above mentioned features, it is clear that health centers wastewater is consist of a complex matrix which requires effectual treatment before discharging into the environment. Following are the perspective points to treat the health centers wastewater.

1. On-site establishment of wastewater treatment plant in health centers,
2. Chlorination of treated health center wastewater before discharging directly into the environment,
3. Health center and Municipal waste should be treated separately
A cost effective and sustainable method with properly constructed, designed hospital effluent treatment plant which is well maintained by trained workers can help to reduce the toxicity of pollutants emerging from health centers wastewater can offer benefit to public health and environment protection.

Generally, these pollutants may be studied by using two resembles: a chemical-specific and a toxicity-based resembles. Chemical analyses are diagnosed and their results are estimated through their threshold values. While toxicity is directly measured by employing biological assays. Health centers wastewater consisting of several unknown potent substances. The determination of toxicity of these substances by chemical analysis does not provide appropriate and relevant information of their potential. Therefore, for assessing the potency of genotoxic compounds through toxicity (Ames test, SOS chromotest and chromosome aberration) is the best method. The advantage of employing toxicity bioassays is due to their amalgamative character. They are helpful in providing important information of these contaminants; their interrogative effects of contaminants, which are not studied by chemical methods.

Toxicity is a useful tool for studying the environmental contaminants. Generally, animal assays are used to assess their toxicity but these tests are costly, time consuming and require large amount of samples. Because of all these drawbacks, present study consisting of fast, less time consuming and cost effective bacterial tests for screening and assessment. A bacterial test does not needs any information of toxic compounds. Further, they can be easily performed at any well equipped microbiological laboratory.

Thus, the present researches signify the consequent use of short term microbial bioassays which are being a complement to other conventional toxicological bioassays for establishing priorities of pollution control. Battery of short term microbial bioassays consisting Ames Salmonella mutagenicity assay to assess mutagenicity, SOS - chromotest to estimate genotoxicity and chromosome aberration as the eukaryotic cytogenotoxic are suggested for evaluating the possible toxicity posed by untreated, filtrate or treated waste water from WTP of hospitals and different health centers before discharging into open dumps or municipal sewerage system.