

1. Name : Dr. Ritesh Kumar

2. Date of Birth : 26.12.1975

3. Current Position and Address : Scientist  
(with E-mail & Phone no.) CSIR-CIMFR, Barwa Road,  
Dhanbad-826015  
Jharkhand (India)  
Email: [ritesh13@rediffmail.com](mailto:ritesh13@rediffmail.com)  
Phone: 9430136460 / 0326 - 2296168



4. Educational Qualification (Graduation and Above):

Sl No.	Degree/ Certificate	Year of Passing	University/ Institute	Subjects
1.	B. Sc. Engg (Civil Engg.)	1998	Birsa Institute of Technology, Sindri (Vinoba Bhave Univ., Hazaribagh)	Civil Engineering Subjects
2.	M. Tech. (Envtl. Sc. & Engg.)	2000	Indian School of Mines, Dhanbad	Environmental Science and Engineering
3.	PhD (Envtl. Sc. & Engg.)	2009	Indian School of Mines, Dhanbad	Solid Waste Management and Ground Water Pollution
<p><b>PhD Thesis Title:</b> Environmental Assessment of Coal Combustion Residues from a Few Thermal Power Stations</p> <p><b>PhD Guide:</b> Dr (Prof.) Gurdeep Singh, Indian School of Mines, Dhanbad</p>				

5. Work experience:

Sl.	From	To	Designation	Employee Details
1.	14 <sup>th</sup> March,	13 <sup>th</sup> March, 2002	Junior Research Fellow	Indian School of Mines, Dhanbad
2.	14 <sup>th</sup> March 2002	13 <sup>th</sup> March, 2004	Senior Research Fellow	Indian School of Mines, Dhanbad
3.	22 <sup>nd</sup> July, 2004	June, 2008	Scientist B	CSIR-Central Institute of Mining & Fuel Research
4.	July, 2008	Till Date	Scientist C	CSIR-Central Institute of Mining & Fuel Research

6. Area of specialization:

Fly ash Characterization, Solid Waste Management, Testing of Explosives and its Accessories, Coal Bed Methane

7. Honours/Awards received:

- Received “**Young Engineers Award**” - 2010 by IEI (India) Bhubaneswar Chapter in the field of Environmental Engineering.
- The work Development of **first and only approved type emulsions explosive (Powerring) and cord (Powercord) system** suitable for Blasting Gallery method in underground coal mines got patented and later on in 2012 was awarded with “**CSIR Technology Award-2012**”.
- Received 2<sup>nd</sup> prize in the **Poster Presentation** at Acharya P C Ray National Young Scientists’ Conference, Presidency College Kolkata, 17-18 February, 2012.

8. Fellowships/Scholarships:

- Selected for ISM JRF fellowship under ISM JRF Scheme.

9. No. of Research Publications:

- **Papers in journals**

**International Journals**

1. Singh, G., Gupta, S.C., **Kumar, R.**, and Sundararajan, M., 2007, ***Mathematical Modelling of Leachate from Ash Ponds of Thermal Power Plants***, Environmental Monitoring and Assessment Journal, July 2007, Vol. 130, Nos. 1-3, pp. 173-185.
2. Singh, G. S., Gupta, S. K., **Kumar, R.** and Sundararajan, M., 2007, ***Dispersion Modeling of Leachates from Thermal Power Plants***, Journal of Environmental Engineering, Vol. 133, Issue 12, pp. 1088 – 1097, December.
3. Roy, S.K., Singh, R.R., **Kumar, R.** and Dey, U. K., 2007, ***Evaluation of Velocity of Detonation of Permitted Explosives***, International Journal of Blasting and Fragmentation, Vol. 1, No. 1, September, pp. 69-79.
4. S. K. Roy, R. R. Singh, **R. Kumar**, and U.K. Dey, 2008, Effect of using plastic spacers on toxic fume generation by permitted explosives, **The Journal of the Southern African Institute of Mining and Metallurgy**, Vol. 108, 691-699.

5. Roy, S.K., Singh, R.R., **Kumar, R.** and Dey, U. K., 2008, *Studies into the possible use of Air Decking in Solid Blasting in u/g Coal Mines*, Mining Technology, Vol. 117, No. 2, pp.83-92.
6. **Kumar, R.**, 2010, *Study of DTPA Extractable Elements and Available NPK in Coal Combustion Residues Samples from some Thermal Power Stations of Eastern India*, International Journal of Agriculture, Environment & Biotechnology (IJAEB), Vol. 3, No. 3, September, pp. 265-269.
7. **Kumar, R.**, 2010, *Comparative Study of Leachate Characteristics of Pond Ash from Long-term Leaching and Ash Pond Disposal Point Effluent from Chandrapura Thermal Power Station, India*, e-journal of Chemistry, Vol. 7(S1), S131-S136.
8. **Kumar, R.**, 2010, *Leaching Aspects of Coal Combustion Residues from a Coal-Fired Thermal Power Station of India*, Indian Journal of Environmental Protection, Vol. 30, No. 6, pp. 510-523.
9. **Kumar, R.**, 2010, *Mineralogical, Chemical and Morphological Studies of Fly Ashes from Thermal Power Stations of India*, Asian Journal of Water Environment & Pollution, Vol. 7, No. 3, pp. 103-110.
10. Tara, K., Singh, S and **Kumar, R.**, 2014, *Green Banking-Green Marketing-Green Environment*, International Journal of Research Commerce and Management, Vol. 5, No. 3, March.
11. Tara, K., Singh, S and **Kumar, R.**, 2015, **Green Banking for Environmental Management: A Paradigm Shift**, Current World Environment Journal, December, Vol 10, No. 3, pp 1029-1038.
12. Nath, A., **Kumar, R.** and Behura, A., 2015, **Watershed Programme: An Innovative way to Solve Scarcity and provide Security of Water in Rural Areas for Sustainable Human and Social Development – Some Cases**, Current World Environment Journal, December, Vol 10, No. 3, pp 839-847.

#### National Journals

1. Tara, K., Singh, S. and **Kumar, R.**, 2015, **Green Marketing: The New Strategic Imperative by Firms in India**, Indian Journal of Marketing, Vol 45, No. 7, pp 19-34, July.
2. Sharma , S. N., **Kumar, R.** and Chowdhury, B ., 2014, **Contribution to the Determination of Nature of Flame of Coal Based on its Physico-chemical and**

**Thermal Characteristics: A Case Study of Coal of Rajmahal Coalfield, Jharkhand, India**, Minetech, Oct. – Dec., Vol. 35, No. 4, pp. 15-26.

3. **Kumar, R.**, 2014, *Investigation of Chemical and Leaching Characteristics of Pond ashes from Thermal Power Stations of Damodar Valley Corporation, India to ascertain its Bulk Utilization Potential in Underground Mines as a Stowing Material*, Minetech, Vol. 35, No. 2, April – June, pp. 44-56.
4. **Kumar, R.**, Sharma, S. and Chakrabarty, G., 2014, *An Innovative Way of Managing Coal Mine Fires*, Minetech, Vol. 35, No. 1, January – March, pp. 29-34.
5. Nath, A., Tara, K., **Kumar, R.** and Sundararajan, M., 2014, **Innovative Teaching to Promote Academic Excellence for Quality Enhancement**, Journal of Research in Education, Vol. 1, No. 1, December, pp. 31-39.
6. **Kumar, R.** and Sharma, S. N., 2013, *Coal Mine Methane: Prospects, Environmental Issues and Control Measures*, Minetech, Vol. 34, No. 4, pp. 8-11, October - December.
7. Nath, A., Tara, K and **Kumar, R.**, 2013, *Green Education as Dynamic Tool for Building Socio-academic Environment in Schools/Colleges for Excellence*, Journal of Research in Education, Vol. 1, No. 1, December, pp. 31-39.
8. Chakrabarty, G. and **Kumar, R.**, 2013, *Application of Thermal Infra-red Remote Sensing Technique for Coal Fire Detection*, Mining Engineers' Journal, Vol. 15, No. 2, September.
9. Sharma, S. N., **Kumar, R.**, Chowdhary, B. and Trivedi, R., 2013, *Comparative Studies of Analysis on the Quality of '0' Seam Coal (Coal Seam I of Barakar Formation) in the presently developed/working faces of Kuyia and Dohari U/G Mines, Bastacolla Area, Jharia Coalfield*, Minetech, Vol. 34, No. 2, June, pp. 28-38.
10. Sharma, S. N., **Kumar R.** and Sundararajan, M., 2012, *A Study of Physico- chemical Characteristics of Coal from Bastacolla underground Mines in Jharia Coalfield to Ascertain its Quality*, Mining Engineers' Journal, Vol. 14, No. 1, pp. 14-19, August.
11. **Kumar, R.** and Chakrabarty, G., 2011, *Impact of Coal Fires on the Environment*, Minetech, Vol. 32, No. 4, pp. 30-39, Oct.- Dec.
12. Sharma, S. N., **Kumar, R.** and Sundararajan, M., 2011, *Contribution to Determination of Coal Characteristics of some Indian Coals using Proximate Analysis*, Minetech, Vol. 32, No. 4, pp. 40-47, Oct.- Dec.
13. **Kumar, R.**, 2010, *The Study of Long-term Leaching Behaviour of Coal Combustion Residues and their Environmental Implications in Mine Backfilling*, Minetech, Oct.- Dec., Vol. 31, No. 4, pp. 29-36.

14. **Kumar, R.**, 2010, *Coal Mining-Impact, Reclamation and Ecological Restoration: Some Case Studies*, Mining Engineers' Journal, August, pp. 24-27.
  15. Singh, R. R., Roy, S. K., **Kumar, R.** and Kamal, K. P., 2007, *Studies on Deflagration Behaviour on Permitted Explosives*, Mining Engineers' Journal December, Vol. 9, No. 5, pp 10-14.
  16. **Kumar, R.**, Amrit, A. K., Roy, S. K., Mondal, S. K. and Singh, R. R., 2007, *An Overview of Respiratory Diseases in Mining*, The Indian Mining & Engineering Journal, Vol. 80, No. 10, pp. 27-31.
  17. Singh, R. R., Roy, S. K. and **Kumar, R.**, 2007, *Export Promotion of Explosive Products – CIM&FR Initiatives for UN Classification of Dangerous Goods*, Journal of Mines, Metal & Fuel, June-July, pp 178-182.
  18. **Kumar, R.** 2007, *Utilization Potential of Coal Combustion Residues in Indian Mines*, Journal of Mines, Metals & Fuels, June, pp. 19 – 25.
  19. Singh, R.R., Roy, S.K., **Kumar, R.** and Kamal, K.P., 2007, *Studies on Deflagration Behaviour on P<sub>5</sub> Permitted Explosives*, The Indian Mining & Engineering Journal, pp 23 - 29, May-June 2007.
  20. Singh, G., **Kumar, R.** and Kumar, P., 2007, *Assessment of Trace Elements Leaching of Coal Combustion Residues from Bokaro Thermal Power Station*, Journal of Environmental Science & Engineering, Vol. 49, No. 1, Jan., pp. 77 – 86.
  21. Singh, R. R., Roy, S. K. and **Kumar, R.**, 2006, *Deflagration Behaviour of Permitted Explosives*, *Journal of Mines, Metal & Fuel*, Vol 54, Nos. 10&11, Oct-Nov, 2006, pp 206-209.
  22. Roy, S. K., Singh, R.R. and **Kumar, R.**, 2006, *Measurement of Toxic Gases in Post Detonation Fumes generated by Permitted Explosives*, The Indian Mining & Engineering Journal, pp 27- 31, October 2006.
  23. Roy, S.K., Singh, R.R., **Kumar, R.**, Amrit, A. K. and Rao, V. V. R., 2006, *Explosive-Cord System for Blasting Gallery Method*, The Indian Mining & Engineering Journal, Jun-Aug, pp 37-40.
  24. **Kumar, R.** and Singh, G., 2002, *Environmental Evaluation of Coal Combustion Residues of Bokaro Thermal Power Station*, The Indian Mining & Engineering Journal, pp 36 - 44.
- **In conference proceedings:**
    1. **Kumar, R.**, Sharma, S., Sundararajan, M. and Ansari Md. Iqbal, 2016, **Swachh and Swasthya Bharat Abhiyan : A Remedy for Environmental Issues in and around Sugar Industries by Generating Electricity from Its Residues**, In the Proceeding

- of National Seminar on Environmental Issues: Protection, Conservation & Management (EIPCM-2016) at BIT, Sindri, Dhanbad, 26<sup>th</sup>-27<sup>th</sup>, February, pp. 329-338.
2. Sundararajan , M. and Sharma, Sadanand and **Kumar, R.**, 2016, **Estimation of SPM Emission in Air Environment through Empirical Modeling and Remedies for Dust Control in and Around Coal Mining Complexes.** In the Proceeding of National Seminar on Environmental Issues: Protection, Conservation & Management (EIPCM-2016) at BIT, Sindri, Dhanbad, 26<sup>th</sup>-27<sup>th</sup>, February, pp. 207-214.
  3. Ansari Md. Iqbal, Sundararajan , M., Sharma, S., **Kumar, R.** and Kumar, G., 2016, **Utilization of Waste for the Production of Biogas and Electricity in Rural Areas,** In the Proceeding of National Seminar on Environmental Issues: Protection, Conservation & Management (EIPCM-2016) at BIT, Sindri, Dhanbad, 26<sup>th</sup>-27<sup>th</sup>, February, pp. 42-46.
  4. Kodati, P. K., **Kumar, R.** and Rath, I., 2016, **Automated Night Vision Systems for Dumpers in Indian Mines: Safety Lies Ahead,** All India Seminar on Advances in Mine Transport System at BCCL, Community Hall, Koyla Nagar, Dhanbad, 20<sup>th</sup> – 21<sup>st</sup> January, pp. 87-98.
  5. Tara, K., Nath, A. and **Kumar, R.**, 2015, **The Human Element Ethics in Business Research Management,** In the Proceeding of the National seminar on Business Dynamics – A Paradigm Shift in Policies for Sustainability, St. Mary's College, Yousufguda, Hyderabad, 31<sup>st</sup> October pp. 173-178.
  6. **Kumar, R.**, Nath, S., Chakrabarty, G., Prasad, S. and Prasad, M., 2014, **Integrated Watershed Management Approach to Sustainable Human and Social Development: Some Case Studies,** In the Proceedings of National Conference on Governance for Sustainable development and Inclusive Growth: Myths & Realities, Inderprastha Engineering college, Ghaziabad, 14<sup>th</sup> – 15<sup>th</sup> February, pp. 178-185.
  7. Sharma, S. N., **Kumar, R.**, Saini, M. K. and Sundararajan, M., 2015, **CBM in India: A Chronological Scientific Study on Unconventional Energy wit Special Focus on its Origination and Formation,** First International Mining Conference at Hyderabad, 19<sup>th</sup> – 22<sup>nd</sup>, November.
  8. Sharma, S. N., **Kumar, R.**, Chowdhury, B. and Sharma, H. H., 2014, **Environmental Impact Assessment of Systematic Coal Combustion for Energy Development Programme by Thermal Power Plants: A Scientific Approach for Country's Growth,** In the Proceedings of National Conference on Governance for Sustainable development and Inclusive Growth: Myths & Realities, Inderprastha Engineering college, Ghaziabad, 14<sup>th</sup> – 15<sup>th</sup> February, pp. 136-143.
  9. Tara, K., Singh, S. and **Kumar, R.**, 2014, **Bank and Sustainability,** In the Proceedings of National Conference on Governance for Sustainable development and

- Inclusive Growth: Myths & Realities, Inderprastha Engineering college, Ghaziabad, 14<sup>th</sup> – 15<sup>th</sup> February, pp. 14-18.
10. Sharma, S. N., Sundararajan, M., **Kumar, R.** and Choudhury, B., 2013, **Coal Bed Methane: Challenges and Remedies**, In Proceedings of the National Seminar on Mining Agenda for Future, Organized by MEAI in association with NMDC, April 20-21, Hyderabad, pp. 47-61. (This presentation is available on the You Tube, URL is <http://www.hybiz.tv/Sadanand-Sharma---NMDC-Seminar/172958> and <https://www.youtube.com/watch?v=xZ7UEXY-YaM>)
  11. Sundararajan, M., Sharma, S. N., **Kumar, R.** and Kumar, G., 2013, **Beach Placer Mining in India: Challenges and Remedies**, In Proceedings of the National Seminar on Mining Agenda for Future, Organized by MEAI in association with NMDC, April 20-21, Hyderabad, pp. 62-70. (This presentation is available on the You Tube, URL is <https://www.youtube.com/watch?v=bJntu4o551Y> and <http://www.hybiz.tv/Ritesh-Kumar---NMDC-Seminar/172959>)
  12. Tara, K., Singh, S. and **Kumar, R.**, 2013, **Green Banking for Green Environment**, In Proceedings of National Seminar on Energy and Environment for Sustainability (EES-2013), BIT, Sindri, 16-17 March. (*ISBN No.: 978-93-82880-18-9*).
  13. Sharma, S., **Kumar, R.**, Sundararajan, M. and Kumar, G., 2013, **CBM- The Present and Future Energy: Problems and Solutions**, In Proceedings of the National Seminar on Energy and Environment for Sustainability (EES-2013), BIT, Sindri, 16-17 March. (*ISBN No.: 978-93-82880-18-9*).
  14. **Kumar, R.**, Narayan, A. and Sharma, S., 2013, **Environmental Aspects of Vibration of Machines and Tools: Issues and Control Measures**, In Proceedings of the National Seminar on Energy and Environment for Sustainability (EES-2013), BIT, Sindri, 16-17 March. (*ISBN No.: 978-93-82880-18-9*).
  15. **Kumar, R.**, Sundararajan, M. and Sharma, S. N., 2013, **Fuzzy Application in Delineating Damodar Sub-Basin with Reference to Water Quality Indices: An Innovative Approach for Evaluating the Industrial Impact on Grounwater Quality**, In Proceedings of the National Conference on Recent Advances in Mathematics and its Application, RAMA-13, Dept. of Mathemetics, Indian School of Mines, Dhanbad, February 14-16, pp. 383-397.
  16. Sharma, S. and **Kumar, R.**, 2013, **Nature and Distribution of Ash forming Constituents in Coal and its Chemistry**, In Proceedings of the National Seminar on Coal Preparation Technology, CIMFR, Dhanbad, 22<sup>nd</sup> – 23<sup>rd</sup> February.
  17. Sharma, S. and **Kumar R.**, 2012, **Coal: Analysis and its Importance**, In Proceedings of 12<sup>th</sup> Annual Symposium on New Equipment New Technology Management and Safety in Mines and Mineral Based Industries” at Bhubaneswar, Orissa, India, 11<sup>th</sup>-12<sup>th</sup> May, pp. 83 – 86.

18. Nath, A., Tara, K and **Kumar, R.**, 2012, **Improving Teacher's Competencies through Information and Communication Technology**, presented at National Seminar on Application of ICT For Quality Enhancement in Teacher Education, St. Xavier's College of Education, Patna, 10-11 February, 2012.
  19. Nath, A. and **Kumar, R.**, 2011, **A Threat for the future generations of the Country due to Crisis in Quality Teachers and Education: Problems and Solutions**, In Proceedings of the National Seminar on Teacher Education: A National Challenge, 23 – 24 March, 2011, St. Xavier College of Education, Digha Ghat, Patna, Bihar.
  20. **Kumar, R.** and Amrit, A. K., 2009, **Safety Training vis-à-vis Organizational Growth**, In Proceedings of the 1<sup>st</sup> International Seminar and Exhibition for Explosive Atmosphere on Recent Trends in Design, Development, Testing & Certification of Ex-Equipment, 29-31 October (*ISBN No.: 978-81-8465-126-3*).
  21. **Kumar, R.**, Chakrabarty, G., Roy, S. K. and Singh, R. R., 2008, **Impacts of Coal Fires on the Environment**, In Proceedings of the National Seminar on Policies, Statutes & Legislation in Mines – POSTALE 2008, organized jointly by CSIR-Central Institute of Mining & Fuel Research (CSIR-CIMFR), Directorate General of Mines Safety (DGMS) and National Institute of Small Mines (NISM) at CIMFR, Dhanbad, India, 20-21 December.
  22. Roy, S. K., Singh R. R., Dey, U. K., **Kumar, R.**, and Amrit, A. K., 2008, **Air Decking in Solid Blasting and its Effect on Toxic Fume Generation**, In Proceedings of the National Seminar on Environmental Issues on Geotechnics & Mineral Industry, EIGMI-2008, jointly organized by SPFU, Ranchi and BIT, Sindri, 4-5 April, pp.174-179.
  23. Amrit, A. K., **Kumar, R.**, Roy, S. K., and Singh R. R., 2008, **Ergonomics: An Effective Tool of Safe and Healthy Working Environment**, In Proceedings of the National Seminar on Environmental Issues on Geotechnics & Mineral Industry, EIGMI-2008, jointly organised by SPFU, Ranchi and BIT, Sindri, 4-5 April, pp.174-179.
  24. **Kumar, R.** and Singh, G., 2004, **Long-Term Leaching Study of Coal Combustion Residues from TISCO Fluidised Bed Combustion Plant at Jamadoba**, In Proceedings of the National Seminar on Environment Engineering with Special Emphasis on mining Environment (NSEEME), Indian School of Mines, Dhanbad, India, March 19-20, pp197 – 214 (*Published in the special volume of Journal of the Institution of Public Health Engineers, India*).
- Invited/key-note addresses:  
**Kumar, R.**, 2013, **Role of Statistical Models in Environmental Engineering**, Invited Talk presented at UGC Sponsored National Seminar on The Strategic Role of



Mathematics and Statistical Models (NSOMSM – 2013), Organized by PG & Research Department of Mathematics, A.D.M. College for Women (Autonomous), Nagapattinam, Tamil Nadu, 4<sup>th</sup>-5<sup>th</sup> July.  
(Note: This was my 1<sup>st</sup> invited Talk)

• List of best 05 publications:

- i. Singh, G. S., Gupta, S. K., **Kumar, R.** and Sundararajan, M., 2007, *Dispersion Modeling of Leachates from Thermal Power Plants*, Journal of Environmental Engineering, Vol. 133, Issue 12, pp. 1088 – 1097, December.
- ii. Roy, S.K., Singh, R.R., **Kumar, R.** and Dey, U. K., 2007, *Evaluation of Velocity of Detonation of Permitted Explosives*, International Journal of Blasting and Fragmentation, Vol. 1, No. 1, September, pp. 69-79.
- iii. Singh, G., Gupta, S.C., **Kumar, R.**, and Sundararajan, M., 2007, *Mathematical Modelling of Leachate from Ash Ponds of Thermal Power Plants*, Environmental Monitoring and Assessment Journal, July 2007, Vol. 130, Nos. 1-3, pp. 173-185.
- iv. S.K. Roy, R.R. Singh, **R. Kumar**, and U.K. Dey, 2008, **Effect of using Plastic Spacers on Toxic Fume generation by Permitted Explosives**, The Journal of The Southern African Institute of Mining and Metallurgy, Vol. 108, 691-699
- v. Roy, S.K., Singh, R.R., **Kumar, R.** and Dey, U. K., 2008, *Studies into the possible use of Air Decking in Solid Blasting in u/g Coal Mines*, Mining Technology, Vol. 117, No. 2, pp.83-92.

10. Number of Books authored/edited: -

11. (a) No. and details of Patents granted/applied for:

(b) Technologies developed, Licensed and/or commercialized:

**(a) Title of the patent** : **New emulsion explosive and cord system suitable for use in blasting gallery method in underground coal mines**  
Inventors : S.K. Roy, R.R. Singh, **R. Kumar**, V.V.R. Rao & S.K. Nayak  
CSIR Ref. No. : 0156NF2006  
Patent Application No. : 2468DEL2006 dated 16.11.2006 & 10.05.2007

12. Foreign visits: -

13. Details of Professional memberships:

- Life Member of “*Indian Society of Remote Sensing*”, Dehradun.
- Life Member of “*Indian Society of Geomatics*”, Hyderabad.

- Life Member of “*Institution of Engineers*”, India
- Life Member of “*The Indian Mining & Engineering Journal*”, Bhubaneswar.
- Life Member of “*Quality Circle Forum of India*”, Mumbai.
- Life Member of “*Youth Hostels Association of India*”, New Delhi.
- Life Member of “*Indian Society of Environmental Science & Technology*”, Mumbai.
- Life Member of “TRINITY”, Jharkhand.

14. Major contributions: (Max.150 words)

- Development of **first and only approved type emulsions explosive (Powerring) and cord (Powercord) system** suitable for Blasting Gallery method in underground coal mines. This development gave a new life to BG method in India and also paved way for complete phase-out of NG explosives in India. This new explosive is safer in use and thus has got **environmental significance**.
- R&D assistance to explosive industry towards **development of new, improved, environmentally safer (w.r.t. toxic fumes generation and its use) & cost-effective** explosives and accessories.
- **Long-term leaching study** was carried for the first time to understand the residues behaviour in the long run in the field in pond and using the data **empirical equations were developed** for prediction of trace element concentration in the leachate.

15. Technologies and Products/ Services:

- (i) Developed:
- (ii) Licensed:
- (iii) Commercialized:

16. Designs and Prototype Developed: -

17. Honours and awards won for technological contributions or sociological impact of R&D:

- The work Development of **first and only approved type emulsions explosive (Powerring) and cord (Powercord) system** suitable for Blasting Gallery method in underground coal mines got patented and later on in 2012 was awarded with “**CSIR Technology Award-2012**”.

Signature