Group name: Plant Ecology and Environmental Science

Group Works On:

1. Objectives
   - Microbial degradation of oily sludge and oil spill over.
   - Microbe-assisted phytoremediation of metals from fly ash.
   - Biology of green house gas emission.
   - Toxicity and tolerance responses of plants to metal and metalloid pollution.
   - Phytoremediation of Geogenic, Urban and Industrial pollution in soil and water.
   - Development of low grain arsenic rice cultivars (safe for human consumption)
     using molecular and chemical approaches.
   - Identification and characterization of contrasting Arsenic accumulating rice lines

2. Goals:
   - Development of a microbial technology for rapid degradation of oily sludge and oil contaminated soils.
   - Development of bacterial consortia for enhancing phytoextraction of metals from fly ash.
   - Mitigation of GHG emission from agricultural fields.
   - Screening of sensitive and tolerant cultivars of selected crops suitable to be grown on metal and metalloid contaminated soil.
   - Strategies for development of low grain arsenic accumulating rice cultivars.
   - Phytostabilization and minimization studies of chromium containing tannery wastewater contaminated sites for safe agriculture.
   - Management of Ganga water pollution through development of constructed wetlands.
   - Biomonitoring and bioremediation of polluted soil and water resources.

3. Competencies:
   - Biodegradation of oily sludge and oil contaminated sites.
   - Microbe assisted phytoextraction of toxic metals.
   - Attenuation of GHG emission from agricultural fields.
   - To monitor, develop and recommend strategies for phytoremediation of metal/metalloid contaminated sites through tolerant plants/crops.

4. Facilities:
   - HPLC-ICP-MS (coupled)
   - HPLC
5. Highlights of Current Research:

Fig 1: Degradation of different fractions of petroleum sludge by microbial consortium in soil amended with vermicompost and inorganic fertilizer during 6 months of incubation.

6. List of Ongoing projects:

NBRI in house Projects

I. INDEPTCH (CSIR Network project BSC0111) till March, 2017 (email: drsn_s@rediffmail.com)

II. Studies on speciation of arsenic in contrasting lines low and high As accumulation of rice: minimization of the translocation of As in the upper parts using phosphate, selenium and iron. DST (Govt. of India) till Sept., 2013, Dr. SaritaSinha (E mail: 

III. Plant-based management of Ganga water pollution: Plantation along the Bank and development of constructed wetland for sewage and waste treatment: phase-I Uttaranchal funded by Ministry of Environment & Forests., Govt. of India, New Delhi Till Dec. 2013, Dr. U.N. Rai (Email: rai_un@rediffmail.com).

IV. Role of thiol and nitric oxide metabolism mediated pathways in arsenic stress in higher plants. (Indo-Spanish Joint research project). DST, Govt of India; till September, 2012; Dr. R D. Tripathi (tripathi_rd@rediffmail.com).

V. Plant based screening technologies for biomonitoring and assessment of heavy metal/metalloid pollution (CSIR Network project) till March, 2012, Dr. R D. Tripathi (tripathi_rd@rediffmail.com).

VI. Development of transgenic rice and hyperaccumulator species for arsenic contaminated (CSIR Network project). March, 2012 (tripathi_rd@rediffmail.com).

Outside Agencies like DBT/DST/MOEF Projects:

Areas Open for Collaboration:

7. Significant achievements:

Upto 11th five year Plan:

- Development of microbial consortia for enhanced degradation of oily sludge and oil contaminated sites.
- A consortium of three bacteria and two fungi was found very effective for degradation of oil sludge in a microcosmic study.
- A bacterial consortium was developed to enhance the phytoextraction of metals from fly ash.
- Several options were worked out to mitigate GHG emission from agricultural fields.
- Identification of oil yielding crop having lowest accumulation of chromium in its seeds and lesser effect on the oil yield (Fig. 1).
- Demonstration of aquatic macrophyte treatment system for tannery wastewater.
• Identified crop/vegetables safe for growing in chromium contaminated sites.
• Phytostabilization of tannery sludge dumps in order to reduce leaching by woody plants and microbial inoculation (Fig 2).
• Stabilization and transformation of chromium during composting of phytoremediated biomass.
• Demonstration of amelioration of toxic metal uptake by essential nutrients.
• PCA analysis of the results of Se & As in grains revealed a site specific affinity of various cultivars to categories of safety. On Chinsurah (a), the safest category A, while at Birnagar (b) except for 8 cultivars all were found grouped as category D; the most unsafe category (Fig. 3 A-C).
• Ceratophyllum demersum, a high accumulator of As synthesized significant amount of metal binding peptides (poly [β-EC] G, the phytochelatins (PCs), catalyzed by phytochelatin synthase. PC synthase gene has been cloned and characterized from C. demersum. (Fig 4).
• Rice plants (IR-64) were transformed using C. demersum PCS for developments of transgenic plant with low grain As accumulation. The lowest grain As level was found in PCS-3 rice line. Over expression of PC Synthase gene reduced the grain As concentration upto 59% than control (41% in the grain) in PCS-3 rice line, in which most of arsenic (327%) was sequestered in root when grown on arsenic laded soils (12 mg/kg) (Fig. 5).

In 12th Five year plan :

8. Recent Publications:


regulation of a set of genes including sulphur assimilation pathway and antioxidant system, Chemosphere, 82, 986–995.


Scientists:

Dr. S. N. Singh (Chief Scientist)
Dr. R.D. Tripathi (Chief Scientist)
Dr. U.N. Rai (Senior Principal Scientist)
Dr. Shekhar Mallick (Scientist)

Technical Staff:

Dr. Mridul Kumar Shukla (TO)
Mrs. Babita Kumari (TA)

Research Fellows/ Project Assistants:

Dr. Sanjay Dwivedi Pool Scientist (CSIR)
Mr. Amit Kumar CSIR-SRF
Ms. Preeti Tripathi CSIR-SRF
Mrs. Sadhna Tiwari CSIR-SRF
Ms. Shweta Mishra CSIR-SRF
Ms. Garima Dixit CSIR-JRF
Mr. Dheeraj Gautam UGC-CSIR-JRF
Mr. Jitendra Kumar Pandey UGC-CSIR-JRF
Mr. Amit Pal Singh CSIR-UGG-JRF
Ms. Sarah Binte Ali UGC-JRF
Ms. Reshu Chauhan Inspire Fellow
Ms. Ruma Ranjan UGC-RGNF-JRF
Mr. Pradyumna Kumar Singh Project – JRF
Mr. Praveen Kumar Jaiswal Project-JRF
Mr. Arvind Kumar Dubey Project-JRF
Mr. Navin Kumari PA II
Ms. Nitanshi Jauhari PA II
Ms. Surbhi Awasthi PA II

**Name of Group Leader:**

**Phone:**

**Mobile:**

**Email:**