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Research Article

Analysis of DNA Damage Levels In *Oreochromis mossambicus* (Peters, 1852) Exposed to a Tirupur Textile Dye Effluent

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Abstract

The expedited advent of human population, urbanization and industrialization for economical growth has adversely affected the biological diversity, which is one of the major concerns of the developing countries. In Tirupur, 729 textile dyeing units were located and these units generated 96.1 MLD of wastewater. The untreated effluent was discharged into the Noyyal River which causes the toxic effect into water and fish. Heavy metals cause DNA damage in *Oreochromis mossambicus* living in untreated effluent. Fish were exposed to untreated effluent for 1st day, 15th day, 25th day and 50th day. The interaction of a xenobiotic with DNA can damage the chromosomes, single- or double-stranded breaks, form DNA adducts, or interfere with the mechanisms involved in repairing these damages. Some of those substances are called eugenics because they cause changes in the distribution of chromosomes during cell division, leading to numerous chromosomal changes. In 50th day DNA damage was maximum amount. Senescence protein Stress protein p21, p16 were increased in untreated 50th day. When fish were introduced in Bio remediated effluent in 1st day, 15th day, 25th day and 50th day the DNA damage was significantly reduced. Fish present several advantages in ecotoxicological studies because they comprise the most diverse group of vertebrates and have a high ecological relevance when exposed to toxic substances. Moreover, fish may present similar results to other vertebrates, humans included.

Keywords: Textile dye effluents, *Oreochromis mossambicus*, DNA damage, Stress protein.

INTRODUCTION

Number of chemicals with genotoxic potential is emitted to Noyyal river water through municipal and industrial waste water effluents, genotoxicity tests are gaining importance. Contamination of aquatic resources is one of the most worrying subjects of humankind. Domestic and industrial effluents are mainly responsible for the contamination of aquatic system [1,2]. Fish have served as bio-indicators of environmental pollution and played

significant roles in assessing potential risk associated with contamination in aquatic environment [3]. The use of fish as bio indicators for assessing the effects of pollution are of increasing importance and permit early detection of aquatic environmental problems [4,5]. Fish have been generally used as bio indicators of the aquatic ecosystems because they play an essential role in the food chain and food web, bioaccumulation of toxic substances directly and indirectly through ingestion of both compounds dissolved in water and previously contaminated organism [6,7].

Many physical and chemicals contaminants can cause structural and functional changes in the molecular compounds of living cells. DNA is an important target of environmental stress due to persistent organic pollutants in both aquatic and terrestrial organisms [8]. One of the ways to evaluate the genotoxic potential of physical, chemical and biological substances is the comet assay. This method is used to detect small DNA damage such as Single strand breaks, double strand breaks and alkalilabile sites of individual cells. The comet assay (CA) is a standard, quick, simple, sensitive, rapid and reliable method for quantitatively measuring DNA damage in the exposed organism [9]. Comet assay is considered sensitive, fast, cheap and requires small number of cells to be performed[10,11] and it has been applied, with great success in erythrocytes of many species of the fishes exposed to several genotoxic agents [12,13]. Genotoxic tests can detect compounds capable of promoting primary damage in the DNA of exposed fish and is therefore a warning sign of future environmental problems.

Hence in the present study an attempt is made to study the DNA damage of the fish *Oreochromis mossambicus* exposed to different days of treated effluent.

Materials and Methods

Study area

The textile dye effluents were collected from a Tirupur private textile industry, situated at rayapuram of Tirupur District, Tamil Nadu, India. The effluent from the industry was collected and transported to the laboratory and used for further experiments. Fingerlings of healthy *Oreochromis mossambicus* were brought to the laboratory and acclimatized for 15 days. The fish were well fed during the acclimatized period. Feeding was stopped one day before commencement of the experiment.

Sample collection

Blood samples from each specimen of *O.mossambicus* were obtained by cardiac puncture using heparinized syringes. The comet assay was performed according to Singh *et al.*, [14]. This protocol describes the fluorescent, ethidium bromide staiming methodology and non-fluorescent, silver staining technique [15], which is now being routinely used in the laboratory.

Results

Regarding overall performance of fish towards induction of DNA damaged cells, under the exposure of metals, all the four fish species showed significantly higher frequency of damaged cells due to exposure of textile effluent (Figure 1). Among the histogram *O.mossambicus*, the percentage of damaged cells in fish erythrocytes varied significantly as: Untreated Effluent 50th day > Untreated Effluent 25th day ≥ Untreated Effluent 15th day. DNA damage level is increased. But the percentage of damaged cells in fish erythrocytes significantly reduced as: Bioremediated Effluent 15th day > Bioremediated Effluent 25th day ≥ Bioremediated Effluent 50th day. DNA damage level was significant amount decreased in Bioremediated Effluent 50th day when compare to untreated 50th day.

Discussion

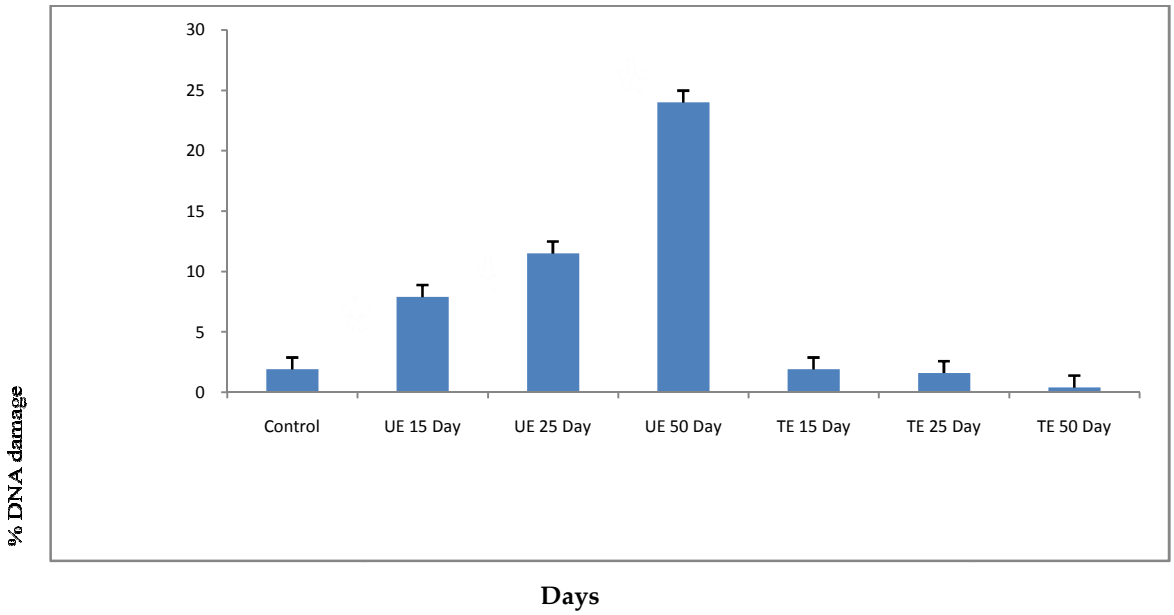
Due to growing number of agricultural, commercial and industrial chemicals, the rate of genetic disorders, diseases and mortality of exposed organisms in the natural habitats has increased significantly [16]. This needs to study the impacts of these chemicals on integrity and functioning of cellular DNA in organisms.

During present investigation untreated 50th day fish species showed concomitant increase in DNA damage in their peripheral erythrocytes with increase in metallic ion concentration.

Moreover, fish blood erythrocytes are the most suitable for DNA damage analyses since peripheral blood reflects the comprehensive health status of the organism. Regarding this issue, fish blood cells have attained particular attention as their erythro-

cytes are nucleated and, therefore, appropriate for obtaining nucleoids for single cell gel electrophoresis[17].

Figure 1: DNA Damage level in fish



Conclusion

Results showed significantly variable genotoxic effect in peripheral blood erythrocytes of fish. It is also concluded that by using Comet assay, *Oreochromis mossambicus* can suitably be used as bioindicators of metallic ion pollution in the natural aquatic habitat. This work will also help sustainable conservation of fresh water fisheries in India.

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