

Study of Toxic Effects of Chemicals on Root Tip Cells

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ABSTRACT: This project includes the study of dividing root tip cells under normal conditions, finding the mitotic index as well as exposing the root tips to different chemicals to see the effect on the mitotic index and chromosomes. Nanotechnology is an emerging branch of science. Nano particles have unique physical and chemical properties and thus used in diverse applications Here Nanoparticles are used for water treatment and thus enriching the quality of water. Onion root tips were exposed to different concentrations such as 10ppm, 50ppm and 100ppm at different time durations such as 12h, 24h, 22h. at different concentrations and time durations toxicity of chemicals was checked. Chromosomal aberrations were observed. Nano fibres are used to filter the polluted water sample. Analysis of polluted water before and after the filtration is done by pH, conductivity, chloride test and turbidity. It was found that after treatment of polluted water using carbon nanofibers (CNFs) there is a drastic improvement in the water quality. Lead Acetate and copper oxide in polluted water deteriorate the quality of onions thus having negative effects on humans.

Keywords: Carbon nanofibers; Chromosomal aberrations; Mitotic index; Onion; Polluted water.

INTRODUCTION: Toxicity induced plants have harmful effect on humans too leading to carcinogenic diseases. Water containing heavy metals like lead, cadmium, mercury, copper results in chromosomal. As India has agriculture-based economy the main motive is to develop the agricultural production brings new technologies to enhance the quality of production. The main component that is responsible for the growth of plant is water. These days the rivers get polluted by the outlets released by industries without any water treatment which causes degradation of quality of water. Many a times this same water is used for cultivation of crops or not so but it gets mixed with ground water thus indirectly the water quality decreases. Water pollution can have dire consequences for plants, and even ecosystems as a whole. The specific effects vary depending on what pollutants enter the environment. Sometimes, water pollution causes an explosion of new plant growth by providing necessary nutrients and food. Other times, it can harm or kill plants by changing growing conditions, such as by raising or lowering the environment's acidity.

The morphological abnormalities of root systems treated with aluminium salts are such that they may be explained by inhibitory effect of aluminium on cell

division or cell extension^[1]. Aberrations in plants which negatively affect plant growth. This polluted water can be treated with the help of carbon Nano fibres. Nanotechnology is a branch of technology that deals with dimensions and tolerances of less than 100nm, especially the manipulation of individual atoms and molecules. Carbon nanofibers^[2-4] are cylindrical Nano structures with graphene layers arranged as stacked cones, cups or plates. Such Nano fibres are used to make sports equipment, wind turbine blades and a host of other products.

MATERIALS AND METHODS: Materials used are Onions, lead acetate, caffeine, polluted river water, carbon nanofibers

Collection of polluted Ulhas river water: For the survey of the project the polluted water of Ulhas river was collected. Polluted water contains outlets of many industries which contain heavy metals.

Treatment of polluted Ulhas river water: Polluted water, water containing pollutants was filtered using CNFs. We procured the CNFs from the Nanotech Research Lab which was obtained using the Natural fibre by Sandesh Jaybhaye *et al.* CNFs bed was prepared by inserting a layer of cotton filter paper and

CNFs in the glass column. This set up was used to filter the polluted Ulhas river water. Polluted water was filtered twice to get a suitable water for growth of plants.



Figure 1: Collection site of polluted water of Ulhas river.



Figure 2: Set up was used to filter the polluted water.

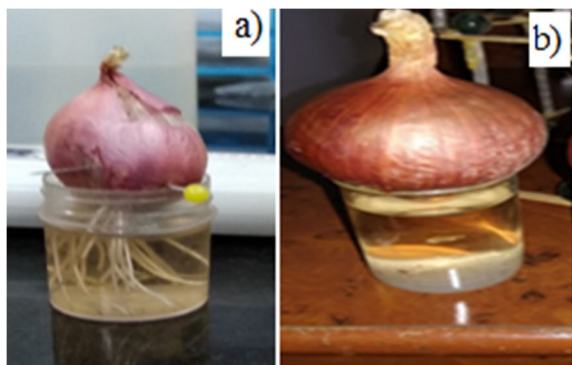


Figure 3: Growth of Onion in CNF treated and Polluted water a) CNF treated water b) Polluted water.

Growth of Onion in CNFs treated and Polluted water: Onions were grown in CNFs treated water as well as in polluted Ulhas river water. Growth of root tip cells was studied under microscope. Chromosomal pattern was studied in CNFs treated as well as collected polluted water.

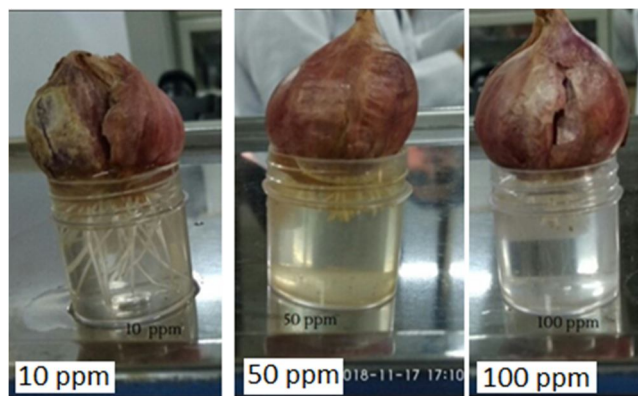


Figure 4: Growth of onions in lead at different concentrations.

Growth of Onions in Lead containing water: Onions were grown in water containing lead to check the toxicity. The grown root tips of onion were observed under microscope. Onions were grown at different concentrations such as 10ppm, 50ppm, 100ppm to check the toxicity.

Characterisation: The polluted water before and after treatment analysed using Turbidity, chloride test, pH, COD, BOD, Conductivity etc.

RESULTS AND DISCUSSION

Treatment of polluted Ulhas river water: Collected sample from Ulhas river was filtered through CNF's filter. The treated water showed less turbidity, conductivity of the treated increased, pH also increased, COD increased, BOD increased comparative to polluted water.

Growth of Onion in Polluted water and CNFs treated water: The polluted water contains heavy metals like cadmium, lead, mercury etc. these heavy metals induces chromosomal aberrations such as sticky chromosomes, faulty polarisation in Anaphase, nucleus and cell elongation, improper cell plate formation in Metaphase. Polluted water deteriorates the condition of crop.

Onion root tip cell showed no chromosomal aberrations. Thus, the quality of crop grown in CNFs treated water was much better as compared to those grown in polluted water.

Growth of Onions in Lead containing water: Onions grown in lead containing water showed toxicity. Difference in the length of the roots was observed. At 10ppm and 50ppm the length of roots was slightly decreased. At 100ppm there was substantial decrease in the length of roots and mitotic index also decreased. The roots showed same chromosomal aberration as in polluted water.

Table 1: Analysis of Before and After treated Ulhas river water.

Parameters	Polluted water	Treated water
pH	5.3	5.8
COD	0.3	0.9
BOD	0.8	1.5
Conductivity	1.994ms	5.72ms
Turbidity	0.13 at 580nm	2.3 at 580nm
Chloride test	35-150	110

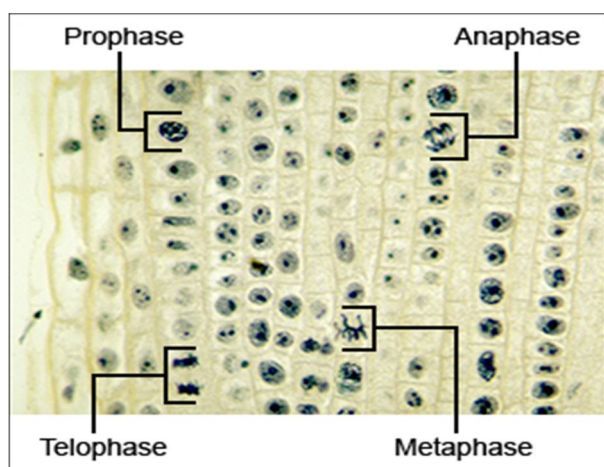


Figure 4: Phases of mitosis.

Table 2: Analysis of growth of onions in different concentration and duration.

Sample after treatment with Lead acetate (ppm)	Duration (hrs)	Mitotic index (%)
Control		21.2
10	12	17.4
50	12	12.6
100	12	8.4
10	24	16.8
50	24	9.8
100	24	7.6

CONCLUSION: Most of the cells were undergoing mitosis, we observed all the phases prophase, metaphase, anaphase, telophase. Roots were grown to maximum length. The difference in the length of the roots were clearly visible. Length of roots decreased after

treatment with chemicals. Also, the length of roots decreased as the concentration of chemical increased. For normal cells all the phases of mitosis were clearly observed. Almost all of the cells were in dividing conditions, mitotic index is very high. After chemical treatment with lead acetate we observed certain chromosomal aberrations such as sticky chromosomes, bridge in anaphase, fault polarization in anaphase, formation of micronucleus, elongated nucleus in prophase and scattered chromosomes. The number of dividing cells was less than that of the normal cells. As the concentration of chemicals increased the mitotic index decreased. More aberrations are observed. Carbon nanofibers can be used to treat the polluted Ulhas river water. This method not only improve the pH, COD, BOD, Conductivity, Turbidity but also removed heavy toxic metals like lead, mercury, cadmium.

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