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Impact of Various Concentration of Sulphur Dioxide Pollution on Photosynthetic Pigment of *Lens Culinaris* l. (LENTIL)

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Abstract - The impact of SO_2 pollution on agricultural as well as physiological and ecological dynamics at both the individual and community scale. Lentil is a prominent source of protein in India. Plant species that produces pods such as lentil and dry pea are adversely affected by the presence of Sulphur di-oxide resulting in a reduction in their overall output. In present study chlorophyll content extracted from lentil plant leaves treated with different concentration of SO_2 and prepared sample were exposed to a range of light having different wavelength and analyzed using a Spectrophotometer and calculation of chlorophyll a and b using by Arnon method (1949). It is concluded that Chlorophyll content was higher in low concentration and reduced gradually with higher concentration.

Keywords - Sulphur dioxide, lentil and chlorophyll.

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INRTODUCTION

The air pollutants include CO, NOx and SO_2. Out of these gases sulphur dioxide is a major air pollutant. It is an acidic gas. It is colorless and soluble in water. The melting point of sulphur dioxide is -72^oC while the boiling point is - 10^oC. Sulphur dioxide has a suffocating and unpleasant smell. SO_2 is an important phytotoxic and it is formed by the combustion of fossil fuels and oxidation of sulphur containing raw materials (Iqbal, M. *et al*., 2015). After being released in to air the sulphur dioxide gas absorbed on surface of leaf, water and soil. The SO_2 is easily soluble in water and due to this features it forms sulphuric acid. This sulphuric acid comes on earth in the form of acid rain. This acid rain is a major cause of harmful for natural as well as crop vegetation's. The sulphur dioxide present on leaf surface enters in to leaves through stomata. When it reaches to leaf tissue it gets converted in to HSO_3^-, SO_3^-, SO_4^{--}. These products affect the plant's metabolism leading to plant damage **(**Priyadarshani 2016). The sulphur dioxide has deleterious effects on growth, productivity, morphology and photosynthetic pigments of plants. After entering in to leaves the sulphur dioxide accumulates in to mesophyll cells. This accumulation of SO_2 in mesophyll cells causes acute, chronic or hidden injury. Due to acute injury the metabolism changes occur due to which interveinal or marginal necrosis occur. The chronic injury in plants is caused due to sub- lethal concentrations of SO_2.

REVIEW OF LITERATURE

Verma & Agrawal (2000) reported the interactive effects of SO_2 and mineral nutrient supply on photosynthetic characteristics and yield in wheat and reported the decrease in photosynthetic rate, contents of photosynthetic pigment. Govind *et al*. (2002) studied the effect of SO_2 exposure on chlorophyll contents in *Raphanus sativus* and reported the significant reductions in chlorophyll-a and b contents and chlorophyll a/b ratio. Singh L.P. (2002) recorded the effect of SO_2 on growth yield and photosynthetic pigments of rice. Kumar & Jayabalan (2003) reported the significant effects of SO_2 on seedling growth in maize. They noticed significant reductions in chlorophyll a and b and total chlorophyll contents, and minor variations in carotenoids were observed. Singh & Javid (2003) observed a significant decrease in chlorophyll and ascorbic acid contents in *Vigna mungo* on exposure to 0.1 and 0.2 ppm SO_2. Muriefah & Al-Jwaizea (2004) studied the effect of SO_2 exposure on wheat and barley seedlings. SO_2 was applied at 3.0, 3.5, 4.0, 4.5 and 5.0 ppm for two hrs. They reported decreased chlorophyll, carotene, carbohydrates and proteins. Joshi & Chauhan (2009) studied the exposure of sulphur dioxide on wheat and mustard plant. They studied the biochemical parameter and yield in both crops. They noticed a significant reduction in chlorophyll-a chlorophyll-b, Total chlorophyll, Ascorbic acid, carotenoids and reduction

in the yield of wheat and mustard. Seyyednejad and Koochak (2011) studied the effect of air pollution on biological factors in *Eucalyptus camaldulensis*. They noticed that two biochemical parameters ie carbohydrate and protein contents are more soluble in plants at polluted site. Chauhan (2010) observed photosynthetic pigment changes in selected tree when they were exposed to SO_2. He reported that a significant decrease in chlorophyll a and b in leaves of *Ficus relegiosa, Mangifera indica.* Irshad & Ahmad Fayz (2011) observed the effect of sulphur dioxide on the biochemical attributes of spinach and noticed a significant reduction in photosynthetic pigments, phenols and amino acids while the carbohydrate content was increased at all the test concentration. Meerabai & Ramana (2012) reported the effect of air pollution on *Cajanus cajan* and reported the decreased chlorophyll content, ascorbic acid, relative water content decreased. Padhi & Dass (2013) investigated the effect of exposure of different concentrations of sulphur dioxide on growth parameters of *Lycopersicon esculentum.* They treated the plants with varying levels of concentrations of sulphur dioxide (0.25 0.5 and 1.0 ppm) the exposure was for 1hour, 2 hours and 3 hours. In significant change regarding chlorophyll content was recorded. Agabire and Akporhonor (2014) studied the effect of SO_2 on some physiological and biochemical characters of some plants. They noticed a sharp decrease in total chlorophyll contents relative water content, ascorbic acid and proline contents due to air pollution. Sharma & Sharma (2014) investigated the effect of SO_2 concentration on growth and some biochemical parameter of *Vicia faba L*. they observed a negative correlation between the sulphur dioxide and biomass, shoot growth, chlorophyll content of the plant.

MATERIAL AND METHODS

The investigation was carried out during 2020-2021 in the D.S College Aligarh. The *Lens culinaris* seeds were obtained from certified company. These seeds were seeding in polythene bags of appropriate size. After 20 day of germination plants were fumigated with different concentration of sulphur dioxide i.e. 0.1, 0.3, 0.5, 0.7 ppm. The fumigation of plants was carried out in fumigation chamber made by with the help of aluminum frame and Perspex sheet. The convenient concentration of sulphur di oxide was made of Singh and Rao method (1979). Sulphur di oxide was produced by using Rao and LeBlanc Method (1966). Chlorophyll content was estimated three times during experimental period and absorption measured by the using spectrophotometer at 480nm, 645nm, 663nm. Assessment and Calculation of chlorophyll a and chlorophyll b was calculated using Arnon method (1949). To assessment the impact of various concentration of sulphur dioxide five set were made and one set kept as control set and other four set treated with followed concentration. The plants were exposed 4 hours a day to respective concentration of Sulphur dioxide and continued up to 60 days of age.

RESULTS

Data concerned to different concentration of sulphur dioxide revealed that the chlorophyll content of leaves declined significantly with increasing concentration of SO_2. Reductions in chlorophyll a content determine up to 24.29% regarded age of 60 days of fumigation. Lowest value being recorded at 0.1ppm. SO_2 fumigation for 4 hours a day. The reduction of chlorophyll content increase with the age of plants. Prominent damage to the chloroplast machinery due to the SO_2 treatment is the main cause of deplete in chlorophyll content in the lentil plant leaves. The chlorophyll content decrease with increasing SO_2 concentration and the effect is more emphasize when the imitation period is increased. The decrease in chlorophyll content has been ascribed to the disruption of the chloroplast membrane due to phytotoxic nature of sulphur dioxide (Winner et al. 1985). Carotenoid is important pigment for photosynthesis in plants. They defend the chlorophyll. The depreciation in carotenoid content was reported up to 8.57% at the age of 60 days when they exposed to 0.7 ppm of Sulphur dioxide.

DISCUSSION

Sulphur dioxide is a significant phytotoxicant and dangerous for the plant. Sulphur dioxide affects the plants in different manner for example variation in morphological and biochemical nature. Keeping this perspective the current work was undertaken to assess the impact of sulphur dioxide on photosynthetic pigments in *Lens culinaris* under various concentration of sulphur dioxide. When sulphur dioxide treatments in lentil were found to be harmful even at lower concentration and duration of exposure which increased continuously with raising concentration and duration.

Table -1 Effect of various concentration of sulphur dioxide on chlorophyll content in *Lens culinaris.*

Age of Plants	20 Days					40 Days					60 Days				
SO_2 Concentration (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.)	0.610 ±0.078	0.605 ±0.065	0.595 ±0.058	0.565 ±0.058	0.559 ±0.055	0.544 ±0.052	0.532 ±0.045	0.499 ±0.043	0.486 ±0.042	0.478 ±0.040	0.601 ±0.096	0.490 ±0.087	0.485 ±0.095	0.476 ±0.086	0.455 ±0.077
Chlorophyll 'b' (mg g 1f.w.)	0.321 ±0.054	0.310 ±0.043	0.285 ±0.039	0.271 ±0.029	0.265 ±0.010	0.291 ±0.047	0.289 ±0.038	0.279 ±0.025	0.265 ±0.021	0.251 ±0.015	0.201 ±0.037	0.195 ±0.022	0.191 ±0.039	0.183 ±0.018	0.171 ±0.041
Total Chlorophyll (a+b) (mg g 1f.w.)	1.121 ±0.054	1.056 ±0.048	0.985 ±0.035	0.872 ±0.026	0.865 ±0.026	0.552 ±0.048	0.502 ±0.039	0.482 ±0.030	0.456 ±0.024	0.421 ±0.012	0.802 ±0.018	0.712 ±0.010	0.702 ±0.025	0.690 ±0.021	0.652 ±0.030
Carotenoids (mg g 1f.w.)	0.402 ±0.019	0.392 ±0.020	0.386 ±0.018	0.369 ±0.015	0.352 ±0.023	0.597 ±0.058	0.586 ±0.029	0.575 ±0.026	0.564 ±0.027	0.555 ±0.019	0.455 ±0.058	0.424 ±0.047	0.415 ±0.032	0.402 ±0.023	0.336 ±0.024

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