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Biochemical Parameters of Chick pea (*Cicer arietinum* L.) as Affected by SO_2 Different Concentration of Pollution

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Abstract - The present study was carried out to determine the impact of SO_2 on Cicer arietinum. SO_2 is most important common air pollutant generally emitted by industries and vehicles on some biochemical parameters in Chick pea. The concentration of SO_2 was determined at the site of D.S. College. The Chick pea showed significant reduction in chlorophyll and carotenoid. It is concluded that the ambient air pollutants have a potential adverse impact on biochemical parameters, which further leads to a reduction in the yield of Chick pea.

Keywords - SO_2 pollutant, chlorophyll a, chlorophyll b, total chlorophyll and carotenoid.

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INTRODUCTION

The major air pollutants emitted from the different industries into the atmosphere either in the form of gaseous or particulates. Chick pea are one of the oldest and most widely consumed legumes in the world, particularly tropic and sub-tropic areas. The past years continuous increase in human pollution, road transportation, vehicular traffic and many industries which has resulted in further increase in the concentration of gaseous and particulate pollutants. (Chauhan & Joshi (2007). Industries and automobiles are the main important air pollution which is responsible for maximum amount of air pollutants. (Joshi & Swami (2007) and the crop plants are very sensitive to gaseous and particulate pollutants and these can be used as indicator of air pollution. (Muzika et,al., 2004), Bytnerowitz et al., 2005, and Petkovsek et al., 2008, crop production is highly dependent upon environmental conditions chlorophyll is found in the chloroplasts of green plants and is called a photoreceptor. Chlorophyll is not a single molecule but designed by different molecules as a chlorophyll a, b, c, d. Chlorophyll a is found in all plant cell its concentration reported during chlorophyll analyses. Chlorophyll measurement is an important tool to evaluate the effect of SO_2 pollution on plants and its plays an important role in plant metabolism and reduction in chlorophyll for plant growth. Carotenoid is accessory pigment and a class of natural fat salute pigments found in plant and play important role in photosynthetic activity.

REVIEW OF LITERATURE

Pandey & Rao (1978) recorded reduction in chlorophyll and carotenoid pigments in wheat. Agrawal et al., (1991) studied the effect of SO_2 exposure on chlorophyll content in *Vicia faba* and reported decreased photosynthetic pigments. Bhushra Wali et al., (2004), studied the impact of SO_2 of photosynthetic pigments and reported decline in chlorophyll a and chlorophyll b contents. Mishra et al., 2007) reported decreased chlorophyll contents in *Aegle marmelos* under air pollution. Panigrahi et al.,(1992) fumigated *Oryza sativa* and *Phaseolus aureus* with different concentration of SO_2 for different period at various growth stages. They observed a significant reduction in chlorophyll- a and chlorophyll- b Peuke and Tischner (1994) reported significant reduction in chlorophyll contents in spruce seedlings exposed to different concentration of SO_2. Mandal & Mukherji (2000) studied the effect of long term exposure to automobile exhaust on chlorophyll

content and chlorophyll activity in different plants and reported decreased chlorophyll contents. Prakash et al., (2002) reported the significant reduction in chlorophyll-a, chlorophyll- b and chlorophyll a/b ratio in *Raphanus sativa* exposed to SO_2. Jeykumar et al., (2003) studied the effect of SO_2 on total chlorophyll, chlorophyll- a and chlorophyll- b in *Zea mays*. Bhardwaj et al., (2009) the effect of SO_2 *Tagetes erecta* and reported a decrease in chlorophyll- a and chlorophyll- b and total chlorophyll. Muriefah et al., (2004) studied the effect of SO_2 exposure on wheat and barley seedling and reported significant reduction in carotenoid pigments. Mishra et al., (2007) observed significant reduction carotenoid contents in plants grown under air pollution. Similar findings were made by Siefermann- Harms (1990). He observed decreased carotenoid contents in plants fumigated with SO_2.

MATERIAL AND METHODS

For present work *Cicer arietinum* seeds were purchased from a certified agency IARI PUSA Delhi. These seeds were sown in polythene bags of suitable size. These polythene bags are filled in sandy loam soil. Waits for germination after 20 days of germination fumigation of seedlings was carried out with different concentration of sulphur dioxide i.e. 0.1, 0.3, 0.5, 0.7 ppm were used. The fumigation of plants was carried out in fumigation chambers made with the help of aluminum frames and Perspex sheet. All chambers were made same size. Chambers are made 1 cubic meter. The desired concentrations of sulphur dioxide were made following Singh and Rao (1979) method. Sulphur dioxide was produced by using Rao and Le Blance (1966) method. Arnon (1949) method was estimation of chlorophyll and for carotenoid Maclachlan and Zalik (1963) method was used. To find the effect of sulphur dioxide concentration 5 sets of plant were made out of them one was kept as a control set and other 4 sets were treated with different concentration of sulphur dioxide. The plants were exposed 4 hours a day with a different concentration of sulphur dioxide and continued up to 45 days of age.

RESULTS

Sulphur dioxide is hazardous and important pollutant to plants and it affects the plant growth. The observation found a significant reduction in photosynthetic pigments. The reductions in chlorophyll content were increased with the age of plants. When observation were regarded at the age of 15 days of fumigation, the decline of chlorophyll a contents with exposure of 0.1 ppm of SO_2 and reached up to 10.16% when similar age of plants with exposed to 0.7 ppm of sulphur dioxide. At the age of 30 days the maximum reduction 18.08% in chlorophyll a. while at the age of 45 days of plants it increase to 22.98% as compared to control set. The decline in chlorophyll b content in 15 days plant the minimum reduction is 2.28% while the maximum reduction 6.18% similar age of plant. The decline of chlorophyll b at the age of 45 days plants the maximum reduction 19.12% when exposure of SO_2 at 0.7 ppm. Total chlorophyll decreased 21.01% at the age of 45 days of plant. Carotenoid is important accessory pigment for photosynthesis. They protect the chlorophyll. The decreased in carotenoids contents was reported up to 13.95% at the age of 45 days when they exposed to 0.7 ppm of SO_2.

Table-1 Showing the effect of variable concentrations of SO_2 on photosynthetic pigments in *Cicer arietinum.*

Age of Plants	15 Days					30 Days					45 days				
SO_2 Concentrations (ppm)	0	0.1	0.3	0.5	0.7	0	0.1	0.3	0.5	0.7	0	0.1	0.3	0.5	0.7
Parameters															
Chlorophyll 'a' (mg g⁻¹f.w.)	0.508 ±0.097	0.485 ±0.085	0.477 ±0.091	0.462 ±0.083	0.456 ±0.077	0.810 ±0.041	0.705 ±0.050	0.695 ±0.068	0.673 ±0.061	0.664 ±0.078	0.710 ±0.035	0.574 ±0.027	0.567 ±0.031	0.560 ±0.020	0.547 ±0.034
Chlorophyll 'b' (mg g⁻¹f.w.)	0.118 ±0.014	0.115 ±0.027	0.113 ±0.018	0.112 ±0.021	0.110 ±0.035	0.358 ±0.052	0.329 ±0.068	0.322 ±0.041	0.317 ±0.049	0.310 ±0.042	0.292 ±0.688	0.251 ±0.080	0.247 ±0.078	0.242 ±0.063	0.236 ±0.057
TotalChlorophyll (a+b) (mg g⁻¹f.w.)	0.626 ±0.026	0.595 ±0.012	0.588 ±0.033	0.575 ±0.28	0.562 ±0.058	1.168 ±0.028	1.034 ±0.034	1.005 ±0.062	0.992 ±0.051	0.968 ±0.048	1.002 ±0.071	0.817 ±0.045	0.806 ±0.083	0.797 ±0.074	0.794 ±0.056
Carotenoids (mg g⁻¹f.w.)	0.456 ±0.024	0.445 ±0.016	0.441 ±0.014	0.437 ±0.034	0.432 ±0.041	0.594 ±0.028	0.555 ±0.042	0.546 ±0.048	0.542 ±0.046	0.539 ±0.035	0.696 ±0.045	0.622 ±0.031	0.615 ±0.062	0.611 ±0.064	0.599 ±0.038

DISCUSSION

Sulphur dioxide is an important photo toxicant pollutant. It affects the plants in various ways. The biochemical parameter is most important for plant growth. Keeping this view in mind present study was undertaken to assess the impact of sulphur dioxide on biochemical parameters of *Cicer arietinum.* They result when plants fumigated with sulphur dioxide the result chlorophyll- a and chlorophyll-b are reduced. Loss of chlorophyll-a depend on the concentration of SO_2 and chlorophyll-b also loss due to SO_2 concentration.

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