<u>**Application for the post of "Associate Professor (Natural Resource)"**</u>

SUNIL KUMAR SRIVASTAVA, Ph.D.

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Jaypee University of Engineering & Technology
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EDUCATION

- **Ph.D. (2006)** in Environmental Science from **Jawaharlal Nehru University (JNU, NIRF Ranking 2nd in 2019)**, **India.**
  Topic- *"Study of the Ground Water Quality Variations in the Vicinity of the Selected Landfill Sites in Delhi, India"*
- **M.Phil. (2002) in** Environmental Science from **Jawaharlal Nehru University (JNU, NIRF Ranking 2nd in 2019) (FIRST DIV.), India.**
  Topic- *"Sediment Characteristics of the Achankovil River Basin, Kerala, India."*
- **M.Sc**. **(1999)** in **Analytical Chemistry** from Banaras Hindu University **(BHU, NIRF Ranking 3rd in 2019) (FIRST DIV.), India**.
- **B.Sc. (HONS.) (1997)** in **Chemistry (HONS.)** from Banaras Hindu University **(BHU, NIRF Ranking 3rd in 2019), (FIRST DIV.), India.**

WORK EXPERIENCE

- Assistant Professor (Sr. Grade) in Department of Environmental Engineering/Chemistry, Jaypee University of Engineering & Technology, Guna (July 2008 to till date).
- Guest Faculty "Special center of nanotechnology" Jawaharlal Nehru University, New Delhi (Aug 2018 to Nov. 2018)
- Senior Lecturer, Department of Applied Science, IMS Engineering College, Ghaziabad (July 2007 to June 2008).
- Lecture, Department of Applied Science, IMS Engineering College, Ghaziabad (May 2006 to June 2007).

RESEARCH PROJECT

<u>Project Completed</u>

- Project Entitled as ***"Hydrogeochemical Assessments of Groundwater Quality Using Graphical & Multivariate Statistical Method, Guna District"***
- Funding Agency- MP Council of Science & Technology (MPCOST).
- MPCOST Sanction Letter No. 1203/CST/R&D/Physical & Engineering Science/2016; Bhopal,
- Started on dated: 18/07/2016.
- Research Project Completed: 17/07/2018

<u>Ongoing Project</u>

- Project Entitled as ***"Optimization of Raw-water Treatment plant"***
- Funding Agency -Jaypee Group
- Started on dated: 1st April 2018 (3 Years)

CONSULTANCY

- I am working as Expert member for **DISTRICT ENVIRONMENTAL IMPACT ASSESMENT AUTHORITY (DEIAA)** for Guna, Ashok Nagar and Shivpuri district of M.P. DEIAA is a constitutional body of MINISTRY OF ENVIRONMENT & FOREST, Government of India for looking environmental issues related sand/stone mining up to 5 hectares (**April 2016 to March 2019).**

- I am working as independent consultant for villagers/people of the Guna district for installation of Biogas/ Energy. The objective of this work to "**Make India Clean and Independent in Energy**" (MICIE).

AWARD /SCHOLARSHIP/FELLOWSHIP

- ***Linnaeus-Palme Scholarship*** for the year 2005-2006 by Swedish International Development Cooperation Agency SIDA, Swedish Government for higher study in Subsurface Hydrology, GIS, Groundwater Modeling, Biogeochemistry.
- Qualified ***CSIR / UGC-Junior Research Fellowship NET*** in CHEMICAL SCIENCES (India).
- Qualified ***Combined State Scholarship Examination***- received Scholarship from 1989 to 1993 (India).

<u>LIST OF PUBLICATIONS</u>

<u>2019</u>

1. **Sunil Kumar Srivastava** "*Assessment of groundwater quality for the suitability of irrigation and its impacts on crop yields in the Guna district, India*". Agricultural Water Management 2019 **(Elsevier Pub.)** vol. 216, page 224-241 **(Impact Factor 3.542).**
2. **Sunil Kumar Srivastava.** "*Biogas production from solid waste by using the anaerobic digester-A Review*". Renewable and Sustainable Energy Reviews, 2019 **(Elsevier Pub.)** (Under Revision) **(Impact Factor 9.184).**
3. Surendra Kumar Parashar, **Sunil Kumar Srivastava,** Vijay Kumar Garlapati. *"The mathematical modeling for the optimization of triacylglycerol Acylhydrolases Production Through Artificial Neural Network and Genetic Algorithm"*. International Journal of Pharma and Bio Sciences. Vol. 10 (3), page 135-143.
4. Surendra Kumar Parashar, **Sunil Kumar Srivastava,** Vijay Kumar Garlapati NN Dutta "*Production of microbial enzyme triacylglycerol Acylhydrolases by ASPERGILLUS SYDOWII JPG01 by in submerged fermentation using agroresidues*". Asian Journal of Microbiology, Biotechnology and Environmental Sciences. Vol 21, issue 4 (Accepted 26th May 2019)**.**

<u>2018</u>

5. **Sunil Kumar Srivastava** and AL Ramanathan. "*Geochemical assessment of fluoride enrichment and nitrate contamination in groundwater in hard rock aquifer by using graphical and statistical methods*" Journal of Earth System Science 2018 **(Springer Pub.)** Vol 127, issue 7, pp 104 (1-23) (Impact Factor 1.104). https://doi.org/10.1007/s12040-018-1006-4.
6. Surendra Kumar Parashar, **Sunil Kumar Srivastava,** NN Dutta and Vijay Kumar Garlapati, "*Engineering aspects of immobilized lipases on esterification: A special emphasis of crowding, confinement and Diffusion effects*" Jan. 2018 **(Wiley VCH Pub.)**, Engineering in Life Science, vol 18, page 308-316. DOI: 10.1002/elsc.201700082 (Impact Factor 2.389).
7. **Sunil Kumar Srivastava** and AL. Ramanathan "*Assessment of landfills vulnerability on the groundwater quality located near floodplain of the perennial river and simulation of contaminant transport*". Modeling Earth System and Environment 2018" **(Springer Pub.)** vol 4 Issue 2 page 729-752. DOI: 10.1007/s40808-018-0464-7.

<u>2017</u>

8. Ravi Ranjan, **Sunil Kumar Srivastava** and AL. Ramanathan, "*An assessment of hydrogeochemistry of two wetlands located in Bihar State in subtropical climatic zone of India*". Environmental Earth Sciences, 2017 **(Springer Pub)** vol 76 (1); pp 1-19; doi: 10.1007/s12665-016-6330-x (Impact Factor 1.871).

9. **Sunil Kumar Srivastava** "*Design of anaerobic digester for producing biogas from Municipal Solid Waste"* Poster presentation in International Workshop on Sustainable Energy, *Kalmar Institute of Technology, Sweden, 6-8th Dec. 2017, poster No 20.*

2016

10. **Sunil Kumar Srivastava**, Alok Gautum and Prempal Singh, "Statistical *evaluation of Recovery of copper from ewaste by using Hydrometallurgical Method and RSM model" Journal of Environmental Science, Toxicology and Food Technology*" Oct. 2016, vol 10, issue 7 ver. II pp 31-43. (Impact Factor 1.832).

2012

11. **Sunil Kumar Srivastava** and AL. Ramanathan*" Groundwater in Vicinity of landfill" 2012* (LAMBERT ACADEMIC PUBLISHING), GERMANY, Jan. 2012 ISBN: 9783847328858.

2011

12. Ravi Kant Upadhyay, Anuj Kumar, **Sunil Kumar Srivastava**, Navin Chandra "*Bottom Up approach: A versatile approach nanomaterial synthesis*" Poster presentation in National Conference, Recent Trend in material Science (RTMS) from 8th to 10th October 2011.

2008

13. **Sunil Kumar Srivastava** and AL. Ramanathan, "*Geochemical Assessment of Groundwater Quality in vicinity of Bhalswa landfill using Graphical and multivariate statistical method, Delhi, India*" Environmental Geology, 2008**, (Springer Pub.)** Vol. 53, 1509-1528. (Impact Factor 1.871).
14. **Sunil Kumar Srivastava** and AL. Ramanathan" *Hydro- geochemical studies around the Bhalswa landfill in Delhi, India*" AA Balkema **(Taylor and Francis Group London UK)** "*Groundwater for Sustainable Development: Problems, Perspectives and Challenges (2008) "ISBN:* 9780415407762, ISBN-10: 0415407761 Chap 8, 69-85.

2007

15. **Sunil Kumar Srivastava** and Al Ramanathan," *An Aquifer Vulnerability Assessment Using the DRASTIC Model in Landfill Sites, Delhi, India***"**, in proceeding an international Conference on Coastal Zone Environment and Sustainable Development, Vulnerable, Adaptation and Beyond. (12th to 14th Feb 2007) pp 103.
16. **Sunil Kumar Srivastava** and Al Ramanathan," *An Approach to Manage Groundwater Aquifers Including Coastal City Aquifer of India"*, in proceeding an international Conference on Coastal Zone Environment and Sustainable Development, Vulnerable, Adaptation and Beyond. (12th to 14th Feb 2007) pp 104.

2006

17. Prasad, M.B.K., Ramanathan, AL, **Sunil Kumar Srivastava,** Anshumali and Saxena, R. (2006)." Metal fractionation studies in Surfacial and Core sediments in the Achankovil River basin, India" Environmental Monitoring and Assessment 2006 **(Springer Pub.)** (Volume 121, NO. 1-3, Page 77-102) (Impact Factor 1.959).
18. **Sunil Kumar Srivastava** and Al Ramanathan, *"Hydrogeochemistry of groundwater in vicinity of Bhalswa Landfill, Delhi, India".* In proceeding of International Conference on Groundwater for Sustainable Development, Problem Perspective and Challenges since 1st Feb to 4rth Feb 2006.
19. **Sunil Kumar Srivastava** and Al Ramanathan, *"Simulation of Solute Transport in South Delhi, Using Okhala Phase II as point source, Delhi, India".* In proceeding of International Conference on Groundwater for Sustainable Development, Problem Perspective and Challenges since 1st Feb to 4rth Feb 2006.

2005

20. Rajesh Kumar Ranjan, **Sunil Kumar Srivastava**, Al Ramanathan and Manish Kumar. "*An overview of the Hydrogeochemical Water Quality Model*" (2005) Mathematical Models in Hydro-geochemistry, Assessment of Quality and Management (sept 19th to 5th Oct 2005) (pp 49-59).
21. **Sunil Kumar Srivastava** and Al Ramanathan," *Groundwater Resource Management"*, in proceeding an international workshop conducted by SIS, Jawaharlal Nehru University (7th to 8th April 2005) (unpublished).

22. **Sunil Kumar Srivastava** and AL. Ramanathan, *"Groundwater quality in vicinity of Bhalswa Landfill, Delhi, India"*, in proceeding of National Workshop conducted by IIT, Delhi (18^{th}-19^{th} May 2005).

2004

23. AL. Ramanathan, Prabhakar and **Sunil Kumar Srivastava**, *"An over view of Mathematical Modelling"*, Hands on Training in Mathematical Modelling, Prashant Publishing Co. (2004), New Delhi, India pp 48-57.

Paper Communicated in International Peer-Reviewed Journals

24. **Sunil Kumar Srivastava** "*Assessment of groundwater quality of the Guna district by DRASTIC Modeling*" Environmental Monitoring Assessment **(Springer Pub.)** 2019 (Under-review) (Impact Factor 1.769

Reviewer of International Journal

1. Journal of Hydrology
2. Journal of Applied Geochemistry.
3. Journal of International Geology.
4. Journal of Hazourdous Waste Management

Students working Along with me

Ph. D. Student

1. **Mr. Surrender Parashar (Submitted his thesis in May 2019)**

   Thesis Topic- *Production, Characterization and Immobilization of Fungal Lipase Produced Using Soybean Husk as substrate.*

M. Tech Student

2. **Mr Prempal Singh (Completed in May 2014)**

   Thesis Topic- *Leaching of copper from eWaste*

M. Sc. Student

3. **Ms Shivani Jain (Completed in May 2019)**

   Thesis Topic- *Characterization of Bioplastic Synthesized by Utilizing Soy Waste*

❖ More than 25 students in B. Tech Project

Short Term Course Attended

1. Faculty Development workshop attended on "Materials and Nanotechnology" in SVNIT Surat from 12^{th} July to 16^{th} July 2010, conducted IUCEE (Indo-USA organization).
2. Faculty Development workshop attended on "Computational Fluid Dynamics" in SVNIT Surat from 5^{th} July to 10^{th} July 2010, conducted IUCEE (Indo-USA organization).
3. Participated in the National Workshop on "*Mathematical Modeling of Ground Water Flow and Mass transport through theory and hands on training*," organized by School of Environmental Sciences, J.N.U., New Delhi (12^{th} November to 9^{th} December, 2004).
4. Participated in the National Workshop on "Inter GIS Train the Trainer workshop" organized by School of Environmental Sciences, J.N.U., New Delhi (6^{th} to 8^{th} February, 2005).

Participated/Chair in Conference/Seminars

1. Chaired the International Conference on "Coastal Zone Environment and Sustainable Development, Vulnerability, adaptation and Beyond (2007)" organized by School of Environmental al Sciences, J.N.U., New Delhi (12-14 Feb, 2007).

2. Participated in the Second International Groundwater Conference (IGC-2006) "Groundwater for Sustainable Development, Problem, Perspectives and Challenges," organized by School of Environmental al Sciences, J.N.U., New Delhi (1-4 Feb, 2006).
3. Participated in the National workshop on "Emerging Technology for controlling groundwater pollution: Drinking water Perspectives", IIT Delhi. (19th to 20th May 2006).
4. Participated in the National Workshop on "*Mathematical Modeling of Ground Water Flow and Mass transport through theory and hands on training*," organized by School of Environmental Sciences, J.N.U., New Delhi (12th November to 9th December, 2004).
5. Participated in the National Workshop on "Inter GIS Train the Trainer workshop" organized by School of Environmental Sciences, J.N.U., New Delhi (6th to 8th February, 2005).
6. Participated in the National workshop on "Groundwater Quality, in India", School of Environmental Sciences, Jawaharlal Nehru University, New Delhi Feb, 2002.

Instruments Used During Research-

ICP-OES	ICP-MS	NMR & IR
Carbon –Sulphur Analyser	Atomic Absorption Spectrophotometer (AAS)	HPLC
X-ray Diffractometer	UV-Visible Spectrophotometer	Microscope
Gas Chromatography (GC)	High Volume Sampler (used for sampling of PAH)	Voltammeter.
Flame Photometer	Water Analyser Kit (Different Electrode)	Tintometer

Administrative Experience (18 Years)

1. Member of NAAC pannel in JUET.
2. Co-ordinator for PG courses M.Tech. in Chemisry in in Jaypee University of Engineering & technology, Guna, MP, 2010-till date
3. Co-ordinator of Environmental Engineering unit in Jaypee University of Engineering & technology, Guna, MP, 2008-till date
4. Warden of Jaypee University of Engineering & Technlogy, Guna, MP, 2008-till date.
5. Member ISO Certfication team in IMSEC, Ghaziabad
6. Member of Proctorial Board of IMSEC, Ghaziabad, 2006-2008.
7. Worked as Coordinator for Self-Finance Scheme in Post Graduate Degree College, Baragaon, Varanasi from 1999-2000.

Knowledge of Computers

Have good understanding and knowledge of computers and information technology and have effectively utilized them for research and analytical work and proficient in MS Office, Adobe PageMaker and SPSS. I have good theoretical knowledge and practical experience in handling of software in Groundwater Modeling, Hydrochemistry and GIS Remote sensing. This software is – Visual MODFLOW/MT3D, WATCLAST, AQUACHEM, SURFUR, MAPSCAN, MAPINFO, ARCVIW, SPSS, STATISTICA, PHREEQC, HBV, WASMOD, WASP etc. Working knowledge of Window Operating system.

International Organization Memberships

1. American Chemical Society (ACS), since 2005.
2. UNICEF volunteer organization member, since 2006.
3. World Wildlife Fund (WWF), Delhi, India (Member No. 5140011010002480).

Research Experience

The more than 18 years of research exposure including Ph.D. research work. I am doing research work in the area of “Energy, Solidwaste, Hydrology, Ground Water Modeling, Hydrochemistry and Biogeochemistry of River sediment”. Hydrochemistry work involved the sampling and physio-chemical analysis of sediment and water samples. Simulation of solute transport can be effectively carried out by using Visual MODFLOW/MT3D, provided by Waterloo Hydrological Inc. Canada. I have used Atomic Absorption Spectrophotometer (AAS), HPLC, GC, ICPE-MS, Flame Photometer, Polarimeter, Colorimeter, NMR, IR, UV/Vis Spectrophotometer, XRD etc. during my research work. I have good basic and technical knowledge about these instruments. I have used various Micro-Analytical Technique, Macro-Analytical Technique, Separation Technique and Special Technique.

Innovation in Teaching

Teaching is an art, during teaching we have to care of following points: -

- We know the level (weakness and strength) of students.
- We should provide basic as well as advance knowledge regarding subject matter.
- Tutorial classes should be taken in time.
- Assignments are evaluated within given time frame.
- Show disciplined attitude and make you an ideal-model for students.
- Maintain discipline in class.
- Always consider feedback of students given to you.
- Inform to students their regular progress regarding subject matter

Date- 09/08/2019
Place- Guna **Dr Sunil Kumar Srivastava**

References-

1. Prof. AL. Ramanathan
   Dean (SES, JNU)
   School of Environmental Sciences
   Jawaharlal Nehru University (JNU)
   New Delhi
   E-mail: alr0400@mail.jnu.ac.in
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2. Prof. P.K. Singh (HOD)
   Department of Chemical Engineering /Chemistry,
   Jaypee University of Engineering & Technology (JUET)
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   School of Environmental Sciences
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Assessment of groundwater quality for the suitability of irrigation and its impacts on crop yields in the Guna district, India

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Department of Environmental Science/Chemistry, Jaypee University of Engineering and Technology, A.B. Road, Raghogarh, Guna, MP, India

ARTICLE INFO

Keywords:
Geochemical modeling
Sodium absorption ratio (SAR)
Salinity-hazard
Sodium-hazard
Crop yield

ABSTRACT

This study was performed to understand the impact of groundwater quality on the crop yields and its suitability for the irrigation. The hydrogeochemical assessment indicates chemical weathering is prevalent in the aquifer system. Low sodium-hazard observed in almost all samples. High salinity-hazard observed in the shallow aquifer indicates leaching of contaminants from the surface. Salinity-hazard statistics indicates ~27.60% groundwater suitable for irrigation, ~47.65% groundwater considerable for irrigation of selected crops whose salinity tolerance limit is high, ~13.44% groundwater (fresh-brackish) cause problem in the soil and ~11.31% groundwater unsuitable for the irrigation.

Salinity tolerance limit indicates yield (%) of the few crops remain unaffected. These crops are Hordeum vulgare (Barley), Gossy pium (Cotton), Beta vulgaris (Sugar-beet), Cynodon dactylon (Bermuda-grass), Thinopyrum ponticum (tall Wheat-grass), Thinopyrum intermedium (Wheat-grass) etc. The yield potential (%) partially affected in the few crops like Arachis hypogaea (Groundnut) (~95.30%), Oryza sativa (Rice) (~93.29%), Carthamus tintorius (Safflower) (~97.32%), Sorghum bicolor (Sorghum) (~95.97%), Glycine max (Soybean) (~97.32%), Triticum aestivum (Wheat) (~99.33%), Brassica oleracea var. italica (Broccoli) (~92.62%), Cucumis sativus (Cucumber) (~90.60%), Solanum lycopersicum (Tomato) (~90.60%), Phalaris aquatic (Harding-grass) (~97.96%), Lolium perenne (Perennial ray-grass) (~97.99%), Sorghum drummondii (Sudan-grass) (~92.62%), Festuca arundinacea (tall-Fescue) (~95.30%), Lotus corniculatus (Trefoil-small) (~97.32%), Phoenix dactylifera (Date-palm) (~95.97%), Ficus carica (Fig) (~95.97%), Olea europaea (Olive) (~95.97%), Punica granatum (Pomegranate) (~91.28%) etc. Few crops sensitive to salinity-hazard indicate low-yield potential listed as Phaseolus vulgaris (Bean) (~36.91%), Daucus carota (Carrot) (~36.91%), Fragaria ananassa (Strawberry) (~36.91%). This groundwater is suitable for the irrigation of crops like Barley, Cotton, Sugar-beet, Wheat, Wheat-grass, Bermuda-grass, etc. But this groundwater can be used for irrigation after salinity management for the crops like Groundnut, Rice, Soybean, Broccoli, Cucumber, Tomato, Harding-grass, tall Fescue, Trefoil-small, Date-palm, Fig, Olive, and Pomegranate. The similar range of the crop yields observed in both Soil Water Salinity (SWS) Model and Ayers and Westcot Model, if the salinity of the irrigation water is low (≤1.5 mS/cm). While low reduction in crop yields observed according to SWS Model in comparisons to Ayers and Westcot Model if the salinity of the irrigation water is high (>1.5 mS/cm). The major reduction in crop yields observed in Ayers and Westcot Model, while the moderate decline in crop yields observed in SWS Model at higher salinity. Crop yield in the study area can be improved by implementing proper irrigation water management.

1. Introduction

The yield of field and vegetable crops depends on the quality of soil and water uses in irrigation. Soil quality affected by the various factors like soil type, slope, drainage patterns, types of irrigation, fertilizer, and water uses for irrigation of the crops (Bauder et al., 2011). Assessment of irrigation water quality is essential for the planning of long term management of the crop yields since high electrical conductivity of water (EC_w) causes the inability of the plant to compete with ions in the soil solution (Bauder et al., 2011). Surface water (river, lake, and pond) and subsurface water (groundwater) extensively use for irrigation worldwide. Subsurface water is preferably using worldwide for irrigation purpose due to its easy availabilities in comparison to surface water. The yields of crop significantly affect the quality of irrigation water (Maas and Hoffman, 1977; Bauder et al., 2011; Straten Van et

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[1]Department of Chemical Engineering/Chemistry, Jaypee University of Engineering and Technology, Guna, Madhya Pradesh, India

[2]Department of Biotechnology and Bioinformatics, Jaypee University of Information Technology, Waknaghat, Himachal Pradesh, India

Research Article

Engineering aspects of immobilized lipases on esterification: A special emphasis of crowding, confinement and diffusion effects

Cross-linked enzyme crystal (CLEC) and sol-gel entrapped pseudomonas sp. lipase were investigated for the esterification of lauric acid with ethanol by considering the effects of reaction conditions on reaction rate. The activation energy for the reaction was estimated to be 1097.58 J/mol and 181.75 J/mol for sol-gel and CLEC entrapped lipase respectively. CLEC lipase exhibited a marginal internal diffusion effect on reaction rate over sol-gel lipases and found to be interesting. The overall reaction mechanism was found to conform to the Ping Pong Bi Bi mechanism. The higher efficiency of sol-gel lipases over CLEC lipases in esterification reaction is mainly due to the combined effects of crowding, confinement and diffusional limitations.

Keywords: CLEC lipase / Confinement / Crowding / Diffusion / Ethyl laurate / Sol-gel lipase

Received: April 17, 2017; *revised:* November 8, 2017; *accepted:* January 24, 2018

DOI: 10.1002/elsc.201700082

1 Introduction

Retaining the primary, secondary, tertiary and quaternary structures are prerequisite for enzymes to maintain the catalytic activity under harsh industrial process conditions (high temperature, extreme ph, operation parameters) by devoiding the substrate/ product inhibition. Cross-linked enzyme crystal (CLEC) and sol-gel immobilizations are a choice of interest in protein stabilization techniques and find practical importance in biocatalysis domain [1,2]. Sol-gel entrapped lipases on a thin film of inert support facilitate reuse of enzymes by overcoming diffusion limitations and also the structural aspect makes them an easy usage in enzymatic bioreactors [3–5]. The sol-gel entrapped lipases also avoid the problems incurred during covalent immobilization techniques where strong binding affect the catalytic triad residues or desorption (van der Waals, hydrogen or ionic binding), which usually encountered during conventional immobilization techniques [6]. As entrapped in a thin film of inert support, sol-gel lipases also overcome the activity inhibition by reaction components such as alcohols, water-miscible solvents, high temperatures and pressures sensitivities of lipases. In case of CLEC, the high catalytic activity of purified lipase is immobilized by crosslinking with a suitable crosslinker such as glutaraldehyde [1].

Once lipase interacts with inert support, the conformation will be changed due to the folding/unfolding phenomenon in a crowded and/or confined environment. The free volume space of the lipase is limited either by the dense surrounding biomolecules, or by the small confinements which eventually affect the protein stability in terms of thermal stability, and chemical reactivity [7,8]. Hence, the knowledge of crowding and confinement of proteins on immobilization drive the researcher for better understanding the folding and its stability in crowding and/or confinement conditions. The profound effects of crowding and confinement on the dynamic and functional properties of enzymes and subsequently on the dependent bioprocess have been started to acknowledge by the researchers [9, 10]. Several studies have been carried out using these immobilized benign catalysts in the esterification and transesterification reactions [11–17]. These studies are mainly targeting the selection/ optimization of the process conditions, reaction mechanism and reusability studies by devoiding the crowding and confinement effects on the enzyme stabiity and subsequent bioprocess. Hence, in this paper, we have attempted the relative assessment of CLEC and sol-gel entrapped lipases for esterification of lauric acid with ethanol in terms of crowding and confinement effect on reaction rates along with the selection of process conditions.

2 Materials and methods

2.1 Materials

Lipase from Pseudomonas sp. L9518 containing ≥ 15 U/mg (Sigma), Lauric acid, ethanol, solvents of analytical grade were

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Abbreviations: CLEC, cross-linked enzyme crystal; **PAMS,** poly (ethoxymethyl) siloxane; **PHOMS,** poly (hydroxymethyl) siloxane

J. Earth Syst. Sci. (2018)127:104
https://doi.org/10.1007/s12040-018-1006-4

Geochemical assessment of fluoride enrichment and nitrate contamination in groundwater in hard-rock aquifer by using graphical and statistical methods

SUNIL KUMAR SRIVASTAVA[1,*] and A L RAMANATHAN[2]

[1]*Department of Chemical Engineering/Chemistry, Jaypee University of Engineering and Technology, Guna 473 226, India.*
[2]*School of Environmental Science, Jawaharlal Nehru University, New Delhi 110 067, India.*
**Corresponding author. e-mail: sunil16sster@gmail.com*

MS received 1 September 2017; revised 30 January 2018; accepted 4 February 2018

This systematic study was carried out with objective to delineate the various sources responsible for NO_3^- contamination and F^- enrichment by utilizing statistical and graphical methods. Since Central Ground Water Board, India, indicated susceptibility of NO_3^- contamination and F^- enrichment, in most of the groundwater, NO_3^- and F^- concentration primarily observed >45 and >1.5 mg/L, respectively, i.e., higher than the permissible limit for drinking water. Water Quality Index (WQI) indicates ~22.81% groundwater are good-water, ~71.14% groundwater poor-water, ~5.37% very poor-water and 0.67% unsuitable for drinking purpose. Piper diagram indicates ~59.73% groundwater hydrogeochemical facies are Ca–Mg–HCO_3 water-types, ~28.19% Ca–Mg–SO_4–Cl water-types, ~8.72% Na–K–SO_4–Cl water-types and 3.36% Na–K–HCO_3 water-types. This classification indicates dissolution and mixing are mainly controlling groundwater chemistry. Salinity diagram indicate ~44.30% groundwater under in low sodium and medium salinity hazard, ~49.66% groundwater fall under low sodium and high salinity hazard, ~3.36% groundwater fall under very-high salinity hazard. Sodium adsorption ratio indicates ~97% groundwater are in excellent condition for irrigation. The spatial distribution of NO_3^- indicates significant contribution of fertilizer from agriculture lands. Fluoride enrichment occurs in groundwater through the dissolution of fluoride-rich minerals. By reducing the consumption of fertilizer and stress over groundwater, the water quality can be improved.

Keywords. Hydrogeochemistry; fluoride; nitrate; Guna; hard-rock.

1. Introduction

The nitrate contamination and enrichment of fluoride in groundwater is a very common problem observed worldwide by various researchers (Bohlke 2002; Kundu *et al.* 2008; Jalali 2009; Kyoung-Ho *et al.* 2009; Suthar *et al.* 2009; Akao *et al.* 2014; Subba Rao *et al.* 2016; Sajil Kumar 2017). Nitrate contamination in groundwater occurs due to leaching of nitrate from agriculture lands, sewage effluent or fertilizer sink (Bohlke 2002; Kundu *et al.* 2008; Jalali 2009; Kyoung-Ho *et al.* 2009; Suthar *et al.* 2009; Ngounou Ngatch and Djoret 2010; Akao *et al.* 2014). India is also suffering from nitrate contamination and fluoride enrichment problems (Handa 1975; Sajil Kumar *et al.* 2014; Subba Rao *et al.* 2016). According to UNICEF (1999), India possesses ~14.1% of total fluoride deposits

Published online: 10 September 2018

Environ Earth Sci (2017) 76:16
DOI 10.1007/s12665-016-6330-x

ORIGINAL ARTICLE

An assessment of the hydrogeochemistry of two wetlands located in Bihar State in the subtropical climatic zone of India

Ravi Ranjan[1] · Sunil Kumar Srivastava[2] · A. L. Ramanathan[1]

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Abstract A total of 30 water samples and 8 sediment samples were collected and chemically analysed for major ions (Na^+, K^+, Mg^{2+}, Ca^{2+}, HCO_3^-, SO_4^{2-}, Cl^-, NO_3^-, silica, PO_4^{3-}, F^-), trace elements (Fe, Mn, Ni, Cd, Zn, Pb, Cu), minerals and nutrients to determine the factors that control the chemistry of water in the Kawar-Tal and Kusheshwar-Asthan wetlands in the Bihar State of India. These analyses indicate that Ca^{2+} and HCO_3^- ions are the most dominant ions in both of the wetlands. It also indicates rock weathering is a major source of ions in these wetlands, particularly the dissolution of carbonate minerals. The hydrogeochemistry of water in Kusheshwar-Asthan is favouring kaolinite formation and in Kawar-Tal favouring kaolinite–gibbsite formation. Quartz (~36%), clay minerals (~21%) and chlorite (~10%) are the dominant minerals in both the wetlands. Orthoclase (~12.49%), calcite (~7.51%) and illite (4.89%) minerals are only available in Kawar-Tal surface sediment, while albite (6.29%) and biotite (~13.6%) minerals are only available in Kusheshwar-Asthan. Total carbon (~3%), inorganic carbon (0.9%), organic carbon (~2.1%), total sulphur (~0.0008%), nitrogen (~0.55%) and phosphate (~0.96%) are available in Kawar-Tal surface sediments, while total carbon (~2.38%), inorganic carbon (0.55%), organic carbon (~1.84%), total sulphur (~0.001%), nitrogen (~0.62%) and phosphate (~0.64%) are available in Kusheshwar-Asthan surface sediments. The study indicates wetlands are rich in nutrient for biological activities and are sufficient to support the biodiversity, but few locations are influenced by anthropogenic activities which cause the increase of sulphur, chloride, iron and lead.

Keywords Hydrogeochemistry · Kawar-Tal · Kusheshwar-Asthan · Bihar · Wetland

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Introduction

Wetlands are areas where water is the primary factor controlling the environment and the associated plant and animal life (Ramasar 2007). The UNEP-World Conservation Monitoring Center has suggested that wetlands cover a land area of about 570 million hectares, roughly 6% of the Earth's land surface, of which 2% is lakes, 30% bogs, 26% fens, 20% swamps and 15% floodplains (Ramasar 2007). India has a rich variety of wetland habitats. The total area of wetlands (excluding rivers) in India is 58,286,000 ha or 18.4% of the country, 70% of which comprises areas under paddy cultivation (Green 1990). A total of 1193 wetlands, covering an area of about 3,904,543 ha, were recorded in a preliminary inventory coordinated by the Department of Science and Technology (DST), of which 572 were natural (Green 1990). In a recent review of the India's wetlands, 93 were identified as being of conservation importance (Scott 1989). India's 19 most important wetlands that cover a total area of 648,507 ha have been designated under the convention of wetlands of international importance as being especially significant waterfowl habitats (Ramsar Convention 2003). The interactions of physical, biological and chemical components of a wetland, such as soils, water, plants and animals, enable the wetland to perform

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ORIGINAL ARTICLE

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Assessment of landfills vulnerability on the groundwater quality located near floodplain of the perennial river and simulation of contaminant transport

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Abstract

This investigation was carried out with the objective to understand the impacts of landfill leachate on groundwater quality. This study also explained the movement of trace metals in groundwater by using Visual MODFLOW/MT3D. It also delineates the various factors controlling the suitability of groundwater for domestic, agriculture and drinking purpose. The statistical assessment shows ~ 60.09% groundwater are in good condition, ~ 35.38% in poor condition and 4.53% in very poor condition. The spatial distributions of water quality index (LWQI) around landfills indicate landfills are in depleted condition. Hydrogeochemical classification indicates ~ 90.91% groundwater shows Ca–Na water-type cation facies and Cl^- water-type anion facies. While 9.09% groundwater shows Ca–Na water-type cation facies and Cl^-–SO_4^{2-}–HCO_3^- anion hydrogeochemical facies. The mineral equilibrium diagram of groundwater has revealed that it is in equilibrium with silicate minerals and favors kaolinite formation. The saturation index indicates chrysotile ($Mg_3Si_2O_5(OH)_4$) (2.84), dolomite ($CaMg(CO_3)_2$) (0.45), ferric hydroxide ($Fe(OH)_3$) (1.97–3.58), goethite (FeOOH) (7.86–9.47), hematite (Fe_2O_3) (17.73–20.95), hydroxyapatite ($Ca_5(PO_4)_3OH$) (2.38–4.62), jarosite-K ($KFe_3(SO_4)_2(OH)_6$) (0.22–1.92), cerussite ($PbCO_3$) (0.39), vivianite ($Fe_3(PO_4)_2{\cdot}8H_2O$) (0.39) and willemite (Zn_2SiO_4) (0.35) are reactive mineral in groundwater aquifer of study area. The seasonal and temporal variation indicates anthropogenic influence. The calibration and validation of model show > 90% models correct with 95% confidence. The contaminant transport simulated in groundwater aquifer with the high accuracy (estimated standard error 0.049 m) for the large area (~ 300 km^2). The trends of contour lines of trace metals concentration indicate; it will contaminate study area within few years of its release through the landfill.

Keywords Groundwater modeling · Landfill · LWQI · Contaminant transport · Chemical speciation

Introduction

Water is essential for the survival of all the living being, the most precious gift of nature. Groundwater is one of the major sources of freshwater in the densely populated study area. Increasing demand of groundwater due to ever-increasing population has initiated the need for an effective management of available groundwater resource (Arrieta et al. 2016; Ghiani et al. 2012; Ljunggren 2003; Zhao et al. 2012; Yalew et al. 2016). Further industrialization in all cities and dumping of their effluent/waste in the unplanned landfill causes a great concern to environmentalist (Das 2017; Srivastava and Ramanathan 2008; Jang and Chen 2015; Li et al. 2017; Kumar and Alappat 2005; Jang and Hong 2002).The availability of geogenic trace metal in groundwater in fractured crystalline bedrock aquifers (semiconfined) is the major concern in these areas, which rely on private bedrock borewells for their domestic/agriculture water supply (Ryan et al. 2013; Zheng and Ayotte 2015). The concentration of trace metal further increases in groundwater due to leaching of these metals through unplanned landfill located in the floodplain of the perennial river (Bezama et al. 2007; Finnveden et al. 1995; Radnekova-Yaneva et al. 1995; Jha et al. 2011; Renou et al. 2008; Tchobanouglus et al. 1998; Zamorano et al. 2009; Olaniya et al. 1991; Srivastava and Ramanathan 2012;

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