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Effect of Various Concentrations of Sulphur Dioxide Pollution on Chlorophyll Pigment of *Pisum sativum* L. (PEA)

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Abstract - More significant are the impacts of SO2 pollution on biochemical and agronomic processes. A lot of people in India and other nations rely on peas (Matar) as a protein source. Sulphur dioxide has a negative effect on pea plant species, causing a decrease in their total biochemical pigments. The present investigation examined the effects of different concentrations of sulphur dioxide on the chlorophyll content of pea plant leaves found reduction in chlorophyll content- chl-a, chl-b at higher concentration of sulphur dioxide.

Keywords: Sulphur dioxide, pea and chlorophyll.

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INRTODUCTION

The undesirable changes in composition of environment regarding the physical, chemical and biological characteristics of air, soil and water is known as pollution. The air pollutants include CO, NOx and SO_2. Out of these gases sulphur dioxide is a major air pollutant. It is an acidic in nature. It is colorless and soluble in water. The melting point of sulphur dioxide is -72^{o}C while the boiling point is - 10^{o}C. Sulphur dioxide is really offensive and overpowering in its odour. The burning of fossil fuels produces sulphur dioxide, a significant phytotoxic and oxidation of sulphur containing raw materials (Iqbal, M. *et al*., 2015). The SO_2 dissolves quickly in water and, because to this features it forms sulphuric acid. This sulphuric acid comes on earth in the way acid rain is formed. The acid rain was 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 and gets converted into sulphite ions and these product affect the metabolism of plant resulting to the plant damage. The sulphuric acid has deleterious effects on growth, productivity, morphology and photosynthetic pigments of plants. After entering in to leaves the Sulphur dioxide ends up in the cells of the mesophyll plant. It has The buildup of sulphur dioxide in chlorophyll cells leads to both short-term and long-term damage. Acute damage alters metabolism, which in turn causes interveinal or marginal necrosis. Plants experience persistent harm from concentrations of SO_2.

REVIEW OF LITERATURE

In their study, Verma and Agrawal (2000) found that photosynthetic pigments in wheat decreased as a result of the combined effects of SO2 and mineral nutrient availability on wheat output. Results showed that Raphanus sativus chlorophyll-a and chlorophyll-b concentrations, as well as the chlorophyll a/b ratio, were significantly reduced after exposure to SO2. Published by Govind et al. in 2002. The impact of SO2 on Oryza sativa growth and photosynthetic contents was discovered by Singh L.P. (2002). Observed a marked decrease in total chlorophyll contents as well as chlorophyll a and b concentrations as a result of SO2's impacts on Zea mays seedling development. (Kumari & Jayabalan 2007). In their study, Singh and Javid (2003) found that when exposed to concentrations of 0.1 and 0.2 ppm SO2, the chlorophyll contents of Vigna mungo significantly decreased. When exposed to SO2, Muriefah and Al-Jwaizea (2004) discovered that it had an effect on in wheat and barley seedlings and discovered reduced levels of protein, chlorophyll, and carotene. The effects of sulphur dioxide on mustard and wheat plants were investigated by Joshi and Chauhan (2009). Ascorbic acid, carotenoids, total chlorophyll, chlorophyll-b, and wheat and mustard plants showed a considerable decline in

these biochemical markers. The effects of air pollution on biological components of Eucalyptus camaldulensis were investigated by Seyyednejad and Koochak (2011). Plants at polluted sites showed increased solubility of two biochemical contents: protein and carbohydrates. When exposed to SO2, certain trees' photosynthetic pigments changed, according to Chauhan (2010). His research showed that both Ficus relegiosa and Mangifera indica have lower chlorophyll a and b levels in their leaves. In their study on the biochemical characteristics of spinach (palak), Irshad & Ahmad Fayz (2011) found that sulphur dioxide reduced the levels of photosynthetic pigments and amino acids. Studying how air pollution affects Cajanus cajan and documenting the results Meerabai and Ramana (2012) found a significant decline in the levels of chlorophyll, ascorbic acid, and relative water content. Research by Padhi and Dass (2013) examined the impact of different amounts of sulphur dioxide on Lycopersicon esculentum growth characteristics, and they discovered a notable shift in chlorophyll content. The 2014 study by Agabire and Akporhonor looked at affects the biochemical and physiological pigments of some plants caused by SO2. Total chlorophyll, ascorbic acid, and proline concentration were found to be lower. In their study on the effects of varying concentrations of sulphur dioxide on the growth and biochemical parameters of Vicia faba L., Sharma & Sharma (2014) found that sulphur dioxide had a negative connection with biomass, shoot growth, and chlorophyll content.

MATERIAL AND METHODS

D.S. College Aligarh was the site of the probe in 2021 and 2022. A company in New Delhi called PUSA supplied the pea seeds. Polythene bags of precisely the right size were used for spreading these seeds. The plants were fumigated with varying concentrations of sulphur after they had germinated for 20 days parts per million, namely 0.1, 0.2, 0.4, and 0.6 ppm. Fumigation of the plants was done in a fumigation chamber that was constructed using aluminium sheets and coated with Perspex. Rao and LeBlanc Method (1966) were used to produce sulphur dioxide. Arnon method (1949) used for evaluation determine the amounts of chlorophyll a and b. One set served as a control, while the other four were subjected to varying concentrations of sulphur dioxide in order to ascertain their effects.

RESULTS

The amount of chlorophyll in the leaves decreased as the SO2 concentration increased. At the 60-day mark after fumigation, chlorophyll-a concentration reductions of up to 23.81% are considered. Plants' chlorophyll a level drops more precipitously as they mature. The chlorophyll content decreased with increasing SO_2 concentration. At the same age, the chlorophyll b concentration of a plant may drop as much as 6.16 percent, with a minimum drop of 4.01%. When exposed to SO2 at 0.7 ppm, plants have a maximum loss of 15.01% in chlorophyll b after 60 days of age. By the 60-day mark, total chlorophyll had dropped by 20.42 percent.

DISCUSSION

Sodium bicarbonate is a significant phytotoxicant and dangerous for plants. The biochemical parameter is most important for plant growth. Keeping this view in mind in present study was to evaluate the results of sulphur dioxide on biochemical parameters of *Pisum sativum*. They results found loss in chlorophyll a and chlorophyll b due to higher concentrations of sulphur dioxide.

Table -1 Changes in chlorophyll content as a function of sulphur dioxide concentration in *Pisum sativum.*

Age of Plants	20 Days					40 Days					60 Days				
SO_2 Concentration (ppm)	0	0.1	0.2	0.4	0.6	0	0.1	0.2	0.4	0.6	0	0.1	0.2	0.4	0.6
Parameters															
Chlorophyll 'a' (mg g 1f.w.)	1.09 ±0.97	1.03 ±0.85	0.99 ±0.93	0.96 ±0.058	0.90 ±0.083	2.60 ±0.41	2.37 ±0.50	2.25 ±0.68	2.20 ±0.61	2.10 ±0.78	4.28 ±0.35	3.82 ±0.27	3.56 ±0.31	3.44 ±0.20	3.26 ±0.37
Chlorophyll 'b' (mg g 1f.w.)	0.986 ±0.65	0.946 ±0.44	0.935 ±0.54	0.927 ±0.78	0.925 ±0.65	1.05 ±0.52	0.970 ±0.89	0.946 ±0.41	0.934 ±0.67	0.922 ±0.67	2.72 ±0.69	2.51 ±0.80	2.41 ±0.78	2.33 ±0.64	2.31 ±0.57
Total Chlorophyll (a+b) (mg g 1f.w.)	2.07 ±0.26	1.97 ±0.12	1.92 ±0.33	1.89 ±0.28	1.83 ±0.058	3.65 ±0.28	3.34 ±0.34	3.19 ±0.62	3.13 ±0.51	3.02 ±0.48	7.01 ±0.71	6.33 ±0.45	5.97 ±0.83	5.77 ±0.74	5.57 ±0.56

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, polyphenoloxidase in Beta vulgaris. Plant Physiology, 24:1-15.,(1949)

[3] 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)

[4] 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)

[5] Iqbal M, Shafiq M, Zaidi S, Athar M., Effect of automobile pollution on chlorophyll content of roadside urban area, Journal of Environment science and management,1, 283-290., (2015)

[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] 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)

[9] 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)

[10] 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)

[11] 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)

[12] Priyadarshni, B. Sujatha, B. Umamahuh, C.H., Morphology and biochemical changes in the leaves of *Cajanus cajan* and *Amaranthus paniculates* under foliar application of aqueous sulphur dioxide, International journal of pharma and bio science,6, 1349-1359.,(2015)

[13] Rao, D.N. and Le-Blance, F. Bryologist, 69: 69-75.,(1966)

[14] Seyyednejad S.M and Koochak H.A., Study on Air Pollution effects on *Eucalyptus camaldulensis*, International Conference on Environmental, Biomedical and Biotechnology, 16, 98-101.,(2011)

[15] Sharma, A. Sharma, N.L., Impact of SO_2concentration on growth and biochemical attributes of *Vicia faba* L., International journal of plant sciences, 9, 271-276.,(2014)

[16] Singh, L.P., Effect of sulphur dioxide on growth, yield and photosynthetic pigments of rice, Bionotes, 4, (2) 35.,(2002)

[17] 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)

[18] 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)

[19] 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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