

ABHIJEET PATHY

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#About

I have a keen interest in the remediation and reclamation of polluted environments. I have primarily worked on pyrolysis modelling and utilized biochar to remediate various organic and inorganic contaminants. Currently, I am researching biochar systems, focusing on increasing biochar application's sustainability and economic viability to make them adaptable at an industrial scale.

#Education

- **Master of Science** in Land Reclamation and Remediation, University of Alberta (2022-Continue); **CGPA: 4.0/4.0**
- **Bachelors** in biotechnology National Institute of Technology, Rourkela; (2017-2021); **CGPA: 9.29/10**
- **Intermediate** in Science from Jawahar Navodaya Vidyalaya, Rayagada; (2014-2016); **Percentage: 92.20%**
- **Matriculation** from Jawahar Navodaya Vidyalaya, Rayagada; (2014); **CGPA: 9.8/10**

Research Interest: Biochar, Pollution-remediation, Soil sciences, Bioenergy, Land reclamation

Awards and Scholarship

- The University of Alberta **Graduate Recruitment Scholarship**; Jan 2022- continue; (Value: 5000\$)
- National Institute of Technology, Rourkela, India; **Institute Silver Medal** for being the branch topper, 2021
- National Institute of Technology, Rourkela, India; **Academic Excellence Award**; 2020; Honorary
- National Institute of Technology, Rourkela, India; **Academic Excellence Award**; 2019; Honorary
- National Institute of Technology, Rourkela, India; **Academic Excellence Award**; 2018; Honorary

Work Experience

- **Graduate Researcher, Forest Soils Lab, the University of Alberta (Jan 2022-present):** The work explores the potential of biochar as an adsorbent in remediating pollutants present in Oil sands process water.
- **Intern, Forest Soils Lab, the University of Alberta (Sept 2021-Dec 2021):** Performed a meta-analysis evaluating the effect of activation on biochar's heavy metal adsorption potential.
- **Undergraduate Researcher, Bioenergy and Environment Lab, National Institute of Technology, Rourkela (Aug 2018- Sep 2021):** The dry lab aspect of the work was based on preparing computational models for analyzing the outputs of pyrolysis (a thermochemical process) and reviewing recent progress in topics related to biochar and algal biomass. The wet lab works involved in the application of biochar in remediation and resource recovery from wastewater.
- **Undergraduate Researcher, Food and Microbiology Lab, National Institute of Technology, Rourkela (Dec 2019-Mar 2020):** The work focused on Preparing nanoparticles using green synthesis methods and exploring their application in chromium sensing and anti-microbial activities.
- **Summer Intern, Water and Energy Nexus Lab, Indian Institute of Technology, Guwahati (May 2019-Jun 2019):** The work was focused on synthesizing and characterizing the activated biochar for remediating antibiotics from an aqueous solution.

#Publications

- **Pathy, A.,** Nageshwari, K., Ramaraj, R., Maniam, G. P., Govindan, N., & Balasubramanian, P. (2022). Biohydrogen production using algae: Potentiality, Economics and Challenges. *Bioresource Technology*, 127514.
- **Pathy, A.,** Krishnamoorthy, N., Chang, S. X., & Paramasivan, B. (2022). Malachite green removal using algal biochar and its composites with kombucha SCOBY: An integrated biosorption and phycoremediation approach. *Surfaces and Interfaces*, 30, 101880.

- Moola, A. K., Krishnamoorthy, N., **Pathy, A.**, Paramasivan, B., Balasubramani, S., Selvam, S., & Kumari, B. D. (2022). Production Techniques, Mechanism, and Application of Biochar in Remediating Soil Contaminated with Heavy Metals: A Review. *Strategies and Tools for Pollutant Mitigation*, 69-90.
- Xia, C., **Pathy, A.**, Paramasivan, B., Ganeshan, P., Dhamodharan, K., Juneja, A., ... & Rajendran, K. (2022). Comparative study of pyrolysis and hydrothermal liquefaction of microalgal species: Analysis of product yields with reaction temperature. *Fuel*, 311, 121932.
- **Pathy, A.**, Ray, J., & Paramasivan, B. (2021). Challenges and opportunities of nutrient recovery from human urine using biochar for fertilizer applications. *Journal of Cleaner Production*, 304, 127019.
- **Pathy, A.**, Meher, S., & Balasubramanian, P. (2020). Predicting algal biochar yield using eXtreme Gradient Boosting (XGB) algorithm of machine learning methods. *Algal Research*, 50, 102006.
- Janakiraman, T., **Pathy, A.**, Poosari Kumaravel, S., & Paramasivan, B. (2021). Effect of coconut shell in gasification kinetics of palm kernel shells at various blending ratios. *Environment, Development and Sustainability*, 1-18.
- **Pathy, A.**, Ray, J., & Paramasivan, B. (2020). Biochar amendments and their impact on soil biota for sustainable agriculture. *Biochar*, 2(3), 287-305.
- **Abhijeet, P.**, Swagathnath, G., Rangabhashiyam, S., Rajkumar, M. A., & Balasubramanian, P. (2019). Prediction of pyrolytic product composition and yield for various grass biomass feedstocks. *Biomass Conversion and Biorefinery*, 1-12.

#Manuscript Under review/constructions

- **Abhijeet Pathy**, Prem Pokhreal, Xinli Chen, Scott X. Chang. "Activation methods increase biochar's potential for heavy metal adsorption: A global meta-analysis," submitted to Chemical engineering journal (Under review).
- Aastha Kapoor, Nageshwari K, **Abhijeet Pathy**, Balasubramanian Paramasivan. "Chemometric analysis unravelling the effect of key influencing factors on algal biochar yield," submitted to Algal Research (Under review).
- Nageshwari K, **Abhijeet Pathy**, Aastha Kapoor, Balasubramanian Paramasivan. "Exploring the evolution, trends and scope of microalgal biochar through scientometrics," submitted to Algal Research (Under review).
- Mohamed Madhar Fazil S, **Abhijeet Pathy**, Bhaskar Das, Balasubramanian Paramasivan. "Photocatalytic Biodegradation of Methyl Orange using Silver Nanoparticles synthesized by the seaweed *Spatoglossum asperum*" (Under Progress)
- **Abhijeet Pathy**, Nageshwari K, Balasubramanian Paramasivan. "A graphical review on algal biochar: Trends, challenges, economics and future scope." (Under progress)

Conferences and Seminars

- Oral presentation at Canadian Society of Soil Science-Alberta Soil Science Workshop (CSSS-ASSW) conference, (May 2022)
- Oral presentation at International Conference on Biotechnology for Resource Efficiency, Energy, Environment, Chemicals and Health, (Dec 2021)
- Participated as an invited speaker at bioenergy seminar, 2022, (Apr 2022)

Research Projects

1. Biochar and its Applications

Removal of lead using carbon nanotube modified biochar (Team size: 3)

Jul 2022-Present

- Biochar produced from canola straw and sawdust was modified with carbon nanotubes.
- The prepared adsorbent was used to remove lead from the aqueous solution.

Removal of contaminants from OSPW (Team size: 12)

Jan 2022-Present

- Canola straw biochar removes heavy metals and PAHs from oil sand process water (OSPW).
- A bench scale study was performed to evaluate the adsorption potential of produced biochar.
- A mesocosm scale study is in progress to evaluate the biochar's adsorption potential at a larger scale.

A global meta-analysis on modified biochar heavy metal adsorption potential

Sep 2021-May 2022

- The impact of various modifications of biochar on its adsorption properties was evaluated.
- The critical parameters that significantly impact biochar adsorption properties were identified.

Malachite green removal using biochar

Jul 2021-Sept 2021

- Biochar was produced from microalgal biomass and modified with Kombucha SCOBY.
- The biochar-kombucha composite was used to remove malachite green from the aqueous solution.
- Integrating the biochar adsorption process with phycoremediation enhanced the removal efficiency from 89% to 99%.

Adsorption of Nutrients from Urine

Aug 2019-Nov 2019

- Prepared biochar from corn cob biomass using a muffle furnace and post-modified by magnesium and iron salt for increasing adsorption efficiency.
- Achieved ~78% efficiency in removing phosphate and nitrate with engineered biochar

Biochar impact on Soil biota

Jul 2019-Aug 2019

- Conducted a theoretical study to evaluate the effect of biochar's application on soil biota and reported the benefits and risks on soil ecology.
- It is concluded that biochar's overall effect on soil biota is positive.

Removal of Antibiotics using Biosorption

May 2019-Jun 2019

- Prepared Activated Carbon by treating the Juli flora with Orthophosphoric acid.
- Quantified the removal of Ciprofloxacin using HPLC with different batch experimental parameters and conducted a batch study to analyze the applicability of the biosorption process on an industrial level.
- The prepared biosorbent shows high removal capacity with maximum efficiency of 99.70%.

Chromium Removal Using Biochar

Feb 2019-Apr 2019

- Used coconut shell biochar to remove common health hazards from heavy metals, i.e. Cr(VI)
- Different experimental assays were performed to optimize the adsorption process's experimental condition.
- Achieved ~90% efficiency for removing Cr (VI)

2. Nanoparticles and their applications.

Phase 1: Biosensor Property of Nanocomposites

Jan 2020- Mar 2020

- Developed biosensors (synthesized gold nanoparticles to mimic the peroxidase enzyme) for detecting Cr (VI) in water with different experimental assays
- Achieved a detection up to the level of 1 micromolar concentration of Cr ion.

Phase 2: Antimicrobial Activity of Nanocomposites

Jan 2020- Mar 2020

- Characterized prepared nanomaterial and evaluated for the antimicrobial potential
- Testing of its antimicrobial property against food and waterborne pathogenic bacteria was performed.

3. Pyrolysis Modelling

Pyrolysis yield Prediction using Machine Learning

Oct 2019-Jul 2021

Phase 1: Algal Biochar Prediction using Machine Learning (Team Size: 2)

Oct 2019-Mar 2020

- Analyzed RF, ANN, and XGBoost in Python to predict biochar yield and composition.
- We have investigated Biomass characteristics and experimental conditions and their effect on biochar.
- Achieved 88% accuracy in predicting biochar yield.

Phase 2: Algal Bio-oil Prediction using Machine Learning (Team Size: 2)

Sep 2020-Sep 2021

- Analyzed results of the XGBoost model to predict the bio-oil yield, composition, and effects parameters.
- We investigated the effect of algae's process parameters and biochemical properties on bio-oil yield and quality.

Pyrolysis Modelling for Grass Biomass

Oct 2018-Mar 2019

- We developed a mathematical model in MATLAB to predict the pyrolysis process's yield at a wide range of operational temperatures & verified it for five grass biomasses.
- Analyzed the effect of temperature on all types of pyrolytic products.
- Achieved an accuracy of ~98% in predicting the pyrolysis yield depending upon various grasses.

4. Others

Biohydrogen production from algal biomass

Dec 2020 - Jan 2022

- Undertook a theoretical study to understand the biohydrogen production potential of algae.
- Investigated different methods and the parameters influencing the hydrogen yield, economic perspective, and challenges associated with the production process; [Research Paper in progress]

Membership and Certifications

- Student member at Canadian Society of Soil Sciences (CSSS), (Apr 2022-Present)
- Certificate member at Land Reclamation International Graduate School (LRIGS), (Mar 2022-Present)
- Student member at NIT Rourkela Overseas Alumni Association (NITROAA), (Feb 2022-Present)
- General body member at Navodaya Alumni Association, Odisha (NAAO), (Apr 2020-Present)
- Academic Literacy (With honour certificate), Moscow Institute of Physics and Technology, Coursera, Jun 2020
- Nanotechnology and Nanosensors, Part 1, Technion - Israel Institute of Technology, Coursera, May 2020
- Employment Generation among Rural Youth through Agripreneurship, IIT Kanpur and Commonwealth of Learning, Canada, Aug 2019
- BioMEMS and Micro/Nano Systems, IIT Bhubaneswar, May 2019

Volunteer Work

- Volunteer as an assistant digging crew in the Alberta Soil tour workshop, 2022. The tour was organized by a group of industrial consultants working in soil sciences, and the workshop explored the different soil profiles in Banff and Jasper National Park.
- Volunteer in organizing a session at the University of Alberta for school children to instigate their interest in soil sciences. Apr 2022-Jun 2022
- Volunteered at the Canadian Society of Soil Science-Alberta Soil Science Workshop (CSSS-ASSW) conference, May 2022. Represented our department stall at the conference and executed general responsibilities (registration, photography, and other miscellaneous roles). The conference saw 300 delegates from various academic institutions and industries from all over Canada.
- Volunteered at a water sanitation and hygiene awareness workshop for 50 at Kansar village by demonstrating essential aspects of sanitation, hygienic health practices, and rural development organized by Unnat Bharat, Feb 2019
- *Organizer*, Biotechnology Popularization and Skill Development Program in association with Genesis Club: Encouraged ~50 students to pursue careers in biotechnology, Dept. of Biotechnology & Medical Engineering, NIT Rourkela, Jan 2020
- *Volunteer* for two events related to time management in Innovision & Nitrustav (college Tech & Cultural fests): Responsible for stage arrangement, which saw an average footfall of ~800 people, NIT Rourkela, Nov 2019
- *Organizer*, International Conference on Bioprocess for Sustainable Environment and Energy organized by Dept. of Biotechnology and Medical Engineering, NIT Rourkela: Helped in guest accommodation for ~50 delegates, Dec 2018

Languages: English, Hindi, Oriya (Read/Write/Speak)