SAKSHI

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CAREER OBJECTIVE

To gain as much knowledge in the field of technology as possible and also benefit the organization with whatever I have learnt in the past.

ACADEMIC QUALIFICATIONS

Year	Degree/ Certificate	Institute/ Board	CGPA / %
2016-2021	Ph.D. (Environmental Engineering)	Delhi Technological University (Formerly DCE)	
2013-2015	M. Tech (Bioinformatics)	Delhi Technological University (Formerly DCE)	8.46/10
2008-2012	B. Tech (Biotechnology)	Dr. B.R. Ambedkar National Institute of Technology (NIT), Jalandhar	7.84/10
2008	XIIth	C.B.S.E.	83.25%
2006	Xth	C.B.S.E.	92.4%

PUBLICATIONS

- Sakshi, Singh, S.K., Haritash, A.K. (2018). Environmental Biotechnology for Control of Environmental Pollution. ***Int J Adv Res*** 6(11), 816-819. DOI:10.21474/IJAR01/8064
- Sakshi, Singh, S.K., Haritash, & A.K. (2019). Polycyclic aromatic hydrocarbons: soil pollution and remediation. ***Int J Environ Sci Technol***. https ://doi.org/10.1007/s1376 2-019-02414 -3
- Sakshi, & Haritash, A.K. (2020). A comprehensive review of metabolic and genomic aspects of PAH- degradation. ***Arch Microbiol***. https://doi.org/10.1007/s00203-020-01929-5
- Sakshi, Singh, S.K., & Haritash, A.K. (2020). Evolutionary Relationship of Polycyclic Aromatic Hydrocarbons Degrading Bacteria with Strains Isolated from Petroleum Contaminated Soil Based on 16S rRNA Diversity. ***Polycycl Aromat Compd***. DOI: 10.1080/10406638.2020.1825003
- Sakshi, Singh SK, Haritash AK (2021). Catabolic enzyme activities during biodegradation of three ring PAHs by novel DTU-1Y and DTU-7P strains isolated from petroleum contaminated soil. ***Arch Microbiol***. https://doi.org/10.1007/s00203-021-02297-4
- Sakshi, Singh, S.K., Haritash, A.K. (2021). Catabolic enzyme activity and kinetics of pyrene degradation by novel bacterial strains isolated from contaminated soil. ***Environ Technol Innov***. https://doi.org/10.1016/j.eti.2021.101744

PRESENTATIONS

INTERNATIONAL CONFERENCES

- Sakshi, Singh SK, Haritash AK (2019) Effect of petroleum hydrocarbons on Soil properties and its biotransformation. Sustainable Technologies for Environmental Management (STEM-2019), DTU, 25th -26th March, 2019
- Sakshi, Singh SK, Haritash AK (2018) Polyaromatic hydrocarbons: soil pollution and bioremediation. Go Green summit at Manila, Philippines, 23rd -24th March, 2018
- Sakshi, Singh SK, Haritash AK (2017) Environmental Biotechnology for Control of Environmental Pollution. International conference on Emerging Areas of Environmental Science and Engineering (EAESE-2017), GJU Hisar, 16th -18th February

NATIONAL CONFERENCES

- Sakshi, Singh SK, Haritash AK (2018) Microbial degradation of polythene: opportunities & challenges. National conference on Beating the Plastic Hazard: Challenges & Strategies, 4th June 2018

INTERNSHIPS

- 6 week Industrial training in IGIB (Institute of Genomics and Integrative Biology, CSIR),Delhi on Project Title-"Expression and purification of fungal recombinant allergen"
  Guide: Dr. Naveen Arora, Scientist E II Period: May-July,2011

- Industrial training in Northern Railway Hospital, New Delhi, Work: Immunology Microbiology, Biochemistry
  Guide; Dr.Meenakshi Agarwal Period: May-July,2010

PROJECTS

- 6 month project in IGIB (Institute of Genomics and Integrative Biology, CSIR),Delhi on Project Title-"Comparative genomic analysis and functional annotation of different strains of *Trichophyton rubrum*".
  Guide: Dr. Bhupesh Taneja, Senior Scientist Period: Jan-June,2015

- M.Tech Project- "Analysis of Expression level of NKG2D in different cancers and study comparative binding of NKG2D receptor with different NKG2D ligands".
  Guide: Dr.Asmita Das Period: Jan- Dec 2014

- B.Tech Project- "Extraction and characterization of potent microbe from soil sample that can degrade pesticide Chlorpyrifos".
  Guide: Dr. Shailu Dalal Period: July 2011- May 2012

ACADEMIC ACHIEVEMENTS

- Awarded DTU Fellowship for Ph.D. in 2016
- Qualified GATE (Biotechnology) in 2016
- Qualified GATE (Biotechnology) in 2013, Awarded MHRD Fellowship

TECHNICAL SKILLS

- Basic knowledge of MS OFFICE
- Basic knowledge of Bioinformatics Tools(Autodock, BLAST, CLUSTALW, MEGA)
- Wet lab skills in 'biotechnology' (Plant Tissue culture, Microbial culture, Protein and nucleic acid gel electrophoresis)

EXTRA CURRICULAR ACTIVITIES

- Worked as a volunteer in the techfest of NIT Jalandhar "Techniti'10"
- Member of photography club and accommodation committee in cultural fest of NIT Jalandhar "Utkansh' 10"
- Worked as Co-Head in BIO-SCIO quiz in techfest of NIT Jalandhar "Techniti'11"
- Participated in fashion show in cultural fest of NIT Jalandhar "Utkansh'11"
- Head of Discipline committee in cultural fest of NIT Jalandhar "Utkansh'12"

HOBBIES

- Travelling, Photography, Playing cricket

International Journal of Environmental Science and Technology (2019) 16:6489–6512
https://doi.org/10.1007/s13762-019-02414-3

REVIEW

Polycyclic aromatic hydrocarbons: soil pollution and remediation

Sakshi[1] · S. K. Singh[1] · A. K. Haritash[1]

Received: 7 January 2019 / Revised: 27 April 2019 / Accepted: 13 May 2019 / Published online: 25 May 2019

Abstract
Soil is an important environmental matrix to support the life of all organisms directly or indirectly. Despite being the ultimate sink for all pollutants, it has been neglected for long, which has negatively affected the quality of the soil. Disposal of pollutants has resulted in changes in properties of soils and introduction of toxicity into it. The presence of heavy metals, pesticides, polychlorinated biphenyls and polycyclic aromatic hydrocarbons (PAHs) affects all forms of life since these chemicals have associated toxicity, mutagenicity, and carcinogenicity. PAHs are typical pollutants of soil which result in alteration in grain size, porosity and water-holding capacity of soil and affect diversity/population of microbes adversely. Significant changes in permeability, volume, plasticity, etc., are also brought about resulting in poor quality of contaminated soils. Considering the toxicity and global prevalence of PAHs, remediation of contaminated soils has become a challenge. Therefore, it is important to understand the detailed mechanism of physical, chemical or biological changes in soil. Simultaneously, it becomes pertinent to identify the environmentally sustainable treatment options for remediation of contaminated sites. Whereas physical and chemical treatment methods are either cost, chemical, or energy prohibitive, the biological treatment is emerging as an efficient and effective option which employs microorganisms for mitigation. Microorganisms are known for their enzyme-catalyzed catabolic activity when degradation/mineralization of a pollutant is aimed at and can prove useful in degradation of PAHs. Therefore, the present study reviews the effects of PAHs on soil properties, different remediation techniques and the role of microorganisms in remediating contaminated sites.

Keywords Advanced oxidation process · Bioremediation · Geotechnical properties · Toxicity · Treatment

Introduction

With increasing awareness of the adverse effects of hazardous chemicals on human health and environment, the remediation of such chemicals has received more attention internationally. Environmental pollution caused by dumpsuch contaminants can enter food chain (Xiaojun et al. 2007). Contamination due to leakage/spillage of crude oil can adversely affect exposed organisms since it is an intricate mixture of toxic aliphatic and complex aromatic hydrocarbons. Studies have established that toxicity increases with an increase in complexity of chemical structure (Patnaik

Archives of Microbiology (2020) 202:2033–2058
https://doi.org/10.1007/s00203-020-01929-5

MINI-REVIEW

A comprehensive review of metabolic and genomic aspects of PAH-degradation

Sakshi[1] · A. K. Haritash[1]

Received: 23 January 2020 / Revised: 14 May 2020 / Accepted: 26 May 2020 / Published online: 6 June 2020

Abstract
Polyaromatic hydrocarbons (PAHs) are considered as hazardous organic priority pollutants. PAHs have immense public concern and critical environmental challenge around the globe due to their toxic, carcinogenic, and mutagenic properties, and their ubiquitous distribution, recalcitrance as well as persistence in environment. The knowledge about harmful effects of PAHs on ecosystem along with human health has resulted in an interest of researchers on degradation of these compounds. Whereas physico-chemical treatment of PAHs is cost and energy prohibitive, bioremediation i.e. degradation of PAHs using microbes is becoming an efficient and sustainable approach. Broad range of microbes including bacteria, fungi, and algae have been found to have capability to use PAHs as carbon and energy source under both aerobic and anaerobic conditions resulting in their transformation/degradation. Microbial genetic makeup containing genes encoding catabolic enzymes is responsible for PAH-degradation mechanism. The degradation capacity of microbes may be induced by exposing them to higher PAH-concentration, resulting in genetic adaptation or changes responsible for high efficiency towards removal/degradation. In last few decades, mechanism of PAH-biodegradation, catabolic gene system encoding catabolic enzymes, and genetic adaptation and regulation have been investigated in detail. This review is an attempt to overview current knowledge of microbial degradation mechanism of PAHs, its genetic regulation with application of genetic engineering to construct genetically engineered microorganisms, specific catabolic enzyme activity, and application of bioremediation for reclamation of PAH-contaminated sites. In addition, advanced molecular techniques i.e. genomic, proteomic, and metabolomic techniques are also discussed as powerful tools for elucidation of PAH-biodegradation/biotransformation mechanism in an environmental matrix.

Keywords Polycyclic aromatic hydrocarbons (PAHs) · Bioremediation · Microorganisms · Catabolic genes · Genetically modified microorganisms

Introduction

Polycyclic aromatic hydrocarbons (PAHs) are hazardous ubiquitous organic pollutants which have become major

carcinogen by the US Environmental Protection Agency (EPA) due to their toxic, carcinogenic, and mutagenic nature. PAHs are basically composed fused benzene rings of carbon and hydrogen (simple to complex structural

POLYCYCLIC AROMATIC COMPOUNDS
https://doi.org/10.1080/10406638.2020.1825003

Evolutionary Relationship of Polycyclic Aromatic Hydrocarbons Degrading Bacteria with Strains Isolated from Petroleum Contaminated Soil Based on 16S rRNA Diversity

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Department of Environmental Engineering, Delhi Technological University, Shahbad Daulatpur, Delhi, India

ABSTRACT

Polycyclic aromatic hydrocarbons (PAHs) are persistent organic pollutants, ubiquitously present and are hazardous to all forms of life due to their toxic, carcinogenic, and mutagenic nature. With enhanced understanding of adverse effects of PAHs on living organisms, reclamation of PAH-contaminated sites has become a global concern. In order to devise efficient bioremediation strategies for PAH-degradation, the identification and study of metabolic potential of microbial species is essential. The goal of this study is to isolate PAH-degrading bacterial strains from petroleum contaminated soil that can utilize PAHs as their sole carbon source and investigate their growth on medium containing PAHs as only carbon source. For the first time, the evolutionary relationship of isolated bacterial strains with known PAH-degrading bacterial strains having PAH-catabolic genes/enzymes involved in PAH-bioremediation was examined. Two strains isolated from contaminated soil, that is, *Kocuria flava* DTU-1Y and *Rhodococcus pyridinivorans* DTU-7P may have the ability to utilize PAHs as sole carbon source for their growth. Phylogenetic analysis for evolutionary relationship revealed that these strains are related to different known PAH-degrading bacterial strains which have catabolic genes/enzymes involved in degradation pathway. The bacterial strains reported in this study may also possess the genes responsible for PAH-degradation and can prove useful in devising sustainable bioremediation approach.

ARTICLE HISTORY
Received 24 December 2019
Accepted 13 September 2020

KEYWORD
Bioremediation; evolutionary relationship; microorganisms; PAHs

Introduction

Polycyclic aromatic hydrocarbons (PAHs) are ubiquitously found around the globe and are considered to be substantially hazardous organic pollutants due to their toxic, mutagenic, carcinogenic, and teratogenic effects.[1] They are composed of fused benzene rings in different structural

Archives of Microbiology
https://doi.org/10.1007/s00203-021-02297-4

ORIGINAL PAPER

Catabolic enzyme activities during biodegradation of three-ring PAHs by novel DTU-1Y and DTU-7P strains isolated from petroleum-contaminated soil

Sakshi[1] · S. K. Singh[1] · A. K. Haritash[1]

Received: 26 November 2020 / Revised: 17 March 2021 / Accepted: 19 March 2021

Abstract

Polycyclic aromatic hydrocarbons (PAHs) are ubiquitous pollutants having health hazards. PAH-utilizing bacterial strains were isolated from petroleum-contaminated soil from siding area, Bijwasan supply location of BPCL, Delhi, India. Bacterial strains with different morphology were isolated and acclimatized to a mixture of low molecular weight PAH compounds in the concentration range of 50–10,000 mg/L. Two bacterial strains surviving at 10,000 mg/L PAH concentration were identified as *Kocuria flava* and *Rhodococcus pyridinivorans,* based on 16S rRNA gene sequencing and phylogenetic analysis over MEGA X, are reported for the first time for PAH degradation. The strain *K. flava* could degrade phenanthrene, anthracene, and fluorene with efficiency of 55.13%, 59.01%, and 63.46%, whereas *R. pyridinivorans* exhibited 62.03%, 64.99%, and 66.79% degradation for respective PAHs at initial PAH concentration of 10 mg/L. Slightly lower degradation of phenanthrene could be attributed to its more stable chemical structure. The consortium of both the strains degraded 61.32%, 64.72%, and 66.64%, of 10 mg/L of phenanthrene, anthracene, and fluorene, respectively, in 15 days of incubation period indicating no synergistic or antagonistic effect towards degradation. Catechol 2,3-dioxygenase (C23O), dehydrogenase and peroxidase enzyme activities during PAH degradation coincided with degradation of PAHs, thus highlighting the role of these enzymes in catabolising three-ring PAHs. This is the first investigation confirming the participation of C23O, dehydrogenase and peroxidases enzyme profiles throughout the period of degradation. The study concludes that these strains can play significant role in microbial remediation of PAH-contaminated environment.

Keywords Bioremediation · Catechol 2,3-dioxygenase · Dehydrogenase · Enzyme activity · Peroxidase · PAHs

Introduction

The contamination due to polycyclic aromatic hydrocarbons air water and soil around the globe (Haritash and Kaushik, 2009b; Kaushik et al. 2012). Since these compounds have a tendency to deposit over suspended dust, these ultimately

Environmental Technology & Innovation 23 (2021) 101744

Contents lists available at ScienceDirect

Environmental Technology & Innovation

journal homepage: www.elsevier.com/locate/eti

Catabolic enzyme activity and kinetics of pyrene degradation by novel bacterial strains isolated from contaminated soil

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ARTICLE INFO

Article history:
Received 19 February 2021
Received in revised form 13 June 2021
Accepted 26 June 2021
Available online 2 July 2021

Keywords:
Biodegradation
Bacteria
Enzyme activity
Oil-contaminated soil
Pyrene
PAHs

ABSTRACT

Polycyclic aromatic hydrocarbons (PAHs) with high molecular weight are difficult to degrade owing to their chemical structure and stability. This study reports degradation of pyrene by two potent Gram-positive bacterial strains isolated from petroleum-contaminated soil from Bijwasan supply location of Bharat Petroleum Corporation Limited (BPCL), India. The bacteria were identified as *Kocuria flava* and *Rhodococcus pyridinivorans* based on 16S rRNA gene sequencing. The degradation of pyrene, enzyme activity of Catechol 2,3-dioxygenase (C23O), dehydrogenase, and peroxidase, and the rate kinetics of degradation were investigated using the isolated bacteria. *K. flava* and *R. pyridinivorans* could degrade pyrene with an efficiency of 53.8% and 56.2%, within 15 days of incubation period under laboratory conditions. The consortium revealed 56.4% degradation of pyrene indicating that there is no significant synergistic/inhibitive effect. The activity (maximum on 9th day of incubation) of peroxidase enzyme (9.4×10^{-4} and 16.9×10^{-4} μM/ml/min) was followed by dehydrogenase (2.6×10^{-4} and 2.3×10^{-4} μM/ml/min) and C23O (2.2×10^{-4} and 2.8×10^{-4} μM/ml/min) for *K. flava* and *R. pyridinivorans*, respectively, suggesting their involvement in ring-cleavage, diol-formation, and subsequent oxidation of the intermediates. Analysis of rate kinetics exhibited degradation of pyrene to be the first order reaction indicating that an increase in initial concentration of pyrene will not compromise with the ability of studied bacteria towards degradation. Analysis of initial and final concentration of treated media over HPLC confirmed significant pyrene degradation within 15 days. The study concludes that *K. flava* and *R. pyridinivorans* can play an active role in remediation of hydrocarbon-contaminated sites.