

Dr. Shailendra Kumar

Professor

Department of Microbiology

Dr. Ram Manohar Lohia Avadh University

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Aim:

To contribute in the **development of Human Resource** for sustainable development of the society

Current Research

- Characterization of antibiotic resistance in waterborne bacteria
- Synthesis, characterization of silver nanoparticles and their role on microbes important for health and agriculture
- Molecular studies of the bacterial blue light photoreceptor protein and its role in modulating growth, virulence and pathogenesis

Academic Profile:

2012: Ph.D. in Microbiology from Dr. Ram Manohar Lohia Avadh University, Faizabad.

Research Topic: Studies on characterization and molecular identification of water borne enteric pathogens from Faizabad region.

Brief Synopsis of Research:

The study was an attempt to assess the physicochemical and microbiological quality of water from various drinking and recreational sources in the region. The physicochemical characterization of water was followed by isolation, biochemical identification, antibiotic resistance and heavy metal tolerance of enteric bacterial isolates from various water sources. The molecular characterization employing RAPD, PCR-RFLP of 16S rDNA, and phylogeny by analyzing sequences of 16S rDNA of representative strains was also carried out.

2000: M.Phil. in Life Science, Jawaharlal Nehru University, New Delhi

One-year pre-M.Phil./Ph.D. course work followed by dissertation on topic: Characterization of *Piriformospora indica*- A Mycorrhiza Like Fungus.

1998: M.Sc. in Microbiology with First Division from Dr. Ram Manohar Lohia Avadh University

The course work included studies on General Microbiology, Agricultural and Environmental Microbiology, Principles of Biochemistry, Instrumentation & Analytical Techniques, Medical Microbiology (Bacteriology, Virology, Mycology & Parasitology) and Immunology, Microbial Genetics, Food & Industrial Microbiology.

Dissertation topic: Antimicrobial properties of Medicinal and Aromatic plants.

1996: B.Sc. (Biology) with First Division from Dr. Ram Manohar Lohia Avadh University, With Botany, Zoology and Chemistry.

Current Research Areas:

- Biosynthesis, characterization and application of nanoparticles
- Characterization of Blue light sensing bacterial protein
- Analysis of water samples for characterization of waterborne enteric pathogens
- Characterization of Multidrug resistance in pathogenic bacteria
- Microbiological treatment of waste water

Honours/Awards:

- INSA VSP 2019 award by Indian National Science Academy to carryout research at Jawaharlal Nehru University on molecular mechanisms of antibacterial properties of silver nanoparticles.
- Young Scientist Award by ICFA 2018 in the International Conference on Food & Agriculture held during 29-31 March 2018 in Dhanbad, Jharkhand, India
- Excellence in Teaching Award honored by Society for Agriculture innovation and Development (SAID), Ranchi (Jharkhand) India during National Conference on Livelihood and Food Security (LFS-2018) on 27-28 January 2018 at Bihar Veterinary College, Patna.
- Distinguished Scientific Award honored by Society for Agriculture innovation and Development (SAID), Ranchi (Jharkhand) India during International Conference on Advances in Agricultural and Applied Sciences for Promoting Food Security on 13-15 May 2017 at Hotel Mirage Lords Inn, Battisputli, Kathmandu, Nepal
- Junior Research Fellowship (JRF), Joint UGC-CSIR JRF/NET, New Delhi (1999).
- JNU-UGC - Junior Research Fellowship during M.Phil. at JNU (1998-2001).

Professional Membership:

- Life Member of Society of Biological Chemists (India).
- Life Membership of Society for Agriculture Innovation & Development, Ranchi
- Life Membership of Association of Microbiologists of India

Research Project Undertaken:

- Successfully completed Research Project entitled “Characterization and molecular identification of Water borne enteric pathogens” funded by University Grants Commission, New Delhi, India (2008-2011).

Teaching & Professional Experience:

- Organized two days National Workshop on Ethics and Values during 02-03 August 2019 at Dr. Rammanohar Lohia Avadh University, Ayodhya
- Organized and attended National Workshop on Research Methodology during 20-26 May 2019, Organized by Internal Quality Assurance Cell (IQAC), Dr. Rammanohar Lohia Avadh University, Ayodhya
- Attended Refresher Course in Environmental Education (ID) during 03-23 February 2017 at Human Resource Development Centre, DDU Gorakhpur University, Gorakhpur
- Attended 7 day Self-Financed Workshop on Flow Cytometry: Applications in Research, Diagnostics and Health Care Innovation during 15-21 December 2015 held at Centre for Medical Diagnostic and research, Motilal Nehru National Institute of Technology, Allahabad.
- Attended Refresher Course in Biotechnology during 16 July to 09 August 2012 at Academic Staff College, Jawaharlal Nehru University, New Delhi
- Attended workshop on bioinformatics at D.Y. Patil University, Navi Mumbai during 21-25th March, 2012.
- Attended Refresher Course in Life Science during 08 January to 02 February 2007 at Academic Staff College, Jawaharlal Nehru University, New Delhi
- Attended Orientation Programme during 01-28 September 2005 at Academic Staff College Lucknow University, Lucknow
- Using Audio-visual methods of teaching since beginning of carrier. Lectures are delivered using multimedia power-point presentations and animations to demonstrate processes in biological system.
- Teaching two papers i) Medical Microbiology & Immunology and ii) Instrumentation & Analytical techniques to M.Sc. students since 2001 through class teaching, seminar, laboratory experiments, discussions, etc.
- Supervising M.Sc. students for their research projects during fourth semester.
- Good experimental skills with working experience on basic microbiology, molecular cloning, gene expression, mutational analysis, electrophoresis analyses, gene sequence analyses, bioinformatic analyses, etc.

Research Publications:

1. Tripathi M, Kumar S (2020). Epidemiology, Treatment and Microbiological Surveillance of SARS-CoV-2. Annual Research & Review in Biology. 35(5): 114-121. ISSN: 2347-565X, NLM ID: 101632869, Doi: 10.9734/ARRB/2020/v35i530230
2. Tripathi M, Pandey R, **Kumar S** (2018). Biodecolorization of Orange II dye by native *Bacillus* sp. and *Staphylococcus* sp. in simulated medium. Journal of Pharmacognosy and Phytochemistry, 7(SP I): 1366-1368.
3. Tripathi M, Haroon M, **Kumar S** (2018). Antibiotic resistance in *E. coli* isolates associated with child diarrhea cases. Journal of Pharmacognosy and Phytochemistry, 7(SP I): 1300-1303.
4. Tripathi M, Kumar S, Kumar A, Tripathi P, **Kumar S** (2018). Agro-nanotechnology: A Future Technology for Sustainable Agriculture. International Journal of Current Microbiology and Applied Sciences, 196-200
5. Tripathi M, Singh S, Ghimire S, Shukla S, **Kumar S** (2018). Effect of Social Media on Human Health. Virology & Immunology Journal, ISSN:2577-4379, 2(2):000114
6. Tripathi M, Singh DN, Vikram S, Singh VS, **Kumar S** (2018). Metagenomic Approach towards Bioprospection of Novel Biomolecule(s) and Environmental Bioremediation. Annual Research & Review in Biology, ISSN: 2347-565X 22 (2), 1-12, DOI: 10.9734/ARRB/2018/38385
7. Tripathi M, Kumar A, **Kumar S** (2017). Characterization of Silver Nanoparticles Synthesizing Bacteria and Its Possible Use in Treatment of Multi Drug Resistant Isolate. Frontiers in Environmental Microbiology, ISSN:2469-7869 (Print); ISSN: 2469-8067 (Online), 3 (4), 62-67
8. **Kumar S** and Tripathi M (2017). Antibiotic Resistant Bacteria: A Global Menace. Virology & Immunology Journal, ISSN:2577-4379, 1(3):000118
9. **Kumar S**, Tripathi VR, Vikram S, Kumar B, Garg SK (2017). Characterization of MAR and heavy metal-tolerant *E. coli* O157: H7 in water sources: a suggestion for behavioral intervention. Environment, Development and Sustainability, ISSN: 1387-585X (print) 1573-2975 (online), 1-15, doi.org/10.1007/s10668-017-9998-5
10. Kumar V, Tripathi VR, Tripathi M, **Kumar S** (2017). Endoproteolytic and bacterial extracellular protease inhibitor extracted from *Pongamiapinnata* seed. Progressive Research– An International Journal 12 (Special-II), 1636-1639

11. Tripathi M, Kumar A, Yadav SK, **Kumar S** (2017). Decolorization and Dechlorination of Pulp-Paper Mill Effluent by Augmentation of Native Isolates of *Bacillus* and *Roultella* Spp. Progressive Research-An International Journal 12 (Special-1), 1173-77
12. Tripathi VR, Sahashrabuddhe AA, **Kumar S**, Garg SK (2014). Purification and characterization of a trypsin inhibitor from *Senna tora* active against midgut protease of podborer. Process Biochemistry.49(2)347-355 (IF: 2.89). ISSN:1359-5113
13. **Kumar S**, Tripathi VR, Garg SK (2013). Antibiotic resistance and genetic diversity in waterborne enterobacteriaceae isolates from recreational and drinking water sources. International Journal of Environmental Science and Technology,10(4):789-798. DOI: 10.1007_s13762-012-0126-7. (IF 1.88). ISSN:1735-1472 (print) 1735-2630 (online)
14. Tewari S, Tripathi M, Ramteke PW, **Kumar S**, Garg SK (2013). Plasmid mediated transfer of antibiotic resistance and heavy metal tolerance in thermotolerant water borne coliforms. African Journal of Microbiology Research DOI: 10.5897/AJMR12.1563. (IF 0.58). ISSN:1996-0808
15. Garg SK, Tripathi M, **Kumar S**, Singh SK, Singh SK (2012). Microbial dechlorination of chloroorganics and simultaneous decolorization of pulp-paper mill effluent by *Pseudomonas putida* MTCC 10510 augmentation. Environmental monitoring and assessment 184 (9), 5533-5544. (IF 1.68). ISSN:0167-6369 (Print) 1573-2959 (Online)
16. **Kumar S**, Tripathi VR, Garg SK (2012). Physicochemical and microbiological assessment of recreational and drinking waters. Environmental Monitoring and Assessment. 184(5): 2691-2698. (IF 1.68). ISSN:0167-6369 (Print) 1573-2959 (Online)
17. Tripathi VR, **Kumar S**, Garg SK (2011). A study on trypsin, *Aspergillus flavus* and *Bacillus* sp. protease inhibitor activity in *Cassia tora* (L.) syn *Senna tora* (L.) Roxb. Seed extract. BMC Complementary and Alternative Medicine. 11: 56. (IF 2.28). ISSN:1472-6882
18. **Kumar S** (2010). Characterization of *E. coli* isolates from diarrhea samples and their antibiotic sensitivity assay. International Research Journal of Commerce, Arts and Science. 183-192.ISSN: 2319-9202
19. **Kumar S** (2010). Molecular methods for characterization and identification of *Salmonella* spp.: A review. International Research Journal of Management Science and Technology.203-213.ISSN:2348-9367 (Print)2250-1959(Online)

20. **Kumar S** (2009). Bacteriological quality of water. *Spectrum: Journal of science and society for sustainable development*. 07-13.
21. Naraian R, Sahu RK, **Kumar S**, Garg SK, Singh CS, Kanaujia RS (2009). Influence of different nitrogen rich supplements during cultivation of *Pleurotus florida* on corn cob substrate. *Environmentalist*. 29: 1-7.

Book Chapter:

1. **Kumar S**, Garg SK, Varma A (2003). *Piriformosproa indica*: A novel fungus. In: *Frontiers of fungal diversity in India*. (Eds: Rao GP, Manoharachari C, Bhat DJ, Rajak RC and Lakhnopal TN). International Book Distributing Co., India. pp: 391-400.
2. Tripathi M, **Kumar S**, Yadav SK (2017). Rhizospheric microorganisms: A bioweapon agent for sustainable agriculture. In: *Environmental Issues पर्यावरणीय मुद्दे: बहुआयामी परिप्रेक्ष्य* (Eds: Yadav L and Tripathi G), Adhyayan publisher and Distributors, New Delhi, India, pp: 127-132.
3. Tripathi M, **Kumar S**, Yadav SK, Pandey R, Tripathi P, Verma M (2019) *Modern Biological Methods for Treatment of Tannery Effluent*, In: *Microbial Treatment Strategies for Waste Management*, OMICS Int. Publisher, UK. ISBN: 978-1-63278-079-9, DOI: 10.4172/978-1-63278-069-9.
4. Tripathi M, **Kumar S**, Verma T, Singh S, Shukla N, Pandey R, Kaur R and Kaur M (2020). *Microbial and Nutritional Approaches towards Sustainable Agriculture Development*. In: *Importance of Biotechnology in Food Production and Food Security* (Eds: Verma T and Prasad S), Shree Publishers & Distributors New Delhi, pp: 113-134.
5. **Kumar S** and Fatima S (2020). *Anaerobes: The Essential Commensal Microbiota of Ruminants*. In: *Anaerobes and anaerobic Process* (Eds: Ranade D and Om Prakash), New India Publishing Agency – NIPA (New Delhi) (in Press).
6. Tripathi M, **Kumar S**, Singh DN, Pandey R, Pathak N, Fatima H (2020) *Bioremediation of Dye Contaminated Soil*, In: *Soil Bioremediation: An Approach Towards Sustainable Technology* (Eds. Parray J, Sayyed R, Abdallah E), Wiley-Blackwell, ISBN: 9781119547952.

5. **Kumar S** (2018). Microbiologically synthesized silver nanoparticles: characterization and its possible application for enhancement in activity of antibiotics. Presented an **invited talk** during (NCECM-2018) held on 03-04 October 2018 at Dr. Ram Manohar Lohia Avadh University, Faizabad.
6. **Kumar S** (2018). Rhizospheric bacteria: An important bio-tool for sustainable agriculture. Presented a paper during the International Conference on Food & Agriculture held on 29-31 March 2018 at Dhanbad, Jharkhand.
7. **Kumar S** (2018). Biosynthesis of Silver Nanoparticles & its use against bacterial pathogens. Presented an **Invited talk** during International symposium on Environmental, Educational and Biological Research for Human Welfare (EEBRHW)-2018 held on 25-26 March 2018 at BHU, Varanasi.
8. **Kumar S**, Tripathi M (2018). Nanotechnology: An effective tool for improved agriculture. Presented an **invited talk** during Biosangam 2018 An International Conference on Innovations and Translational Dimensions: Food, Health and Environmental Biotechnology held at Motilal Nehru National Institute of Technology, Allahabad on 09-11 March 2018.
9. **Kumar S** (2017). Multi Drug Resistance in Bacterial Isolates from Dental Plaque: A Suggestion for Behavioral Intervention. Paper Presented in Microbes for Sustainable Development: Scope & Applications (MSDSA-2017) during 58th Annual Conference of Association of Microbiologists of India 2017 held at Babasaheb Bhimrao Ambedkar (A Central) University Lucknow, (U.P) on 16-19 November 2017.
10. **Kumar S**, Sharma M (2015). Multiple antibiotic resistant *Salmonella sp.* isolates from drinking water Samples. Poster presented in 56th AMI Conference at JNU, New Delhi held during December 07 to 10, 2015.
11. **Kumar S**, Tripathi VR, Garg SK (2015). Multidrug Resistant *E. coli* O157 isolates from recreational and drinking water sources. Paper presented at National conference entitled "Biotechnology and Human Welfare: New Vistas" held at VBS Purvanchal University, Jaunpur (U.P.) during March 21-22, 2015.
12. **Kumar S**, Monika Patel, Suman Yadav, Farheen Khan, Jagdeesh Prasad (2015). Drug Resistance in bacterial isolates from dental plaque. Paper presented at International Symposium Innovations in Educational, Environmental & Health Research (ISIEEHR-2015) held at Banaras Hindu University, Varanasi (U.P.) during February 23-24, 2015.

13. **Kumar S**, Tripathi VR, Garg SK (2014). Antimicrobial effect of protease inhibitor from *Senna tora* seed. Paper presented at Lucknow Science Congress held at Babasaheb Bheemrao Ambedkar University, Lucknow during March 27-28, 2014.
14. **Kumar S**, Patel M, Yadav S, Khan F, Prasad J, Tripathi VR (2014). Microbial diversity in oral cavity and their antibiotic resistance: A threat. Invited Lecture presented in National Conference on Diversity and Physiology of Desert Fauna held at Jai Narain Vyas University, Jodhpur during February 7-8, 2014.
15. **Kumar S**, Tripathi VR, Garg SK (2013). Multi drug resistance in waterborne *Enterobacteriaceae* pathogenic isolates. Paper presented in 1st International Forum on Asian Water Environment Technology held at JNU, New Delhi during December 18-20, 2013.
16. Tripathi VR, **Kumar S**, Garg SK (2013). Antimetabolic effects of *Senna tora* trypsin inhibitor on pod borer *Helicoverpa armigera*. Paper presented in International conference on Health, Environment and Industrial biotechnology 'Biosangam' held at MNNIT, Allahabad, during November 21-23, 2013 (Awarded best oral presentation in agricultural biotechnology)
17. **Kumar S**, Tripathi VR, Kumar V (2013). Perils of neglecting waterborne diseases in India. Paper presented in 9th Annual Conference of Uttar Pradesh and Uttarakhand Economic Association (UPUEA) held at Dr. Ram Manohar Lohia Avadh University, Faizabad during October 26-27, 2013.
18. **Kumar S**, Tripathi VR, Garg SK (2011). Antibiotic sensitivity and molecular characterization of *Enterobacteriaceae* isolates in recreational and drinking water sources. Paper presented in Conference on "Environmental Problems in India and challenges to Plant Biologist" held at UP College Varanasi during February 4-5, 2011.
19. **Kumar S**, Tripathi VR, Garg SK (2010). Microbiological assessment of water quality and enteric isolates from different water sources in Ayodhya-Faizabad region. Poster presented in 51st AMI held at BIT Mesra, Ranchi during December 14-17, 2010.
20. **Kumar S**, Garg SK, Varma AK (2002). Effect of commonly used fungicides on *Piriformospora indica*- a mycorrhiza like fungus. Paper presented at National Conference on Environmental Biology at Saurashtra University, Rajkot (Gujrat), during October 17-18, 2002.

Number of M.Sc. Dissertation Supervised: 20

Ph.D. Supervised (Enrolled): 01

Guest Lecture Presentations:

- Lectures on “HIV/AIDS” and “Health & Hygiene” to cadets of 10/65 Coy NCC, Dr. Ram Manohar Lohia Avadh University, Faizabad (19 December 2016)
- Lectures on “Introduction of Immunology”, “Cells and Organs of Immune system”, “Nonspecific and Specific host defense”, “Antibody diversity”, “Expression of B and T cells” delivered at Department of Biotechnology, V.B.S. Purvanchal University, Jaunpur (28-29, September 2012).
- Invited lectures on “Microscopic Techniques” and “Genetically Modified Organisms” Department of Environmental Microbiology, Babasahab Bheemrao Ambedkar University, Lucknow (October 2010).
- Invited lectures delivered on the topics “Hydrophobia: Rabies” (2008), “Role of Immune System in HIV Infection” (2008), “Quality of water: Microbiological Aspects” (2009), “Secondary infections in AIDS patients” (2009) at Department of Microbiology, KNIPSS, Sultanpur.
- Series of guest lectures on “Medical Bacteriology” Department of Biotechnology, Dr. Ram Manohar Lohia Avadh University, Faizabad (2006-2008).
- Lectures on “Confocal Laser microscopy: working and applications” Munshi Raghunandan Prasad Patel Mahila Degree College, Barabanki (December 2007).

Member Editorial Board:

- Spectrum: Journal of science and society for sustainable development

Reviewer:

- World Journal of Microbiology & Biotechnology
- Environmental Development and Sustainability

Science Outreach Activities:

- Presentation of talk on the topics “जल संकट से बचाव एवं उपाय”, “एंटीबायोटिक दवाओं की बढ़ती निष्क्रियता” and “सूक्ष्मजीवों का हमारे जीवन पर प्रभाव” on All India Radio, Faizabad during 2016-2017.
- Delivered Lecture on “Careers in Biology” to class XI & XII students at J.B. Academy, Faizabad on 19th July 2017.
- Awareness programme for rural public on health and hygiene to safeguard from infectious diseases.

- Awareness programme for children by presentations and demonstration of bacteria in various foods, water and biological samples to school children.

Consultancy Services:

- Water quality analysis

Board Membership:

- Member of Board of studies in the department, Dr. Ram Manohar Lohia Avadh University, Faizabad
- Member of board of Science faculty of university
- Member of several committees of the university as assigned time to time.

Department Developmental Activities:

Carried out the execution of the following departmental grants from DST-FIST and Government of U.P.

- DST-FIST Level-I (2000-2005)
- Centre of Excellence (2009-2011)
- DST-FIST Level-I (2011-2014)

Administrative Responsibilities:

- Convener or SWAYAM, NAAD, DIGITAL INDIA, SHODH GANGA, Spoken Tutorials, Since November 2019
- Convener or AISHE, Since November 2019
- Convener Rakshak App- Since August 2019
- Convener SC/ST cell Since 2018
- Department Store responsibility- 2001-2009; 2014-2017
- Assistant Proctor- 2001-2002
- Assistant Dean Students Welfare- 2009-2011; 2017-till date
- Care Taking Officer (NCC)- October 15, 2009 to November, 2011
- Superintendent, Saryu Boys Hostel, September 2016- 2018

Nodal Coordinator:

- J.E.E. B.Ed. Entrance Exam 2018 for Faizabad Centre

Examination Observer:

- In the capacity of observer conducted several examinations of MBBS/BDS/MD/MS at Era's LMC, Carrier Dental College, Sardar Patel Dental

College, Lucknow, Chandra Dental College, Hind Institute of Medical Sciences, Barabanki.

- Ph.D. Entrance Examination of the University conducted on 25th may 2018.

Examination Superintendent:

- Back paper Examinations, December 9, 2012
- Semester Examinations, December, 2012
- M.B.A./B.B.A./ B.C.A./M.P.Ed. Examinations, Feb-Mar, 2012
- Joint B.Ed. Entrance Examination 2013, April 24, 2013
- Main Annual Examinations, May, 2013
- Semester Examinations, May, 2012
- M.B.A./B.B.A./ B.C.A./M.P.Ed. Examinations, June, 2013
- M.Ed. Entrance Examination 2012
- M.Ed. Entrance Examination 2013, July 07,2013
- Back paper Examinations, November 29, 2013
- U.P. Police Recruitment Board Exam December 15, 2013
- M.B.A./B.B.A./ B.C.A./M.P.Ed. and residential coursessemester Examinations, Jan, 2014

Participation in Admission Examination Work:

- Assistant Coordinator in Residential Courses Admission Test (RCAT) 2010.
- Active Participation in admission test for admission to M.Sc. programme in Microbiology, Biochemistry and Environmental Sciences during session 2002-2003.
- Deputy Coordinator in Residential Courses Admission 2020



(SHAIENDRA KUMAR)

S.No.	Department	Name of the Teacher	Designation	D.O.B	Post Type (Regular / Contract / Guest)	Date of Joining in this University	Total Teaching Experience	Professional Experience	Research Experience	Total Publication till Date	Publication During Last 05 Years	Project/Patent/ Awards During Last 05 Years	E-Contents Developed During Last 02 Years
1.	Microbiology	Prof. Shailendra Kumar	Professor & Head	07/12/1975	Regular	11/04/2001	19 Years	-	22 Years	21 (Annexure I)	11 (Annexure II)	INSA-VSP 2019 Fellowship (Annexure III)	M.Sc. Medical Microbiology, Immunology, Analytical methods and Bioinformatics PPT Presentations for class and e-notes (Annexure IV)

Publications of Shailendra Kumar

1. Tripathi M, Kumar S (2020). Epidemiology, Treatment and Microbiological Surveillance of SARS-CoV-2. Annual Research & Review in Biology. 35(5): 114-121. ISSN: 2347-565X, NLM ID: 101632869, Doi: 10.9734/ARRB/2020/v35i530230
2. Tripathi M, Pandey R, **Kumar S** (2018). Biodecolorization of Orange II dye by native *Bacillus* sp. and *Staphylococcus* sp. in simulated medium. Journal of Pharmacognosy and Phytochemistry, 7(SP I): 1366-1368.
3. Tripathi M, Haroon M, **Kumar S** (2018). Antibiotic resistance in *E. coli* isolates associated with child diarrhea cases. Journal of Pharmacognosy and Phytochemistry, 7(SP I): 1300-1303.
4. Tripathi M, Kumar S, Kumar A, Tripathi P, **Kumar S** (2018). Agro-nanotechnology: A Future Technology for Sustainable Agriculture. International Journal of Current Microbiology and Applied Sciences, 196-200
5. Tripathi M, Singh S, Ghimire S, Shukla S, **Kumar S** (2018). Effect of Social Media on Human Health. Virology & Immunology Journal, ISSN:2577-4379, 2(2):000114
6. Tripathi M, Singh DN, Vikram S, Singh VS, **Kumar S** (2018). Metagenomic Approach towards Bioprospection of Novel Biomolecule(s) and Environmental Bioremediation. Annual Research & Review in Biology, ISSN: 2347-565X 22 (2), 1-12, DOI: 10.9734/ARRB/2018/38385
7. Tripathi M, Kumar A, **Kumar S** (2017). Characterization of Silver Nanoparticles Synthesizing Bacteria and Its Possible Use in Treatment of Multi Drug Resistant Isolate. Frontiers in Environmental Microbiology, ISSN:2469-7869 (Print); ISSN: 2469-8067 (Online), 3 (4), 62-67
8. **Kumar S** and Tripathi M (2017). Antibiotic Resistant Bacteria: A Global Menace. Virology & Immunology Journal, ISSN:2577-4379, 1(3):000118
9. **Kumar S**, Tripathi VR, Vikram S, Kumar B, Garg SK (2017). Characterization of MAR and heavy metal-tolerant *E. coli* O157: H7 in water sources: a suggestion for behavioral intervention. Environment, Development and Sustainability, ISSN: 1387-585X (print) 1573-2975 (online), 1-15, doi.org/10.1007/s10668-017-9998-5
10. Kumar V, Tripathi VR, Tripathi M, **Kumar S** (2017). Endoproteolytic and bacterial extracellular protease inhibitor extracted from *Pongamiapinnata* seed. Progressive Research– An International Journal 12 (Special-II), 1636-1639

11. Tripathi M, Kumar A, Yadav SK, **Kumar S** (2017). Decolorization and Dechlorination of Pulp-Paper Mill Effluent by Augmentation of Native Isolates of *Bacillus* and *Roultella* Spp. Progressive Research-An International Journal 12 (Special-1), 1173-77
12. Tripathi VR, Sahashrabuddhe AA, **Kumar S**, Garg SK (2014). Purification and characterization of a trypsin inhibitor from *Senna tora* active against midgut protease of podborer. Process Biochemistry.49(2)347-355 (IF: 2.89). ISSN:1359-5113
13. **Kumar S**, Tripathi VR, Garg SK (2013). Antibiotic resistance and genetic diversity in waterborne enterobacteriaceae isolates from recreational and drinking water sources. International Journal of Environmental Science and Technology,10(4):789-798. DOI: 10.1007_s13762-012-0126-7. (IF 1.88). ISSN:1735-1472 (print) 1735-2630 (online)
14. Tewari S, Tripathi M, Ramteke PW, **Kumar S**, Garg SK (2013). Plasmid mediated transfer of antibiotic resistance and heavy metal tolerance in thermotolerant water borne coliforms. African Journal of Microbiology Research DOI: 10.5897/AJMR12.1563. (IF 0.58). ISSN:1996-0808
15. Garg SK, Tripathi M, **Kumar S**, Singh SK, Singh SK (2012). Microbial dechlorination of chloroorganics and simultaneous decolorization of pulp-paper mill effluent by *Pseudomonas putida* MTCC 10510 augmentation. Environmental monitoring and assessment 184 (9), 5533-5544. (IF 1.68). ISSN:0167-6369 (Print) 1573-2959 (Online)
16. **Kumar S**, Tripathi VR, Garg SK (2012). Physicochemical and microbiological assessment of recreational and drinking waters. Environmental Monitoring and Assessment. 184(5): 2691-2698. (IF 1.68). ISSN:0167-6369 (Print) 1573-2959 (Online)
17. Tripathi VR, **Kumar S**, Garg SK (2011). A study on trypsin, *Aspergillus flavus* and *Bacillus* sp. protease inhibitor activity in *Cassia tora* (L.) syn *Senna tora* (L.) Roxb. Seed extract. BMC Complementary and Alternative Medicine. 11: 56. (IF 2.28). ISSN:1472-6882
18. **Kumar S** (2010). Characterization of *E. coli* isolates from diarrhea samples and their antibiotic sensitivity assay. International Research Journal of Commerce, Arts and Science. 183-192.ISSN: 2319-9202
19. **Kumar S** (2010). Molecular methods for characterization and identification of *Salmonella* spp.: A review. International Research Journal of Management Science and Technology.203-213.ISSN:2348-9367 (Print)2250-1959(Online)

20. **Kumar S** (2009). Bacteriological quality of water. *Spectrum: Journal of science and society for sustainable development*. 07-13.
21. Naraiian R, Sahu RK, **Kumar S**, Garg SK, Singh CS, Kanaujia RS (2009). Influence of different nitrogen rich supplements during cultivation of *Pleurotus florida* on corn cob substrate. *Environmentalist*. 29: 1-7.

Publications of **Shailendra Kumar** during last five years

22. Tripathi M, Kumar S (2020). Epidemiology, Treatment and Microbiological Surveillance of SARS-CoV-2. Annual Research & Review in Biology. 35(5): 114-121. ISSN: 2347-565X, NLM ID: 101632869, Doi: 10.9734/ARRB/2020/v35i530230
23. Tripathi M, Pandey R, **Kumar S** (2018). Biodecolorization of Orange II dye by native *Bacillus* sp. and *Staphylococcus* sp. in simulated medium. Journal of Pharmacognosy and Phytochemistry, 7(SP I): 1366-1368.
24. Tripathi M, Haroon M, **Kumar S** (2018). Antibiotic resistance in *E. coli* isolates associated with child diarrhea cases. Journal of Pharmacognosy and Phytochemistry, 7(SP I): 1300-1303.
25. Tripathi M, Kumar S, Kumar A, Tripathi P, **Kumar S** (2018). Agro-nanotechnology: A Future Technology for Sustainable Agriculture. International Journal of Current Microbiology and Applied Sciences, 196-200
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E-Content Developed

**Semester I Paper IV, Analytical Methods and Bioinformatics, Topic:
Chromatography**



INDIAN NATIONAL SCIENCE ACADEMY
Bahadur Shah Zafar Marg, New Delhi – 110002

S. P. Mishra
Deputy Executive Director – I (Scientific)

INSA/SP/VSP-64/2019-20/
26 March, 2019

Dr. Shailendra Kumar
Department of Microbiology
Dr. Rammanohar Lohia Avadh University
Faizabad, Ayodhya
Uttar Pradesh 224001

Sub: INSA Visiting Scientist Programme 2019 for FY2019-20

Dear Dr. Kumar,

This is with reference to your application for INSA Visiting Scientist Programme 2019 for 2019-20, I am happy to inform you that you have been selected for the award of INSA Visiting Scientist 2019-20 under which you can visit the Institute (as mentioned in your application) for a period of **02 Months** on following terms and conditions:

- 1. During the fellowship period you will be paid consolidated amount of Rs. 30,000/- (maximum) per month to cover your expenses related to boarding, lodging, travel etc.**
- 2. Candidate selected as Visiting Fellow must avail this Fellowship on or before January 31, 2020. No Claim bills for payment will be accepted by the Academy after March 31, 2020.**
3. Grant will be made to Parent Institute on completion of the visit upon submission of Claim Bill (in duplicate) duly forwarded by Parent Institute.
4. A short report (2-3 typed pages) should be sent to the Academy immediately after completion of the visit along with a certificate from the Host Institute.

Kindly communicate your acceptance.

With best wishes,

Yours sincerely,

(S P Mishra)

Encl. Claim Bill and UC (available on website also)

Copy to:

1. Registrar, Dr. Rammanohar Lohia Avadh University, Faizabad, Ayodhya, Uttar Pradesh 224001

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**Semester I Paper IV, Analytical Methods and Bioinformatics, Topic:
Chromatography**

Chromatography

Partition / distribution Coefficients :

K_d ^{describes} the way in which a compound distributes itself between two immiscible phases

$$\frac{\text{Concentration in phase A}}{\text{Concentration in phase B}} = K_d.$$

In fact the K_d is multiplied by the ratio of the volumes of the two phases,

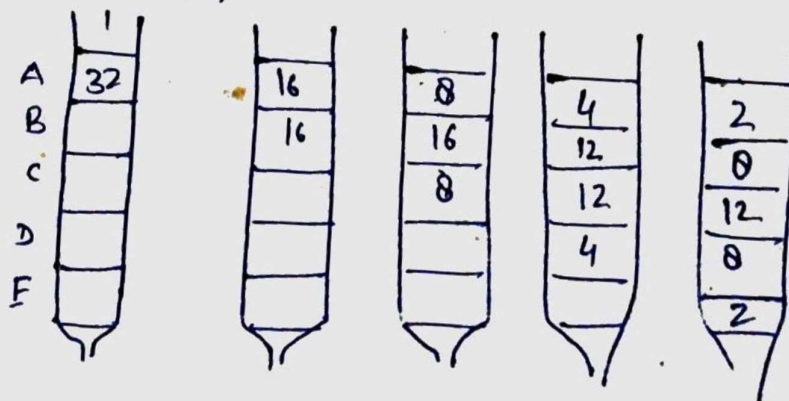
if K_d of a compound between two phases A & B is 1 & the compound is distributed between 10 cm^3 of A & 1 cm^3 of B

Conc. in the two phases will be the same but the total amount of the compound in phase A will be 10 times the amount in phase B.

Stationary phase: Solid, gel, liquid or solid/liquid immobilised

Mobile phase : liquid or gases,

Column Chromatography :



It is apparent that after a relatively small number of equilibrations the compound distributes itself symmetrically within a band.

Mixture of two one $K_d = 1$
 another $K_d = 100$.

Compound of $K_d = 100$ will reparate rapidly.

Time taken for each analyte peak to emerge from the column is referred to as its retention time, t_R .
Volume required to elute the analyte — V_R (elution volume)

$$V_R = t_R F_c$$

F_c = flow rate of the mobile phase through the column.

$$V_R = V_m + K_d V_s$$

V_m = void volume or dead space
 V_s = volume of the stationary phase

In ~~the~~ Adsorption column chromatography V_s is replaced by A_s surface area of the adsorbent.

Partition ratio or Capacity ratio

$$k' = \frac{C_s V_s}{C_m V_m} = K_d \frac{V_s}{V_m}$$

V_s/V_m is referred to as the volumetric phase ratio, β
hence $k' = K_d \beta$

d Volume,
 round & within
 a stationary phase
 articles.

The capacity ratio — is actually a measure of the additional time the analyte takes to elute from the column relative to an unretained or excluded analyte that does not partition in the stationary phase for which $k' = 0$

$$k' = \frac{t_R - t_M}{t_M} = \frac{V_R - V_M}{V_M}$$

t_M = transit time, through the column, of an unretained compound

$$\bar{u} = \frac{L}{t_M}$$

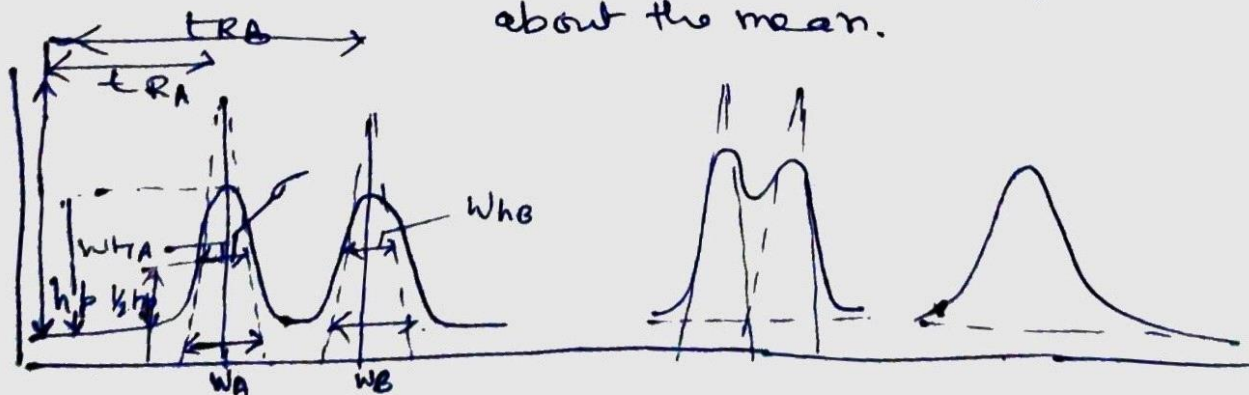
L : length of the column.

\bar{u} = linear velocity of the mobile phase through the column

Capacity ratio, are most commonly reported in liquid chromatography

Reported infrequently in GPC due to practical difficulty of measuring t_M or V_M

Gaussian distributions as each analyte passes down the column it becomes distributed in a band that has a Gaussian distribution about the mean.



Fronting or tailing is result of

↓
 gradual
 after
 $\frac{N}{N}$

Application of too much analyte to the column,
 poor packing of the column
 poor application of the sample to the column or
 solute - support interactions.

Success in ^{judged} ability to separate completely one analyte
 from the mixture

Peak resolution (R_s)

$$R_s = \frac{2(t_{RB} - t_{RA})}{W_A + W_B}$$

Number of theoretical plates (N)

$$H = \frac{\sigma^2}{x}$$

x = distance travelled by analyte
 in the column.

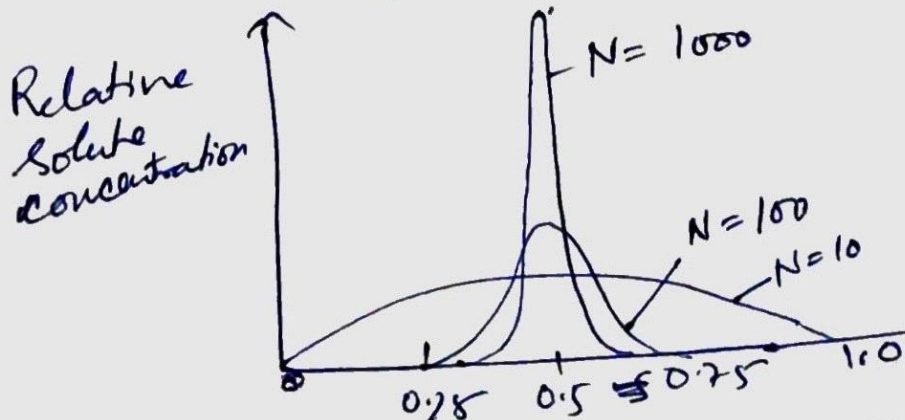
$$N = \frac{L}{H} = \frac{Lx}{\sigma^2}$$

$$N = 16 \left(\frac{t_R}{W} \right)^2$$

$$N = 5.54 \left(\frac{t_R}{W_h} \right)^2$$

$$W = 4\sigma, \quad W_h = 2.355\sigma$$

if both L & σ are measured in unit of time rather than length.
 $N = 16 \left(\frac{t_R}{W} \right)^2$
 Plate number can be increased by simply increasing
 the column length (L)



Height equivalent to a theoretical plate (HETP)

$$HETP = \frac{L}{N} = H$$

The maximum no. of peaks that can be separated by a specific chromatography is called peak capacity

$$n = 1 + \sqrt{\frac{N}{16} \left(\ln \frac{V_{\infty}}{V_{\alpha}} \right)}$$

retention volume of first & last peaks
(V_{α} & V_{∞} , respectively)

Success judged by ability to achieve good resolution and is determined by three functions;

Selectivity
Efficiency
Capacity

Low Pressure Column Chromatography

- Column Column packing with stationary phase as close possible near the base temp.
- Matrix materials
 - material used to support stationary phase
 - matrix should have
 - high mechanical stability to encourage good flow rate & to minimise the pressure drop along the column.
 - good chemical stability
 - funcⁿ groups to facilitate the attachment of the statⁿ phase
 - high capacity, i.e. density of functional groups to minimise bed volume.
 - should be available in a range of particle sizes.
 - some processes require porous matrix
 - The surface of matrix should be inert.

Agarose:

- D - galactose & 3,6 - anhydro-1-galactose
Unbranched polysaccharide chains are cross linked with agents such as 2,3-dibromophenol
- gels are stable in pH range 3 - 14
 - should not be dried
 - good flow property, high hydrophilicity
Sepharose, BioGel A.

Cellulose:

- β -1-4 linked glucose units.
Cross linked with epichlorohydrin
Available in bead, microgranular & fibrous forms,
good pH stability & flow properties, highly hydrophilic

Dextran:

- α -1-6 - linked glucose, same as above
pH = 12,
~~Step~~ Sephadex.

Polyacrylamide:

acrylamide cross linked with
N,N'-methylene bisacrylamide
pH — 2 — 11
BioGel P

Polystyrene:

Styrene cross linked with divinyl benzene
good stability overall pH ranges
used for exclusion & ion exchange chr.^m
relatively low hydrophilicity

Silica:

Orthosilicic acid.

Si-OH groups make it hydrophilic.

Si-OH groups may be removed by treatment
with trichloromethylsilane.

pH = 3-8

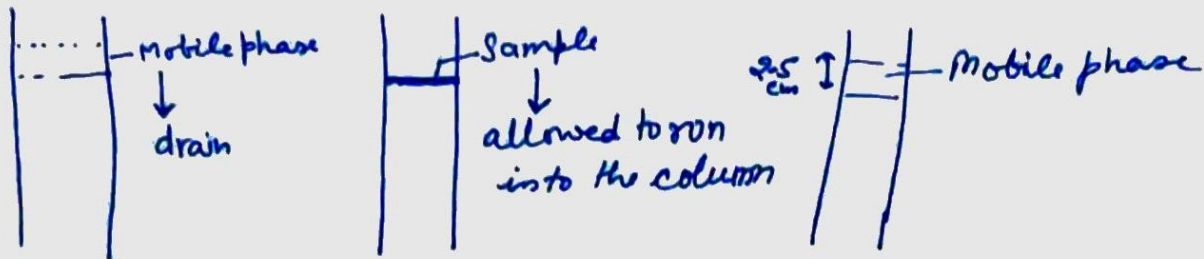
Stationary phase:

- Chemical nature varies. (dependent upon the particular form of Chr.)
- Most stationary phases are available attached to the matrices in a range of sizes & shapes (both are imp. as they influence flow rate & resolution)
 - a balance is required.
- Most stationary phases have spherical or approximately spherical shapes.
- Particle size - (mesh size)
measure of - openings per inch of 1 in sieve
larger mesh size, smaller the particle

Column Packing

Application of Sample :

Remove most of the mobile phase from above the column by suction & just to drain the remainder into the bed.



An alternative -

add sucrose to a conc. of 1X into the sample.

IIIrd method: Use of capillary tubing and/or syringe or peristaltic pump

Care : avoid overloading the column with sample

High performance liquid chromatography (HPLC)

As we know, resolving power increases with increase in column length. & the no. of theoretical plates per unit length.

As -

smaller the particle size of the stationary phase better the resolution.

Smaller the particle size of the stationary phase greater the resistance to flow of mobile phase - creates back pressure in the column & is sufficient to damage the matrix structure of the stationary phase.

Stationary phases of low particle size are available which can withstand high pressure.

Development in adsorption, partition, ion-exchange, exclusion and affinity chromatography

has emerged resulted in most popular, powerful, & versatile form of HPLC.

Columns:

Stainless steel

with stand $5.5 \times 10^7 \text{ Pa}$ ($\approx 8000 \text{ lbf m}^{-2}$)

length 15-30 cm, 1-4 mm dia

Microbore column - internal diameter 1-2 mm
25 cm. long.
 $0.05 - 0.20 \text{ cm}^3 \text{ min}^{-1}$

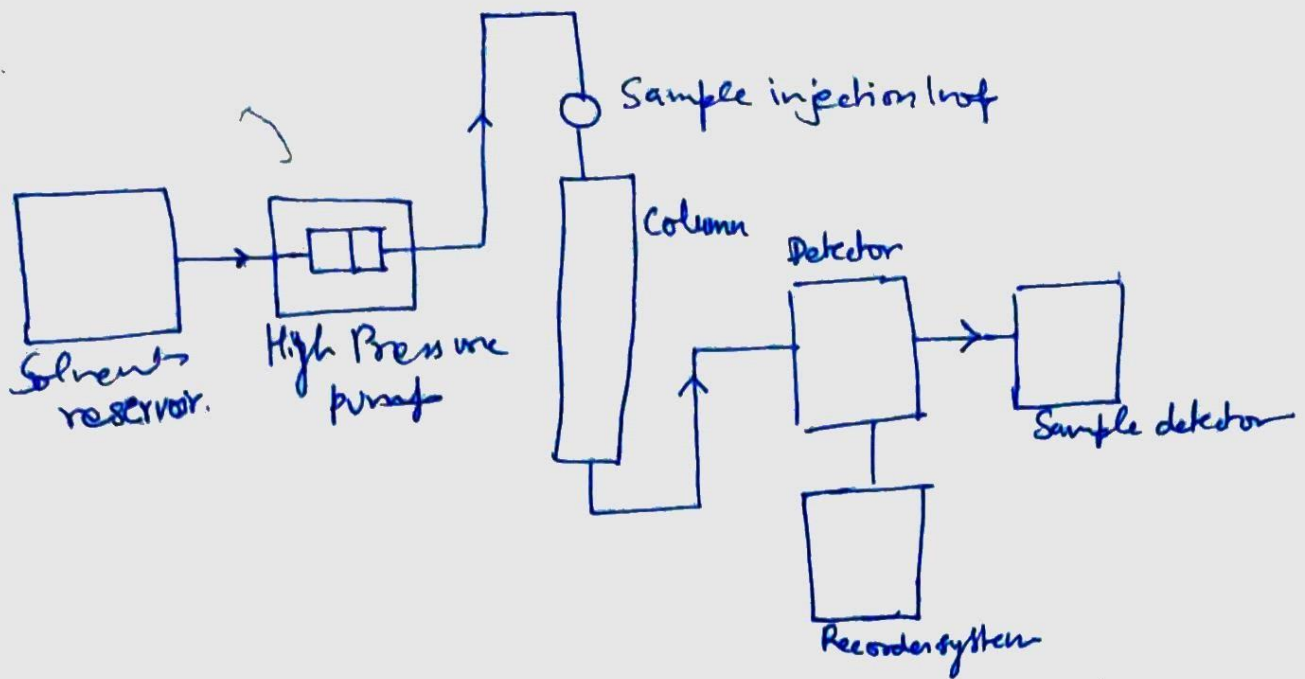
Preparative columns -

internal diam - 25 mm

flowrate - $100 \text{ cm}^3 \text{ min}^{-1}$

Precision bored - internal mirror finish

Porous plugs of steel or teflon



Matrices & Stationary phase:

Microporous supports:

micropores ramify through the particles pores which are generally 5-10 μm (diam)

Pellicular supports:

porous particles are coated over a solid inert core such as glass bead of about 4 μm (diam)

Bonded phases:

Stationary phase is chemically bonded on to an inert support as silica.

Column packing

Mobile phase & pumps

Application of sample

Detectors.

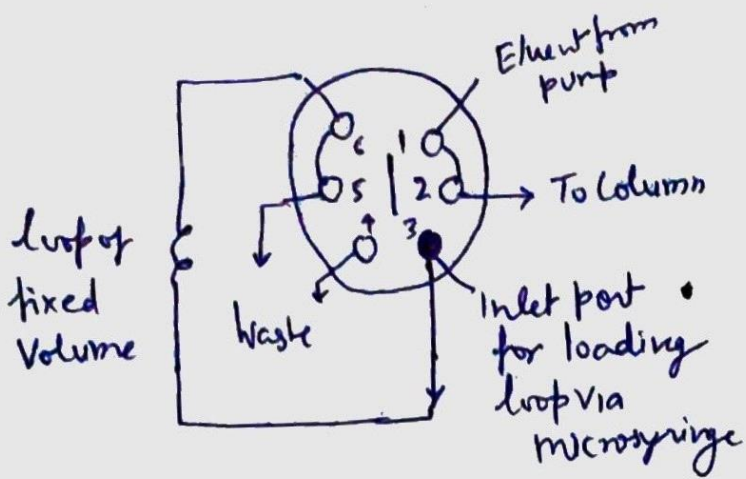
UV vis spectrophotometer, fluorescence detector

Application:

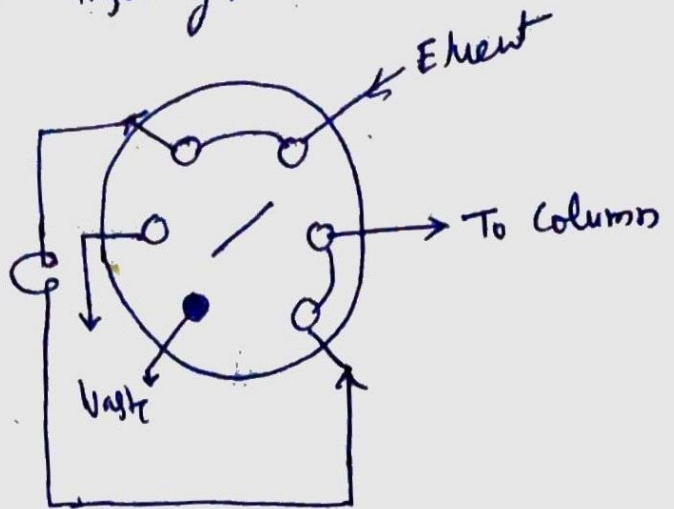
big impact on the separation of oligopeptides & proteins

FPLC (fast protein liquid chromatography)

Loading position

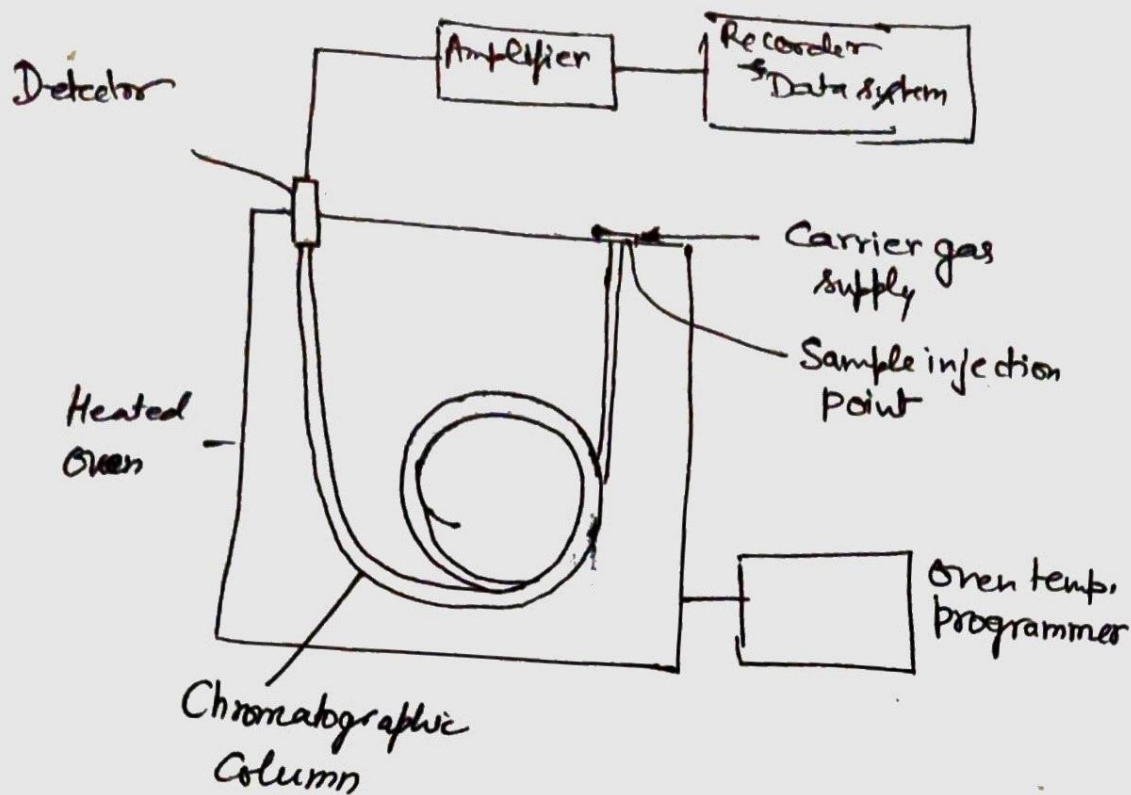


Injecting position



HPLC loop injector

Gas liquid chromatography



GLC System

Partition of the compound between a liquid and a gas phase
— qualitative & quantitative analysis

high sensitivity,
reproducibility
speed of resolution.

— proved most valuable for the separation of
compounds of relatively low polarity

— Staⁿ phase — hbp liquid material — silicon grease
~~supported~~ supported on an inert granular solid.

Column — 1-3 m long, 2-4 mm dia

Capillary column — 0.03 — 1.0 mm i.d. 100 m long
wallcoated open tubular (WCOT)

Support coated open tubular (SCOT), also called as porous layer open tubular (PLOT)

Matrix -

- Celite (diatomaceous silica)
- Silanization with compounds as hexamethyl disilazane

Staⁿ phase:

poly ethylene glycols,
methylphenyl- and methylvinyl silicone gums
Apiezone L & esters of adipic acid, succinic
and phthalic acids.

~~Carrier gas~~

Sample Preparation

Sample is dissolved in suitable solvents as acetone, heptane or methanol.

Chlorinated organic solvents are generally avoided as they contaminate the detector.

Separation conditions: $N_2, He, Ar.$
flow rate 40-80 $cm^3 \text{ min}^{-1}$

- No thermal analysis
- temperature programming
- reference columns

Application:

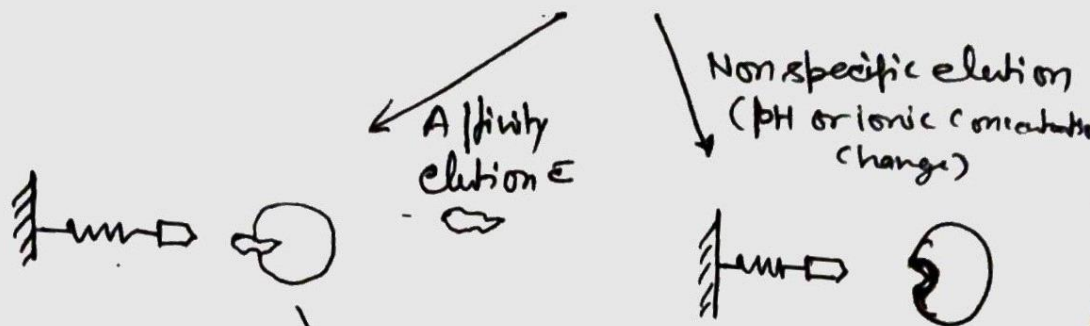
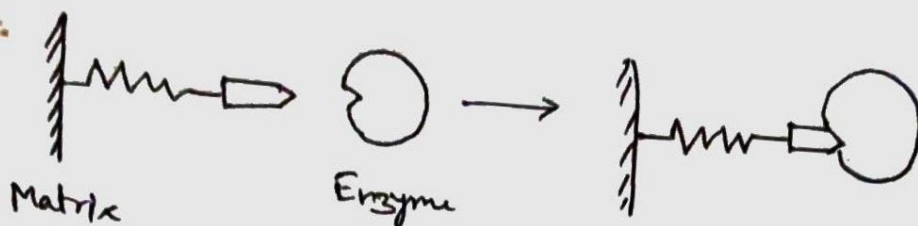
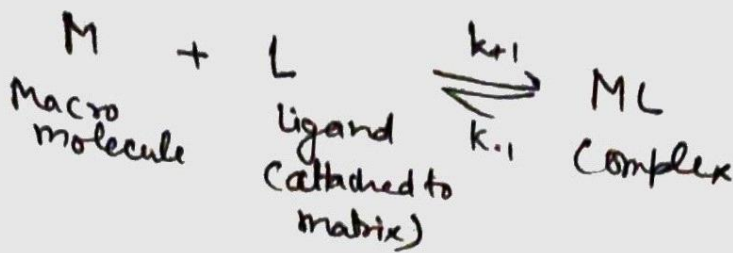
methyl esters of saturated fatty acids

Retention index (RI)

Affinity Chromatography:

For enzymes,
Nucleotides
Nucleic acids

Ig, membrane
receptors,
Whole cell



ionic hydroxyl group in matrix \rightarrow Activating reagent \rightarrow Activated matrix
 Contains reactive groups or good leaving groups \rightarrow Immobilized ligand L
 Coupling reagent: CNH_2

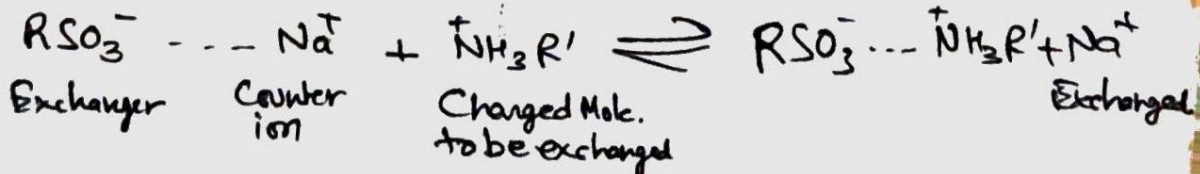
Dialysis

Restore optimum conditions

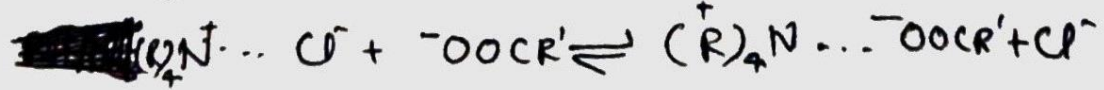
Ion exchange chromatography:

A.A / Proteins have ionisable groups. Net charge exhibited by these compounds is dependent upon their pKa and on the pH of the solution in accordance with the Henderson-Hasselbalch eq.

Cation exchanger:



Anion exchanger:



Ion exchange mechanism:

- ① Diffusion of the ion to the exchanger surface. This occurs very quickly in homogeneous solution
- ② Diffusion of the ion through the matrix surface structure of the exchanger to the exchange site. This depends upon the degree of cross reaction (linkage) of the exchanger and the conc. of the solution. Controls the rate of the whole ion-exchange process.
- ③ Exchange of the ion at exchange site. Thought to occur instantaneously & an equilibrium process
- ④ Diffusion of exchanged ion through the exchanger to the surface
- ⑤ Selective desorption by the eluent and diffusion of the molecule into the external eluent. The selective desorption of the bound ion is achieved by changes in pH / ionic conc. or by affinity elution.

Thin Layer Chromatography (TLC)

$$R_f = \frac{\text{distance moved by analyte from origin}}{\text{distance moved by solvent front from origin}}$$

$$N_s = 16 \left(\frac{d_A}{w} \right)^2$$

d_A = distance moved by the analyte from origin
 w = width of the spot.

$$H = \frac{d_A}{N}$$

Capacity factor k'

$$k' = \frac{d_m}{d_A} = \frac{1 - R_f}{R_f}$$

d_m = distance moved by the solvent front from the origin.

TLC:

Paper chromatography

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Semester III paper II, Concepts of immunology, Anatomy of Immune System

Dr. Shailendra Kumar

Anatomy of Immune SystemHematopoiesis:

Formation and development of RBC & WBCs from stem cells.

begins in the yolk sac in the first week of Embryonic development.

Yolk sac stem cells → Primitive erythroid cells containing ^{erythrin} hemoglobin

3rd month of gestation stem cells (yolk sac)

↓
fetal liver
↓
Spleen.

from 2nd -
up to 7th months

bone marrow becomes the major hematopoietic organ

by birth. hematopoiesis ceases in liver & spleen

hematopoietic stem cells is pluripotent.

granulocytes
Erythrocytes
Monocytes
Mast cells
lymphocytes
megakaryocytes

Pluripotent stem cells $\left\{ \begin{array}{l} \text{Lymphoid stem cell} \\ \text{Myeloid stem cell} \end{array} \right.$

Subsequent diff.ⁿ → progenitor cells

Lymphoid stem cell → T & B progenitor lymphocytes.

Myeloid stem cells → generate progenitor cells for erythrocytes, neutrophils, eosinophils, basophils, monocytes, mast cells & platelets.

diff.ⁿ depends on the acquisition of responsiveness to particular growth factor.

In adult bone marrow, the hematopoietic cells grow and mature on a meshwork of stromal cells (non-hematopoietic cells)

Stromal cells: fat cells, endothelial cells, fibroblasts, and macrophages.

Stromal cells provide - a hematopoietic-inducing microenvironment consisting of a cellular matrix and either membrane bound or diffusible growth factors.

Hematopoietic Growth Factors:

Family of acidic glycoproteins, the colony-stimulating factors (CSFs)

multilineage colony-stimulating factor (M-CSF)
also known as IL-3

Granulocyte-macrophage colony-stimulating factor (G-M-CSF).

macrophage colony stimulating factor (M-CSF)

and granulocyte colony-stimulating factor (G-CSF)

glycoprotein called erythropoietin (EPO), produced by the kidney.

IL-4, IL-5, IL-6, IL-7, IL-8, IL-9

Many of these secreted by stromal cells, activated T_H cells, and activated macrophages.

Regulation of hematopoiesis:

Programmed cell death: (apoptosis)

- Pronounced decrease in cell volume.
- modification of the cytoskeleton
- Condensation of chromatin
- Degradation of the DNA into oligonucleosomal fragments.

Lymphoid Cells:

20 - 40% of body's WBC

B cells, T cells, Null cells

CD: Clusters of diffⁿ.

B - Lymphocytes:

1.5×10^5 Ab molecules on surface
identical ~~Ab~~ receptors for Ag.

B220 (CD45) - marker of the B-cell
Class II MHC molecules (APC)

Receptor for Complement: CR1 (CD35)
binds to

C3b, & CR2 (CD21)
binds to C3.

Receptor for Fc of IgG FcγR II (CD32)

show the slide - for Plasma & Memory cell diffⁿ

T - Lymphocytes:

membrane receptor for Antigen
structurally distinct from Ig
recognition of Ag. with MHC molecules only
APCs, virus-infected cells, cancer cells
and grafts may present antigen to T cells

Thy-1 - first expressed receptor

CD4 / CD8
| |
MHC II MHC I

Organs of the Immune System:

Primary (central) } lymphoid organs.
Secondary (Peripheral)

Primary lymphoid organs: Bone marrow,
Thymus.

Lymph nodes - collect ag from the
intracellular tissue fluids

Respiratory & gastrointestinal tracts possess
aggregations of mucosal-associated lymphoid
tissues (MALT) - including Peyer's patch,
tonsils, adenoids, and the appendix.

Primary lymphoid organs:

Thymus - two compartments -
Cortex
Medulla

Maturation & selection of T cell lymphocytes

Thymic epithelial cells secrete
hormonal factors

α_1 - thymosin

β_2 - thymosin

thymopoietin

thymulin

IL-7 - stromal cells.

- Maturation - Selection - Positive selection
- negative selection.

Bone Marrow: 'bursal equivalent'

Secondary Lymphoid Organs:

- Plasma
- Interstitial fluid
- lymph.
- lymphatic vessels (thoracic duct)
- + empties into subclavian vein near the heart.

Ag is brought to the lymph ~~nodes~~ organs.

Lymph nodes:

- bean shaped, encapsulated.
- Containing a reticular network packed with lymphocytes, macrophages, & dendritic cells.
- Clustered at junctions of the lymphatic vessels.
- Cortex - Lymphocytes (B cells), macrophages, follicular dendritic cells
- paracortex - T cells, & dendritic cells (interdigitating) (class II MHC)
- medulla - Sparsely populated \bar{c} lymphoid-lineage cells, plasma cells are present.

Spleen: