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Impact of variable concentrations of sulphur dioxide exposure on biochemical contents in *lens culinaris* l.

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Abstract - The effect of Sulphur di oxide gas on crop production as well as physiological and biotic dynamics at both the individual and community scale. pulses are a remarkable source of protein in India. Plant variety that produces legume such as lentil and dry pea are negatively affected by the existence of Sulphur dioxide causing in decrease in their whole production. In present work biochemical content extracted from lentil plant leaves treated with various concentration of SO_2 and prepared sample were exposed to a range of light having various wavelength and interpreted using a Spectrophotometer and calculation of chlorophyll a and b applying Arnon method (1949). It was observed that biochemical content chlorophyll and also carotenoid was higher in low concentration and depleted gradually with higher concentration.

Keywords: ***Sulphur dioxide, various concentrations, Lens culinaris L. and Biochemical contents.***

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INRTODUCTION

Air pollution refers to the introduction of dangerous compounds in to the atmosphere, resulting in contamination that poses risks to the health of people & other living organisms, causing damage to the environment and materials (Ozkara et al., 2016). The phenomenon being referred to is the alteration of the natural characteristics of the atmosphere by the introduction of chemical activity, physical agents, or biological agents, whether in indoor or outdoor environments (Tham et al., 2016). A wide range of air pollutants may be identified, including several categories of gases (Sulphur dioxide, nitrous oxide), particles both organic and inorganic, as well as molecules (Rawat., 2020). Sulphur dioxide is a significant main pollutant. Volcanic eruptions serve as a primary natural source of Sulphur dioxide (SO_2).

According to Khalaf et al., 2022, the combustion of fossil fuels by power plants & industries, mining operations, metal extraction from ore, transportation activities, ships, and locomotives are among the anthropogenic sources of Sulphur dioxide (SO_2). According to the Environmental Protection Agency (EPA), the primary contributor to this pollutant is from burning of fossil fuels inside power plants and industrial facilities. The issue of this pollutant is particularly prevalent in developing nations that are now experiencing fast industrialization.

REVIEW OF LITERATURE

Sulphur di oxide is an odoriferous, colorless, and chemically reactive air contaminant. This gaseous substance has the Potential to pose a risk to the well-being of humans, animals, and plant species. Muriefah & Al-Jwaizea (2004) observed the impact of Sulphur di oxide 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 observed sharp reduction in chlorophyll, carotene, proteins and carbohydrate. Govind *et al*. (2002) observed the impact of Sulphur di oxide exposure on biochemical contents in *Raphanus sativus* and recorded the significant deduction in chlorophyll-a and b, and chlorophyll a/b ratio.

Singh L.P. (2002) also reported the impact of SO_2 on growth, yield and chlorophyll content in rice. Verma & Agrawal (2000) investigated the interactive effects of Sulphur di oxide and mineral nutrient

supply on photosynthetic attribute and yield in wheat and recorded the reduction in photosynthetic rate, and biochemical content. According to Kumar & Jayabalan (2003) the negative effects of SO_2 on seedling growth in maize. They also recorded sharp reduction in chlorophyll a and b and total chlorophyll contents, and minor difference in carotenoids. Singh & Javid (2003) reported a significant reduction in chlorophyll and ascorbic acid contents in *Vigna mungo* on exposure to 0.1 and 0.2 ppm SO_2.

Similar findings regarding exposure of various Sulphur di oxide concentrations were also made by Joshi & Chauhan (2009) studied on wheat and mustard plant. They noticed a significant reduction in chlorophyll-a chlorophyll-b, Total chlorophyll, Ascorbic acid, carotenoids in both crops. Chauhan (2010) revealed that chlorophyll content changes in some preferred tree when they were exposed to SO_2. He observed that a significant decrease in chlorophyll a and b in leaves of *Ficus relegiosa, Mangifera indica.* According to Bhardwaj *et al*. (2023) The effect of Sulphur di oxide exposure on *vigna munga revealed* a significant reduction in photosynthetic pigment.

Meerabai & Ramana (2012) studied the effect of air pollution on *Cajanus cajan* and recorded the decreased ascorbic acid, chlorophyll content, relative water content. Padhi & Dass (2013) studied the effect of exposure of various concentrations of Sulphur dioxide on growth attribute 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) investigated the effect of SO_2 on some physiological and biochemical parameter of selected plants. They noticed a sharp decrease in relative water content, ascorbic acid, total chlorophyll and proline contents due to air pollution.

Sharma & Sharma (2014) observed the influence of SO_2 concentration on growth and some biochemical parameter of *Vicia faba L*. they were recorded a negative correlation between the Sulphur dioxide and biomass, shoot growth, chlorophyll content of the plant. Irshad & Ahmad Fayz (2011) studied the impact of Sulphur dioxide on the biochemical attributes of spinach and noticed a remarkable reduction in photosynthetic pigments, phenols and amino acids.

MATERIAL AND METHODS

The present work *Lens culinaris* seeds were purchased from certified company. These seeds were seeding appropriate size of polythene bags. plants were fumigated after 20 days of germination with selected concentration of Sulphur dioxide. The fumigation of plants was carried out in fumigation chamber made by with the help of aluminum frame and Perspex sheet. The appropriate 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 measured by the using spectrophotometer at 480nm, 645nm, 663nm. Chlorophyll content was estimated three times during investigation phase. Assessment and Calculation of chlorophyll a and chlorophyll b was calculated using by Arnon method (1949). To assessment the effect of different concentrations of Sulphur dioxide five set were made and one set kept as control set and other four set treated with appropriate concentration. The lentil plants were exposed 4 hours a day to relevant concentration of SO_2 and proceed up to 60 days of plant age.

RESULTS

It is clear that the chlorophyll contents of leaves declined significantly with increasing concentration of SO_2. Reductions in chlorophyll a content determine highest percentage regarded age of 60 days of fumigation. minimal value being reported at 0.1ppm. SO_2 fumigation for 4 hours a day. The reduction of photosynthetic pigment increases with the age of plants. Prominent damage to the photosynthetic machinery due to the Sulphur dioxide treatment is the important reason of depleted in photosynthetic pigments in the lentil plant leaves. The chlorophyll content reduces with increasing SO_2 concentration and the impact is more emphasize when the imitation period is increased. The reduction in chlorophyll content has been ascribed to the disruption of the chloroplast membrane due to phytotoxic nature of SO_2 (Winner *et al*. 1985). Carotenoid is essential pigment for photosynthesis in plants. They act as a safeguard for chlorophyll content. The depreciation in carotenoid content was recorded highest value at the age of 60 days when they exposed to 0.7 ppm of Sulphur dioxide.

DISCUSSION

Sulphur dioxide is a significant main pollutant, phytotoxicant and dangerous for the plant. Sulphur dioxide influence the plants in various aspects for example variation in morphological and biochemical nature. Keeping this view, the present work was undertaken to assess the impact of Sulphur dioxide on biochemical contents in *Lens culinaris* under variable concentrations of Sulphur dioxide exposure. When Sulphur dioxide treatments in lentil were found to be hazardous even at lower concentration. Reduction of photosynthetic pigments depend on Sulphur di oxide concentration exposure and duration. When the raising concentration of SO_2 and duration chlorophyll contents were more reduced.

Table -1 Impact of different concentrations of Sulphur dioxide on biochemical contents 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.)	0.931 ±0.054	0.915 ±0.048	0.880 ±0.035	0.836 ±0.026	0.824 ±0.026	0.835 ±0.048	0.821 ±0.039	0.778 ±0.030	0.751 ±0.024	0.729 ±0.012	0.802 ±0.018	0.685 ±0.010	0.676 ±0.025	0.659 ±0.021	0.626 ±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

REFERENCES

1. Agbaire, P.O. and Akporhonor, E.E., The effect of air pollution on plants around the vicinity of the Delta steel company, ovwian-Aladja, Delta state, Nigeria, Journal of Environmental Science, Toxicology and Food Technology,8, 61-65., (2014)
2. Arnon D. Copper enzymes isolated chloroplast, polyphenol oxidase in Beta vulgaris. Plant Physiology, 24:1-15., (1949)
3. Bhardwaj, Mukesh. K., Singh, jogander and Singh, Anjul. Impact of Sulphur di oxide exposure on photosynthetic pigments in Vigna mungo. PollRes.42(1):38 42(2023)
4. Chauhan, A. and Joshi, P.C. Effect of Ambient Air Pollutants on Wheat and Mustard Crops Growing in The Vicinity of Urban and Industrial Areas, New York Science Journal, 3, (2)52-60., (2010)
5. Govind, V.G., Shefali and Sanjita, S.S., Effect of sulphur dioxide exposure on the chlorophyll content in *Raphanus sativus* L. and *Brassica rapa* L., Plant Archives, 2, (2): 165-170., (2002)
6. Irshad, A.H Ahmad, S. and Sultan, P., Effect of sulphur di oxide on biochemical parameter of Spinach (*Spinacea oleracia*), Trakia journal of science, 9, 24-27., (2011)
7. Joshi, N. Chauhan, A.& Joshi, P.C., Impact of industrial air pollutants on some biochemical parameters and yield in wheat and mustard plants, Environmentalist, 29, 398–404., (2009)
8. Khalaf, E. M., Mohammadi, M. J., Sulistiyani, S., Ramírez-Coronel, A. A., Kiani, F., Jalil, A. T., ... & Derikondi, M., Effects of sulfur dioxide inhalation on human health: a review. Reviews on Environmental Health, (0). (2022)
9. Kumar, J. M., Jayabalan, N. and Arockiasamy, D.I., Effect of sulphur dioxide on *Zea mays* L. var. (Co-1) seedlings at lethal dose 50, Physiology and Molecular Biology of Plants, 9, (1)147-151., (2003)
10. Meerabai, G. Ramana, V. Rasheed, M.,Effect of industrial pollutants on Physiology of *Cajanus cajan* (L.) Fabaceae, International Journal Of Environmental Sciences, 2, (4) 1889-1893.,(2012)
11. Muriefah, S.S.A., Al-Jwaizea, N.I. Effect of sulphur dioxide exposure on wheat and barley seedling, Arab. Gulf. J. of Sci., Research, 22, (1) 34- 39., (2004)
12. Özkara, A., Akyıl, D., & Konuk, M.., Pesticides, environmental pollution, and health. In Environmental health risk-hazardous factors to living species. IntechOpen (2016)
13. Padhi, S.K Dash,M. Swain, S.C., Effect of SO_2 on growth, chlorophyll and sulphur content of *Lycopersicon esculentum* L., European scientific journal,9,465-471 .,(2013)
14. Rao, D.N. and Le-Blance, F. Bryologist, 69: 69-75., (1966)
15. Rawat, V., A STUDY ON AIR QUALITY VARIATIONS IN FARIDABAD CITY (Doctoral dissertation, NATIONAL INSTITUTE OF TECHNOLOGY, KURUKSHETRA-136119). (2020)
16. Sharma, A. Sharma, N.L., Impact of SO_2 concentration on growth and biochemical attributes of *Vicia faba* L., International journal of plant sciences, 9, 271-276., (2014)
17. Singh, L.P., Effect of sulphur dioxide on growth, yield and photosynthetic pigments of rice, Bionotes, 4, (2) 35., (2002)
18. Singh, S., Javid, S. and Sayeed, S., Effect of sulphur dioxide exposure on chlorophyll and ascorbic acid in *Vigna mungo*. Bionotes. 5(2) 50., (2003)
19. Tham, K. W., Indoor air quality and its effects on humans—A review of challenges and developments in the last 30 years. Energy and buildings, 130, 637-650. (2016)
20. Verma, M., Agrawal, M. and Deepak, S.S., Interactive effects of sulphur dioxide and mineral nutrient supply on photosynthetic characteristics and yield in four wheat cultivars, Photosynthetica, 38, (1) 91-96., (2000)
21. Winner, W.E., H.A. and Goldstun, R.A. Sulphur dioxide and vegetation: Physiology, ecology, and policy issue. Standard Univ. Press, Stanford, C.A., (1985).

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