INTERNATIONAL JOURNAL OF PLANT, ANIMAL AND ENVIRONMENTAL SCIENCES

IJPAES

Volume-3, Issue-4, Oct-Dec-2013

ISSN 2231-4490

www.ijpaes.com

Received: 27th August -2013 *Revised: 02nd Sept-2013* *Accepted: 20th Sept-2013*

Research article

COMPARISION OF THE ACTION OF MERCURY OR DIURON ON PHOTOSYSTEM II PHOTOCHEMISTRY OF THE CYANOBACTERIUM *SPIRULINA PLATENSIS.*

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ABSTRACT: In this present study an attempt has been made to compare the effect of mercury or diuron individually on photosystem II catalyzed Hill reaction in *Spirulina platensis.* Our studies indicated that the action of mercury or diuron on photosystem II is similar and caused inhibition in p-BQ supported Hill activity at reducing side of photosystem II. The similar observations has been supported by our Chl *a* fluorescence kinetic measurements using PAM kinetic fluorimeter through F_0 rise in the kinetic spectrum and Fv loss in the intensity of fluorescence .The above studies indicated that the action of mercury and diuron is almost similar in the cyanobacterium *Spirulina platensis.*

Keywords: Diuron, Mercury, Photochemistry, *Spirulina*

INTRODUCTION

Photosystem (PS) II is one of the important multimeric pigment protein complex is responsible for performance of light reactions of photosynthesis in cyanobacteria [1,2]. The photochemistry of PS II can be influenced by several environmental factors like high temperature [3] and heavy metal stress(4)and UV-B stress [5].Several workers have made individual stress studies using either polorography [6] fluorescence methods [7].Therefore in the present investigation an attempt has been made to study the effect of diuron and mercury individually using O_2 electrode and PAM kinetic spectrophotometer and a comparison has been made regarding the action of the herbicide as well as heavy metal employed in this investigation. For these studies *Spirulina platensis* has been employed as experimental material and the effect of mercury (6-15 µM) and diuron (5-10 µM) was studied and results were compared by exposing the cells for 5 min for dark incubation.

MATERIALSAND METHODS

Spirulina platensis is a non-nitrogen fixing cyanobacterium grows autotrophically in the medium of Zarrouk's [8] at 25 ± 2^0c under continuous illumination (20Wm^{-2}).Intact cells were harvested by centrifugation at 9000 rpm for 5 minutes washed twice with the 20mM HEPES-NaOH buffer (pH-7.5) contains 20 mM NaCl. Cells were incubated with different concentration of diuron (2-6µM) or HgCl2 (6-18µM) individually by stirring continuously in dark for 5min. Photochemical activity was measured polorographically with Clark- type oxygen electrode [6]**.** The reaction mixture for assaying PSII activity contained suspension buffer as mentioned above and freshly prepared 0.5 mM P-BQ. Cells equivalent to 15µg of Chl was used in electron transport assay measurements. The fluorescence kinetics of Chl*a* were measured using PAM fluorimeter. as described by Murthy [7] .Cells equivalent to 8µg Chl were used for measuring fluorescence kinetics. Cells were initially adapted to dark under continuous mixing before measuring the kinetics. The concentration of Chl *a* was measured using the methods of Mackinney [9].

RESULTS AND DISCUSSION

After exposing the intact cells to diuron PSII catalyzed electron transport has been measured using PBQ as Hill acceptor. Control cells exhibited the PSII activity equal to 192 µmoles of $0_2 \uparrow$ mg Chl^{-1} h^{-1}. The incubation of cells with different concentration (2-6µM) diuron for 5min induced concentration dependent loss in PSII activity and at 6 µM of diuron 66% in the activity was noticed (Table 1).

This loss in PSII activity could be due to binding of diuron to Q_B protein of PSII Complex (D_1 protein) as has been earlier suggested by Renger [10]. Similarly when the cells were treated with $HgCl_2$ (6-18 µM) for 5min in dark it also caused 55% in the activity of PSII (Table 2) which can be due to problem at reducing side of PSII a has been for earlier reported by Murthy *et al* [6].To verify the exact target site of diuron or mercury, Chl *a* fluorescence (Table 3) using control and treated *Spirulina* cells. In control sample when the cells were excited with weak light, it has reached a point which is called as Fo (original fluorescence).When the sample excited with red active light it has reached a point which is known as F_m (maximal fluorescence). The difference between the F_m and Fo is known as Fv,which indicates the function of PSII photochemistry. After treatment with diuron, the excitation caused increased in F_0 and decrease in Fv indicating that diuron treatment caused changes in LHCII of PSII in intact cells of *Spirulina*. The similar reports were earlier suggested by Renger [10] in case of higher plant thylakoid membranes. Mercury treatment (12 µM) also mimicked the similar results as F_0 increase and Fv loss indicating the disturbances at PSII reaction centre. These results were supported by the observations of Murthy *et al* [6] as altered fluorescence kinetics in the cyanbacterium *Spirulina*. Thus our studies clearly demonstrated that the action of mercury or diuron is similar in causing LHC II changes of PS II through Fo rise and inhibition of photosynthetic electron transport through Fv loss in the above cyanobacterium.

Table1: Effect of diuron on photosystem II catalyzed electron transport in intact cells of the cyanobacterium *Spirulina platensis*.

Concentration (µM)	PS II Activity µ moles of $O_2\uparrow$ mg Chl^{-1} h^{-1}	Percent loss
Control	192 ± 16	0
2	125 ± 13	35
4	93 ± 7	52
6	65 ± 4	66

Table2: Effect of $HgCl_2$ as PSII catalyzed electron transport in intact cells of the cyanobacterium, *Spirulina platensis*.

Concentration (µM)	PS II Activity µ moles of $O_2\uparrow$ mg Chl^{-1} h^{-1}	Percent loss
Control	162 ± 14	0
6	101 ± 12	17
12	196 ± 16	48
18	89 ± 7	55

Table3: Effect of diuron (4µM) or $HgCl_2$ (12µM) as Chl *a* fluorescence kinetics of in intact cells of the cyanobacterium, *Spirulina platensis*.

Sample	F_0, Cm	Fv, Cm	Percent loss in F_V
Control	7.2	5.4	0
Diuron treated	8.6	3.7	32
Hg^{2+} treated	8.4	3.9	28

AKNOWLEDGEMENTS

SDS is thankful to UGC for providing BSR one time grant (2013-2014).

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