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Effect of fly ash on *Spirogyra decimina* species

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ABSTRACT
Flyash particles are formed during the combustion of coal at very high temperature (above 1500^0C); it contains some ions as Iron, Aluminium, Silica in their oxide form. It also contains Glass particle along with Cd, Co, Cr, Ni, Se, Pb, Zn, Fl, Hg, particles. Heavy metals from industries are known to have adverse effect on the environment. Similarly, fly ash coming from power plants also has adverse effect on every organism. It was observed that Spirogyra was not found in fly ash discharged water pond while it was present in all the nearby water bodies. ,disasterous effects of heavy metals present in flyash may be the reason. Thus, our present study is mainly focused to elucidate the effect of fly ash on green filamentous algae Spirogyra. It was already found that Microtubules are very sensitive especially to the presence of Cd ions (P. Přibyl, V. Cepák and V. Zachleder,2008), depending on the Cd concentration present in fly ash and to the time of exposure the disintegration was seen. Microtubules got disintegrated into short fragments or some even completely disappeared.

Introduction

During the past three decades, the rapid development of technology called for the increase of the exploitation, processing and utilization of the various heavy metals and this simultaneously meant the concentrated return of the heavy metals into our environment. Metals are non-biodegradable and can accumulate in the living tissues, thus becoming intense throughout the food chain (WILLIAMS *et al.*, 1998).

Industrial & agricultural activities increase day by day, pollution by heavy metals will likely increase. Agricultural and industrial activities is a major cause of global- scale inhabitat loss and degradation in the lotic environment (Nakano & Nakamura, 2006; Arnold and Beristain, 1993)

It is also known that certain heavy metals are necessary for the living organism in little amounts but the heavy metals extraneous for the living organism are definitely toxic.

Flyash contains some ions such as Iron, Aluminium, Silica in their oxide it also contains glass particle with cd, co, cr, Ni, se pb, Zn, Hg particles. From these elements cd, Hg and pb, cr are explicitly toxic heavy metals (E. Fekete 1984)

Heavy metals affect numerous metabolic or developmental processes in all living organism & the cytoskeleton are the intracellular target for the heavy metal ions. (Pravel Pribyl 2008) Higher dose of Cd inhibits the liver and kidney functions and causes the demineralization of Osseous system. (E.Fekete1984) Mechanism of Ni toxicity include it alters G-actin conformation which can affect dynamics of polymerization/depolymerization of actin filament. (Dalledonne 1999)

Exposure to higher copper doses can interfere with tyrosine phosphorylation of actin molecule, which can affect actin polymerization. (Fagotti et al 1996)

Spirogyra is a genus of filamentous green algae of the order Zygnematales, named for the helical or spiral arrangement of the chloroplast that is a diagnostic feature of the genus. Spirogyra is very common in relatively clean eurotrophic water, developing a slimy filamentous green mass that comes to the surface and become visible as slimy green mats.

Biomass of filamentous algae Spirogyra has adsorption capacity of Cr (VI) from the solution & they can act as a Bio-absorbent for the removal and recovery of Cr (VI) from wastewater. (V.K. Gupta, A.K. Shrivastava 2001)

In *Spirogyra weberi*, high ash, lipids, carbohydrate, protein and inorganic elemental composition were determined. It was found that the extract of this alga was not toxic but it inhibits the growth of *pennisetan* seeds at very high concentration. (Mudassir, Israr. 1995) Spirogyra provides food for fish because it was found that different Spirogyra species were found in gut of *Cyprinus carpio.(M. awasthi et al 2006)*

Classification

Domain: Eukaryote
Kingdom: Protista
Phylum: Chlorophyta
Class: Zygnematophyceae
Order: Zygnematales
Family: Zygnemataceae
Genus: Spirogyra
Species: *Spirogyra decimina*

Methodology

- Water samples were collected during the period MAY-JUN 2011 with plankton net from fresh water pond. This pond is inhabited by a large biomass of spirogyra.
- They were carefully washed and preserved in 4% formaline & identified under microscope. According to their morphological characteristics and nature and habitat they were identified as Spirogyra decimina Sps. (A.Zarina , Masud-ul-Hasan and Mustafa Shameel 2007)
- Spirogyral mat containing water sample was kept on 4 petridishes and thegradually amount of fly ash was increased gradually in each petridish.
- Specimens from each bowl were drawn daily and observed with research microscope.

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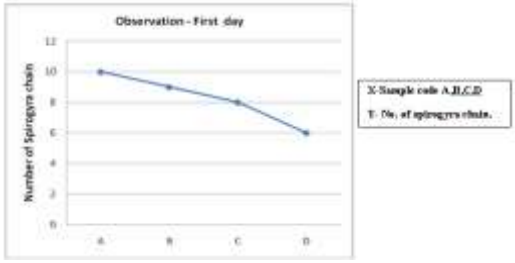
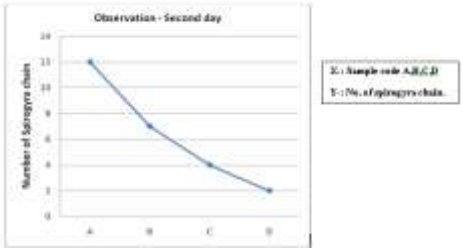
- These observations were recorded & labelled and photographed with camera.

Sample preparation:

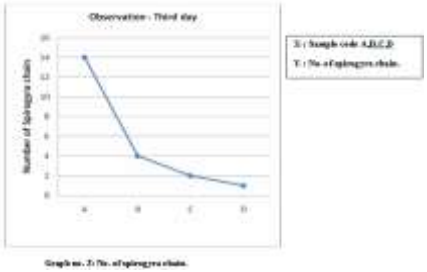
- Cleaned petridishes were labeled A, B, C, D.
- Normal pond water was used as stock for the spirogyra mat.



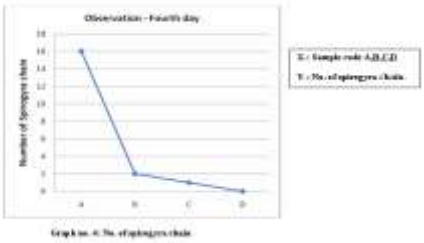
Graph 1. No. of spirogyra chain



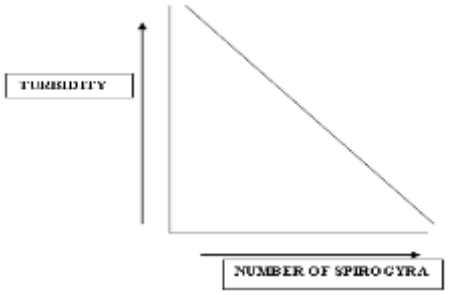
Graph 2. No. of spirogyra chain



Graph no. 3: No. of spirogyra chain



Graph no. 4: No. of spirogyra chain



Graph no. 5: relationship between turbidity and no. of Spirogyra.

Result and discussion

Thus in this study we have observed that when we study Spirogyra's relation with fly ash, we see that in the prepared sample A,B,C,D in plate A (without fly ash) No. of spirogyra chain were increased & in Sample plate B,C,D no. of Spirogyral chain gradually decrease & after 4 days they were totally disappeared in plate D which contain higher amount of fly ash.

In figure no.1, we see a long chain of Spirogyra, sample was drawn from the plate A, which does not contain fly ash.

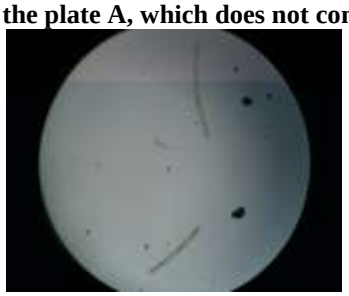


Fig no. 2 shows long spirogyra chain dissociated into short chains.

Fig no. 3 shows damaging chloroplast of spirogyra.

Fig no 4 shows different damaged structure of spirogyra chains.

Fig no. 5 shows disappearance of cell wall of Spirogyra chain.

In addition to the uptake of nutrients, algae can also take up toxic compounds such as heavy metals (Page *et al*., 2006; Qiming *et al.*, 1999; White and Broadley, 2003.)

We found that tolerable limit of fly ash for spirogyra was 0 .5gm in 100ml for 4 days exposure at 30° C room temperature in hot summer of central India. After 4 days exposure the damage started in the chain in the form of dissociation of chains.

LD 50 of fly ash for spirogyra was 1.00 gm in 100ml at 2 days exposure at 30^0C room temperature in hot summer.

Thus we can say that fly ash inhibits growth of spirogyra, when fly ash is present in more than its tolerable level in water, it also depends on time of exposure as we see in Graph no. 1, 2, 3 & 4. In Sample plate A total no. of spirogyra chain were increased gradually from day 1 to 4.and in sample plate B, C, D total no. of spirogyra chain were decreased from day 1 to 4.

Previous studies have shown that cytoskeleton structures of interphase Spirogyra decimina cells were severely damaged by Cd. (Pribyl et al,2005). Ni causes any slight cytomorphological changes in cytoskeleton whereas Cu & Cd causes rapid disorganization of cytoskeletal structure. (Pravel 2000).

Light's ability to pass through water depends on how much suspended material is present. Because of the higher turbidity of fly ash water, sufficient sunlight was not passed through the water, while spirogyra needs sufficient light for their growth and reproduction. Graph no. 5 shows relationship between spirogyra and turbidity as turbidity increases the no. of Spirogyra were gradually decreases.

Conclusion

Thus From all above statements we can conclude that in our study the breakage of Spirogyra chain is due to the presence of heavy metals in Fly ash. Thus, they cannot survive in Fly ash discharged water pond. We found that tolerable limit of fly ash for spirogyra was 0 .5gm in 100ml for 4 days exposure at 30^0 C room temperature in hot summer of central India. LD 50 of fly ash for spirogyra was 1.00 gm in 100ml at 2 days exposure at 30^0 C room temperature in hot summer. We can conclude that Fly ash have adverse affect for the growth and reproduction of Green filamentous algae Spirogyra.

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Table I: sample preparation

Sample code	Pond water	DW	Fly ash(gm)
A	10ml	90ml	Nil
B	10ml	90ml	0.5
C	10ml	90ml	1.0
D	4 10ml	90ml	2.0

Above preparations was kept on clean and lightened room and observed after 2 days.

Observation:

To take 0 .5ml of sample water from each petridish on a cavity slide and observed for 4 days.

Sample code	1^{st} day	2^{nd} day	3^{rd} day	4^{th} day
A	10	12	14	16
B	10	9	8	6
C	6	4	2	1
D	3	2	1	0