



## Curriculum Vitae

1. **NAME** : **DR. S.N. SINGH, M.Sc., Ph.D. (BHU)**
2. **POSITION HELD & SCALE** : **Chief Scientist and Area Coordinator  
Plant Ecology & Environmental Science  
Rs. 37400-67000: Grade Pay: 10000**
3. **INSTITUTE** : CSIR-National Botanical Research Institute,  
Lucknow-226 001 (INDIA)
4. **DATE OF BIRTH** : 06.01.1953
5. **CORRESPONDING ADDRESS** : **Dr. S.N. Singh, Chief Scientist & Head**  
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### **6. LEADERSHIP**

**Providing leadership to Environmental Science Division as Head and Area Coordinator for last 15 years for stimulation of R & D activities on different aspects of environmental pollution and bioremediation.**

### **7. Ph.D. STUDENTS SUPERVISED**

Dr. Amitosh Verma  
Dr. Larisha Tyagi  
Ms. Sadhna Tiwari  
Ms. Babita Kumari

A few more students are also registered for Ph.D. degree

### **8. AREAS OF SPECIALIZATION**

- Abatement of urban and industrial pollution through plants
- Environmental Impact Assessment

- Biology of GHG emission
- Ecotoxicology and remediation of industrial wastes
- Biodegradation of xenobiotic compounds

## 9. RESEARCH EXPERIENCE: 32 Years

- Obtained Ph.D. degree in 1978 from the Botany Department, BHU on an air pollution problem *Plant Responses to Cement Dust Pollution* under the supervision of Prof. D.N. Rao (Retired) - an eminent environmentalist.
- Worked as a post-doctoral fellow of C.S.I.R., New Delhi for two years (1979-81) on air pollution problem in relation to plants at Botany Department, B.H.U., Varanasi.
- Appointed as a Scientist at N.B.R.I., Lucknow in 1981 and studied different aspects of air pollution problem in relation to plants in the field and laboratory conditions for biomonitoring and abatement.
- Involved in *Methane Campaign 1991*- an All India coordinated Project: for the *in situ* measurement of methane efflux from the rice-fields for preparation of a methane budget for Indian rice fields.
- Visited U.K. for three months under Bilateral Scientists' Exchange Programme of C.S.I.R. with British Council and worked at Institute of Terrestrial Ecology, Bangor on *plant Response to Elevated levels of CO<sub>2</sub>*.
- Investigated biology of GHG emission from agricultural fields and wetlands.
- Worked on bioremediation of fly ash through microbial interventions
- Presently investigating microbe-based biotreatment and bioremediation of petroleum sludge- a recalcitrant waste of oil refineries.

## 10. RESEARCH PROJECTS COMPLETED

Steered NBRI components of three All India coordinated projects:

- Study of Indian plants in relation to air pollution.*
- Effects of SO<sub>2</sub> and particulates on plants in some industrial/urban areas.* Sponsored by Dept. of Environment, Govt. of India, New Delhi.
- Methane budget from Indian paddy fields.* Sponsored by Dept. of Environment, Govt. of India, New Delhi.
- Investigations on methane efflux from water bodies.* Sponsored by Dept. of Science and Technology, New Delhi.
- Reclamation of fly-ash landfills through successive plantation, soil amendments and/or through integrated biotechnological approach* sponsored by Department of Environment (U.P.).
- Attenuation of automobile generated air pollution by higher plants* sponsored by Department of Environment (U.P.).
- Investigations on GHG emission from agricultural fields and wetlands,* Sponsored by D.o.En & F., New Delhi.
- Bioremediation of fly- ash sites using selected plants and microbial interventions-* a CSIR network project.

i) *Biodegradation of oily sludge by microbes*, CSIR network project.

## 11. ONGOING PROJECTS

- a. **Biotreatment and bioremediation of petroleum sludge - A CSIR network project** (NBRI, NEERI, IICT and RRL, Jorhat).
- b. **Biodegradation of PCBs in *in vitro* and *in situ* conditions - A CSIR network project** (NBRI, IITR, NEERI).

## 12. VISIT ABROAD

**Received British Council Fellowship in 1992 to visit U.K. under Bilateral Exchange programme for three months.**

**Attended an International workshop in 2006 on Agriculture Air Quality: State of the Science held at Washington, DC, USA with full support from Indo-US Science and Technology Forum, New Delhi and also delivered a lecture**

## 13. HONOURS AND AWARDS

**Life Time Achievement Award, called AEB Honour in the field of Resource Management & Environmental Toxicology by Academy of Environmental Biology in 2007.**

## 14. SYMPOSIA/CONFERENCES

Attended a number of national and international symposia/conferences held on various aspects of air pollution and also organized an international conference on **Plants and Environmental Pollution** at NBRI, Lucknow in 1996.

## 15. LECTURES

Delivered 55 invited lectures at conferences/workshops on air pollution, global warming, ozone depletion, methane efflux from rice-fields and wetlands, biogenic emission of GHGs.

## 16. EXAMINERSHIP

Appointed many times as Ph.D. thesis examiner of different Universities of Bhopal, Kanpur, Cuttack, Ujjain, BHU, Binoba Bhave University, Vir Kunvar Singh University etc.

## 17. REVIEWER

Served as a reviewer for the research papers of several journals of India and abroad and also acted as an evaluator for the research projects of C.S.I.R., D.S.T. and D.O.En., New Delhi for financial support.

- **Indian Journals**
  - Current Science

- J. of Environmental Biology
- J. of Air Pollution Control
- J. of Ecophysiology & occupational Health
- J. Environmental Health
- **Foreign Journals**
  - Chemosphere
  - Ecological Engineering
  - Environmental Contamination & Toxicology
  - Agriculture Ecosystem & Environment
  - Global Change Science
  - Bioresource Technology
  - Ecotoxicology
  - Environmental Monitoring & Assessment
  - Water, Soil and Air Pollution
  - Plant Science
  - Environmental & Experimental Botany
  - Plant and soil
  - Journal of soil science and environmental management
  - Journal of environmental conservation
  - Journal of atmospheric science

## **18. EXPERTS**

- i) Served as experts in several technical committees of NBRI and other institutes for assessment promotion of scientists.
- ii) Appointed as an expert by NEDA, UP on the techno feasibility of methane based thermal power plant.
- iii) Appointed as an expert by UP Pollution Control Board for renewal of licenses for EIA and EU work

## **19. MEMBERSHIP OF PROFESSIONAL BODIES/SOCIETIES**

- a) Life member, International Society of Environmental Botanists (ISEB), Lucknow, (INDIA).
- b) Life member, Indian Association of Air Pollution Control, Baroda.
- c) Life member, The Academy of Environmental Biology, Lucknow.
- d) Member, Indian Botanical Society.
- e) Member, Indian Science Congress Association, Calcutta.

## **20. HIGHLIGHTS OF MAJOR SCIENTIFIC CONTRIBUTIONS**

1. A microbe-based phytoremediation technology was developed for bioremediation of metals from fly ash.
2. Development of certified research materials of 16 mono and 3 multi-metal solutions, and gas mixtures was achieved and released for sale and many more CRMs are in the pipeline.

3. Various strategies to contain emission of CH<sub>4</sub> and N<sub>2</sub>O from crop fields were worked out and recommended for field application.
4. N<sub>2</sub>O and CH<sub>4</sub> emission patterns were studied in kharif and winter season from crop fields. Regulating factors of their production and emission from rice and wheat crop fields were investigated and their local budgets were estimated to be 1.64 x 10<sup>6</sup> kg yr<sup>-1</sup> for CH<sub>4</sub> from paddy fields and 1.67 x 10<sup>5</sup> kg yr<sup>-1</sup> for N<sub>2</sub>O from wheat crop.
5. Plant-mediated emission of CH<sub>4</sub> through aquatic plant (*Shoenopectuss subalatus*) was elucidated and published in *Aquatic Botany* in 2000.
6. Methane emission dynamics as regulated by seasons as well as edaphic and plant factors was thoroughly investigated in the wetlands of Lucknow city. A local budget for budget for water bodies was computed to be 2.38 x 10<sup>5</sup> kg yr<sup>-1</sup>
7. A methane budget of 4.3 Tg yr<sup>-1</sup> for Indian paddy fields was prepared to counter the allegation of USA that India is a major contributor to global CH<sub>4</sub> budget due to large area under paddy cultivation.
8. Avenue trees/shrubs of Lucknow were classified into sensitive, moderately tolerant and tolerant species on the basis of air pollution tolerance index
9. A pollution map of Lucknow city was first time prepared on the basis of air pollution levels in different localities to help civil authorities to take remedial measures.
10. Fourteen pollution sensitive plants were also identified to serve as early alarm systems in industries, mainly thermal power plants and oil refineries, for the benefit of human and animal health.
11. Sixty pollution tolerant plants (mainly trees/shrubs) were screened out and the list was released to be used for developing greenbelts in industrial areas and in lung spaces in urban areas for the abatement of polluted atmosphere.
12. Certain mitigating options were worked out to minimize the crop loss by cement dust pollution and safeguard the health of local residents and factory workers.

## 21. RESEARCH PUBLICATIONS (*research papers 81 with impact factor 123.441*)

1. Singh, S. N. and Rao, D. N. (1978). Effect of cement dust pollution on soil properties and on wheat plants . *Indian J. Environ. Hlth.*, 20(3): 258-267.
2. Singh, S. N. and Rao, D. N. (1978). Possibilities of using chlorophyll and potassium contents in plants to detect cement dust-polluted environment. *J. IPHE, India*, 1: 10-13.
3. Singh, S. N. (1980). Synergistic action of particulates and gaseous pollutants on the growth of *Triticum aestivum* L. *J. Expt. Bot.* (UK) 31: 1701-1705. **IF: 4.745**
4. Singh, S. N. and Rao, D. N. (1980). Growth of wheat plants exposed to cement dust pollution. *Water, Air and Soil Pollut.* (USA) 14: 241-249. **IF: 1.676**
5. Singh, S. N. and Rao, D. N. (1980). Growth responses of wheat plants to cement dust polluted environment. *Proc. Indian Natl. Sci. Acad.*, B-46: 325-329.
6. Singh, S. N. and Rao, D. N. (1981). Certain responses of wheat plants to cement dust pollution. *Environ. Pollut.*, (UK) 24: 75-81. **IF: 3.426**
7. Singh, S. N. (1981). Role of foliar urea spray in reducing pollutant injury to plants. *Environmental Conservation*, (Switzerland) 8(3): 183-185. **IF: 1.541**
8. Singh, S. N. and Ahmad, K. J. (1982). The sun pays the energy bill. *Science and Society*, 5(4): 90-94.

9. Singh, S. N. (1983). Alteration in mineral accumulation of *Triticum aestivum* L. exposed to particulate pollution. *Environ. Pollut.*, (UK) 32: 171-177.  
**IF: 3.426**
10. Singh, S. N. (1983). Growth impairment in *Butea monospema* around a cement factory. *New Botanists*, 8: 103-109.
11. Singh, S. N., Yunus, M., Srivastava, K., Kulshreshtha, K. and Ahmad, K. J. (1985). Response of *Calendula officinalis* L. to long term fumigation with SO<sub>2</sub>. *Environ. Pollut.* 39: 17-25.  
**IF: 3.426**
12. Yunus, M., Singh, S. N., Srivastava, K., Kulshreshtha, K. and Ahmad, K. J. (1985). Relative sensitivity of *Calendula* and *Dahlia* to SO<sub>2</sub>. In: *Perspectives in Environmental Botany*, Vol. I (eds.) D. N. Rao, K. J. Ahmad, M. Yunus & S.N. Singh Print House (India), Lucknow. pp. 271-282.
13. Singh, S. N., Yunus, M., Kulshreshtha, K., Srivastava, K. and Ahmad, K. J. (1988). Effect of SO<sub>2</sub> on growth and development of *Dahlia rosea* Cav. *Bull. Environ. Contam. Toxicol.*, (USA) 40(5): 743-751.  
**IF: 0.992**
14. Singh, N., Singh, S.N., Yunus, M., Sharga, A.N., Sharma, S.C. & Ahmad, K.J. (1990). Relative sensitivity/tolerance of some *gladiolus* cultivars to sulphur dioxide. *Ann. Bot.*, (U.K.) 65: 41-44.  
**IF: 3.501**
15. Singh, S.N., Yunus, M. & Singh, N. (1990). Effect of sodium metabisulphite on chlorophyll, protein and nitrate reductase activity of tomato leaves. *The Science of the Total Environment*, (Canada) 91: 269-274.  
**IF: 3.399**
16. Khan, A.M., Pandey, V., Shukla, J., Singh, N., Yunus, M., Singh, S.N. & Ahmad, K.J. (1990). Effect of thermal power plant emissions on *Catharanthus roseus* L. *Bull. Environ. Contam. Toxicol.*, (USA) 44: 865-870.  
**IF: 0.626**
17. Shukla, J., Pandey, V., Singh, S.N., Yunus, M., Singh, N. & Ahmad, K.J. (1990). Effect of cement dust on the growth and yield of *Brassica campestris* L. *Environ. Pollut.*, (U.K.) 66: 81-88.  
**IF: 3.426**
18. Singh, S.N. (1990). Effects of SO<sub>2</sub> and particulates on plants in some industrial and urban areas. Final technical project report of D.O.En., New Delhi.
19. Singh, S.N. (1990). Plants in relation to air pollution. *ENVIS Newsletter* 3(2): 4-6.
20. Ahmad, K.J., Yunus, M., Singh, S.N., Srivastava, K., Singh, N., Pandey, V. & Mishra, J. (1991). Air Pollution and Plants. *CSIR News* 41(5): 170-174.
21. Singh, S.N. (1992). Global change: Greenhouse gas emission in India – 1991 methane campaign (Ed. A.P. Mitra). A Scientific Report – No. 2, June, 1992, CSIR and MoEF, New Delhi.
22. Singh, N., Yunus, M., Singh, S.N. & Ahmad, K.J. (1992). Performance of *Vicia faba* plants in relation to simulated acid rain and/or endosulphan treatment. *Bull. Environ. Contam. Toxicol.* (USA) 48: 243-248.  
**IF: 0.992**
23. Singh, N., Singh, S.N., Yunus, M. & Ahmad, K.J. (1992). A relationship between buffering capacity and acid neutralizing ability of plant foliage. pp. 1023-1032. In:

Proceedings of the symposia on *Precipitation, Scavenging and Atmosphere-Surface Exchange* held at Richland (USA)

24. Misra, J., Pandey, V., Singh, S.N., Singh, N., Yunus, M. and Ahmad, K.J. (1993). Growth response of *Lycopersicon esculentum* Mill. to cement dust treatment. *J. Environ. Sci. Hlth.*, (USA) 28(8): 1771-1780.

**IF: 1.301**

25. Singh, N., Farooqui, A., Pandey, V., Mishra, J., Kulshreshtha, K., Srivastava, K., Singh, S.N., Yunus, M. & Ahmad, K.J. (1993). Heavy metal pollutants and plants - a review. *Applied Botany Abstract*, 13(1): 41-56.

26. Kulshreshtha, K., Farooqui, A., Srivastava, K., Singh, S.N., Ahmad, K.J. & Behl, H.M. (1994). Effect of diesel pollution on cuticular and epidermal features of *Lantana camara* L. and *Syzygium cuminii* L.(Skeels). *J. Environ. Sci. Hlth.*(USA)29(2):301-308.

**IF: 1.301**

27. Pandey, V., Mishra, J., Singh, S.N., Singh, N., Yunus, M. & Ahmad, K.J. (1994). Growth response of *Helianthus annuus* L. grown on fly-ash amended soil. *J. Environ. Biol.* 15(2): 117-125.

**IF : 0.212**

28. Singh, N., Singh, S.N., Yunus, M. & Ahmad, K.J. (1994). Growth response and element accumulation in *Beta vulgaris* L. raised in fly-ash amended soils. *Ecotoxicology*, (USA) 3: 287-298.

**IF: 3.507**

29. Parashar, D.C., Mitra, A.P., Gupta, P.K., Rai, J., Sharma, R.C., Singh, N., Kaul, S., Lal, G., Chaudhary, A., Ray, H.S., Das, S.N., Parida, K.M., Rao, S.B., Kanungo, S.P., Ramasami, T., Nair, B.U., Swamy, M., Singh, G., Gupta, S.K., Singh, A.R., Saikia, B.K., Barua, A.K.S., Pathak, M.G., Iyer, C.S.P., Gopalkrishnan, M., Sane, P.V., Singh, S.N., Banerjee, R., Sethunathan, N., Adhya, T.K., Rao, V.R., Palit, P., Saha, A.K., Purkait, N.N., Chaturvedi, G.S., Sen, S.P., Sen, M., Sarkar, B., Banik, A., Subbaraya, B.H., Lal, S., Venkataramani, S., Sinha, S.K. (1994). Methane budget from paddy fields in India. *Current Science*, 66(12): 938-940.

**IF: 0.8**

30. Pandey, V., Mishra, J., Singh, S.N., Singh, N., Yunus, M. & Ahmad, K.J. (1994). Transfer-experiment studies on two winter annuals around a coal-fired power plant. *Bull. Environ. Contam. Toxicol.*, (USA) 53: 528-535.

**IF: 0.992**

31. Parashar, D.C., Mitra, A.P., Gupta, P.K., Rai, J., Sharma, R.c., Singh, N., Kaul, S., Ray, H.S., Das, S.N., Parida, K.M., Rao, S.B., Kanungo, S.P., Ramasami, T., A.K.S., Pathak, M.G., Iyer, C.S.P., Gopalkrishnan, M., Sane, P.V., Singh, S.N., Banerjee, R., Sethunathan, N., Adhya, T.K., Rao, V.R., Palot, P., Saha, A.K., Purkait, N.N., Chaturvedi, G.S., Sen, S.P., Sen, M., Sarkar, B., Banik, A., Subharaya, B.H., Lal, S., Venkatramani, S., Lal, G., Chaudhary, A. & Sinha, S.K. (1994). Methane emission studies and estimate from Indian paddy fields. In: *Proceedings of the symposium The Netherlands "Non-CO<sub>2</sub> Greenhouse Gases: Why and How to Control?"* pp. 389-404. J. van Ham. *et al.* Kluwer Academic Publishers. The Netherlands.

32. Farooqui, A., Kulshreshtha, K., Singh, S. N., Pandey, V. and Ahmad, K. J. (1995). Photosynthesis, stomatal response and metal accumulation in *Cineraria maritima* and *Centuaria moschata* grown in metal rich soil. *Sci. Total Environ.*, (Canada), 164: 203-207.

**IF: 3.399**

33. Singh, N., Yunus, M., Srivastava, K., Singh, S. N., Padey, V., Misra, J. and Ahmad, K. J. (1995) Monitoring of auto-exhaust pollution by road-side plants. *Environ. Monit. and Assess.* (USA), 34: 13-25.

**IF: 1.356**

34. Parashar, D.C., Mitra, A. P., Gupta, P. K., Rai, J., Sharma, R. C., Singh, N., Koul, S., Ray, H.S., Das, S. N., Parida, K. M., Rao, S. B., Kanungo, S. P., Ramasami, T., Nair, B. U., Swamy, M., Singh, G., Gupta, S. K., Singh, A. R., Saikia, B. K., Barua, A. K. S., Pathak, M. G., Iyer, C. S. P., Gopalkrishnan, M., Sane, P. V., Singh, S. N., Banerjee, R., Sethunathan, N., Adhya, T. K., Rao, V. R., Palit, P., Saha, A. K., Purkait, N. N., Chaturvedi, G. S., Sen, S. P., Sen, M., Sarkar, B., Banik, A., Subbaraya, B. H., Lal, S., Venkataramani, S. Lal, G., Chaudhary, A. and Sinha, S. K. (1996). Methane budget from paddy fields in India. *Chemosphere* (Germany), 33 (4): 737-757.

**IF: 3.253**

35. Singh, S.N. (1996). Inhibition of net photosynthesis in soybean by SO<sub>2</sub> and NO<sub>2</sub> applied alone and in combination. pp. 141-150. In: *Biodiversity and Environment* (eds.) S.K. Agrawal, Swaranlata Tiwari and P.S. Dubey, A.P.H. Publishing Corporation, New Delhi.
36. Farooqui, A., Kulshreshtha, K., Singh S. N., Farooqui, S. A., Yunus, M. and Ahmad, K. J. (1996). Foliar metal content and changes in epidermal traits of *Lagerstroemia parviflora* (L.) Roxb. *Environ. Monit. Assess.* (The Netherlands), 35: 107-115.

**IF: 1.356**

37. Singh, S. N., Kulshreshtha, K. and Ahmad, K. J. (1997). Impact of fly ash soil amendment on seed germination, seedling growth and metal composition of *Vicia faba* L. *Ecological Engineering* (USA), 9: 203-208.

**IF: 2.745**

38. Singh, S.N. (1997). Seasonal dynamics of methane efflux from wetlands. *CSIR Newsletter* 15 July: 185-188.

39. Singh, S.N. (1997). Methane efflux from wetlands. *NBRI Newsletter* 24(2): 18-21.

40. Singh, S.N. (1998). Investigations on methane efflux from water bodies – Final Technical Report, Department of Science and Technology, New Delhi.

41. Agnihotri, S., Kulshreshtha, K. and Singh, S. N. (1999). Mitigation strategy to contain methane emission from rice-fields. *Environmental Monitoring and Assessment* (USA), 58: 95-104.

**IF: 1.356**

42. Kulshreshtha, K., Singh, S. N. and Agnihotri, S. (2000). Existence of micropores on the tiller surface of *Schoenoplectus subalatus* (Vahl.) K. Lye : Portable port for methane emission. *Aquatic Botany* (The Netherlands). 66/3: 241-247.

**IF: 1.497**

43. Singh, S. N., Kulshreshtha, K. and Agnihotri, S. (2000). Seasonal dynamics of methane emission from wetlands. *Chemosphere:Global Change Science* (USA), 2:39-46.

**IF: 2.359**

44. Rai, U.N., Tripathi, R.D., Singh, N., Kumar, A., Pal, A., Ali, M.B. and Singh, S.N. (2000). Amelioration of fly-ash by selected nitrogen fixing blue green algae. *Bull. Env. Contam. Toxicol.* 64(2): 294-301.

**IF: 0.992**

45. Vajpayee P., Tripathi, R.D., Rai, U.N. and Singh, S.N. (2000). Chromium accumulation reduces chlorophyll biosynthesis, nitrate reductase activity and protein content of *Nymphaea alba*. *Chemosphere* 41: 1075-1082.

**IF: 3.253**



46. Vajpayee P., Rai, U.N., Choudhary, S.K., Tripathi, R.D. and Singh, S.N. (2000). Management of Fly-ash landfills with *Cassia surattensis* Burm. : A case study. *Bulletin of Environmental Contamination Toxicology* 65: 675-682.  
**IF: 0.992**
47. Singh, S.N. (2000). Climate change with increasing N<sub>2</sub>O fluxes. In: *Trace Gas Emissions and Plants* (Ed. S.N. Singh), Kluwer Academic Publishers, The Netherlands, pp. 231-248.
48. Vajpayee, P., Rai, U. N., Ali, M.B., Yadav, V and Singh, S.N. (2001). Chromium induced physiological changes in *Vallisneria spiralis* L. and its role in phytoremediation of tannery effluent. *Bull. Env. Contam. Toxicol. (USA)* 67: 246-256.  
**IF: 0.992**
49. Singh, S.N. (2001). Exploring correlation between redox potential and other edaphic factors in field and laboratory conditions in relation to methane efflux. *Environment International (U.K.)* 27: 265-274.  
**IF: 4.79**
50. Kumar, A., Vajpayee, P., Ali, M.B., Tripathi, R.D., Singh, N., Rai, U.N. and Singh, S.N. (2002). Biochemical changes of *Cassia siamea* L. grown on coal combustion residue (fly-ash). *Bull. Env. Contam. Toxicol. (USA)* 68: 675-683.  
**IF: 0.992**
51. Ali, M.B., Vajpayee, P., Tripathi, R.D., Rai, U.N., Singh, S.N. and Singh, S.P. (2002). Phytoremediation of lead, nickel and copper by *Salix acmophylla*: Role of antioxidant enzymes and antioxidant substances. *Bull. Env. Contam. Toxicol. (USA)* 70(3): 166-173.  
**IF: 0.992**
52. Verma, A., Singh, S.N. and Shukla, M.K. (2003). Air quality of trans-Gomti area of Lucknow city, India. *Bull. Env. Contam. Toxicol.* 70:166-173.  
**IF: 0.992**
53. Singh, S.N., Verma, A. and Tyagi, L. (2003). Greenhouse effect and Plants. In: *Current Environmental Issues* (eds. B.B.S. Kapoor, Ahmad Ali, K.K. Singh and Chandrakanta), pp. 261-284, Madhu Publications, Bikaner.
54. Singh, S.N., Verma, A. and Tyagi, L. (2003). Biogenic emission of GHGs from agricultural fields. *Physiology and Molecular Biology of Plants* 9(1): 63-73.
55. Singh, S.N. (2003). Methane efflux and climate change. In: *Air Pollution: Development at what cost?* (eds. Y.T. Jasrai and A. Arya), pp. 129-149, Daya Publishing House, Delhi.
56. Singh, S.N., Verma, A. and Tyagi, L. (2003). Investigating options for attenuating methane emission from Indian rice fields. *Environmental International (U.K.)* 104: 1-7.  
**IF: 4.79**
57. Verma, A., Tyagi, L., and Singh, S.N. (2003). Temporal Variation in Methane Efflux from IR64 Rice Cultivar. *Bull. Environ. Contam. Toxicol. (USA)* 71:212-218.  
**IF: 0.992**
58. Tyagi L., Verma A. and S.N. Singh (2003) Influence of different chemical fertilizers on N<sub>2</sub>O emission from paddy fields; In: *Proceedings of International conference on Water and Environment (Environmental Pollution)*: pp. 223-228.
59. Verma, A. and Singh, S.N. (2004). Air quality status of central and southern regions of Lucknow city, India. *Bull. Env. Contam. Toxicol. (USA)* 73: 497-505.  
**IF: 0.992**
60. Tyagi, L., Verma, A. and Singh, S.N. (2003). Investigation on temporal variations in methane emission from different rice cultivars under the influence of weeds. *Environ. Monit. Assess. (USA)* 93, 91-101.  
**IF: 1.356**

61. Rai Vartika, Vajpayee P., Singh S.N. and Mehrotra S. (2004) Effect of chromium accumulation on photosynthetic pigments, oxidative stress defence system, nitrate reduction, proline level and eugenol content of *Ocimum tenuiflorum* L. *Plant Science* 167 (5): 1159-1169. **IF: 2.05**
62. Baghel VS, Tripathi RD, Ramteke PW, Gopal K, Dwivedi S, Jain RK, Rai UN and Singh SN (2005) Psychrotropic proteolytic bacteria from cold environment of Gangotri glacier, Western Himalaya, India. *Enzyme and Microbial Technology* 36, 654-659. **IF: 2.638**
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