Dr. Ravi Kumar D
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PERSONAL STATEMENT:

I am a skilled, enthusiastic and curious doctoral graduate. Highly analytical and have a hands on approach to solve problems. Have the ability to work in a team, lead a team and also be able to take up solo work. Have a multi-perspective thinking, and interdisciplinary approach to work. My flexible work approach would be an asset to myself and the organization in achieving the goals.

AREA OF EXPERTISE:

- Fermentation, bioenergy.
- Anaerobic digestion, wastewater treatment.
- Bio-reactor design, experience handling bioreactor systems.
- Design of isothermal catalytic reactors.
- Data analysis and regression analysis.
- Gas chromatography, GC-MS and chromatogram analysis, FTIR.

PRESENT POSITION:

Postdoctoral Fellow, CGPL, Indian Institute of Science, Bengaluru.

POSITIONS HELD AFTER PhD:

Postdoctoral Fellow, Indian Institute of Science, January 2022, Biomass gasification has been receiving attention in India for power generation. With the development of the gasifiers the industry also faces the problem of the wastewater generation and disposal (and reuse). The scrubber water from the gasifier has a high concentration of phenols and dissolved solids. A multitude of treatment methods have been tested and employed to reduce the load of water wastage and usage. As the field is still in nascent stage in India and literature being limited, studies from allied fields such as the treatment of coke oven wastewater and coal gasification wastewater have been used to understand and overcome shortfalls in the present understanding and technology development.

EDUCATION:

- Doctor of Philosophy (PhD), Centre for Sustainable Technologies, Indian Institute of Science, Bengaluru, (July 2021).
- M.Sc (Engg), Centre for Sustainable Technologies, Indian Institute of Science, Bengaluru, (January 2014).
- BE Biotechnology, M S Ramaiah Institute of Technology (VTU), Bangalore, (July 2010).

DISSERTATION PROJECTS:

PhD: Titled "**Lignin and Extractive Tracing- an alternative approach to assess and predict biogas yields and production among the Tropical Biomass feedstock**". The study shows the importance of lignin and extractives on the overall gas yields and rates. The work introduced a new concept of "Two-component" fit and "inflection point". The work successfully implements K-means cluster algorithm and thereby increasing the accuracy of *a priori* predictability of biogas yields from the biomass cutting across the different classes or natural groups. Apart from exploring the possibility of correlations, the study clearly shows the differences in the lignin of monocots, dicots and conifers and its negative influence on the gas yields. To understand the functional groups in lignin, FTIR of lignin extracted through acid treatment and whole biomass were performed and analyzed. The influence of substrate to inoculum ratio on a variety of substrates were experimentally collated and correlated to the composition of the biomass. Extractives were shown to positively influence the gas production extent and rates; this study also shows the influence of extractive concentration on the stability of the reaction. The study therefore, opens the research in the field of anaerobic digestion towards new directions.

M.Sc (Engg.): Thesis work titled "**Effect of extractives and crude proteins on the kinetics of hydrolysis in a solid-state bio-reactor**". Work describes the effect of crude proteins and extractives on the kinetics of hydrolysis which is considered to be a rate limiting and a very important step in the anaerobic digestion process. Also a generalization of the first order kinetics was attempted with respect to the initial rates of hydrolysis The data from earlier experiments using various (dry and fresh) feedstocks conducted at the Centre for Sustainable Technologies, (CST; Chanakya et al., 1997, 1999) were used for the evaluation of the kinetic parameters in order to understand the process of hydrolysis in the SSB reactor. First order hydrolysis rate was used for the kinetic analysis for particulate hydrolysis (Tong et al., 1990; Vavilin et al., 1996) has been considered. Rate expression is arrived at by correlating the fraction of extractives and crude proteins to the rates of initial hydrolysis. The rate parameters obtained are used for analysing the effect of concentration of lignin on the hydrolysis process. Values from literature are further used to validate and compare the rates of hydrolysis. Effect of lignin, which is significant component in the ligno-cellulosic material, on the rates of hydrolysis was also looked into. The effect of lignin on the rates of hydrolysis though prominent, with dry lignin bound feedstocks showing decreased rates, the rate of decrease could not be generalized owing to limited number of data points. Finally, a comparison of rates with pure substrate and values from literature showed comparable results in some cases and higher rates in some (fresh feedstock) when fed in fed batch mode

B.E.: Project Titled "**Comparison of the growth parameters of CHO cell lines using reusable and disposable fermenter systems.**" CHO cell lines were grown in two different reactor systems to study the growth kinetics and parameters such as oxygen transfer rates, mass transfer were studied to characterize the functioning of the reactor systems.

PUBLICATIONS:

JOURNAL:

- **Ravi Kumar, D.**, Chanakya, H.N., Bhatia, S., Dasappa, S., 2020. Predicting biogas production from a two-plot fit of extractables and recalcitrants from ligno-cellulosic biomass feedstocks. Bioresour. Technol. Reports 10, 100411. https://doi.org/10.1016/j.biteb.2020.100411
- Himanshu Kumar Khuntia., Aastha Paliwal., **Ravi Kumar D.**, Chanakya H N, 2022. Review on Solid-State Anaerobic Digestion of Lignocellulosic Biomass and Organic Solid Waste. Environmental Monitoring and Assessment. https://doi.org/10.1007/s10661-022-10160-2

BOOK CHAPTER:

- **Ravi Kumar D.**, Chanakya H.N., Swati Bhatia, Dasappa S. (2022). Anaerobic digestion of yard waste: Effect of inoculum concentration and particle size of substrate on anaerobic digestion. Biomethane through Resource Circularity: Research, Technology, and Practices. CRC press, Taylor and Francis. https://doi.org/10.1201/9781003204435
- **Ravi Kumar D.**, Chanakya H.N., Dasappa S. (2020) Predicting Biomethanation Pattern from Feedstock Composition for Biomass Residues Bio-resource Utilization and Bioprocess. Bioresource Utilization and Bioprocess. Springer, Singapore. https://doi.org/10.1007/978-981-15-1607-8_8.
- **Ravi Kumar D.**, Chanakya H.N., Dasappa S. (2019) Anaerobic potential of leaf litter: Degradability and gas production relationships. Waste Valorisation and Recycling. Springer, Singapore. https://doi.org/10.1007/978-981-13-2784-1_52

CONFERENCE PAPER:

- **Ravi Kumar D**, Chanakya H N, Dasappa S (2018) On the effect of particle size and its relationship with gas production. EUBCE 2018, Copenhagen, Denmark ISBN: 978-88-89407-18-9
- **Ravi Kumar D.**, Chanakya H.N., Swati Bhatia, Dasappa S. Effect of substrate to inoculum ratio on the degradation of various biomass substrates: Influence of binding.8th ICONSWM
- Meghashri K.L., **Ravi Kumar D.**, Chanakya H.N. Alkaline pretreatment of lignocellulosic waste: A review.9th ICONSWM.

TEACHING ASSISTANTSHIP AND RESEARCH ASSISTANTSHIP:

- Project "Enhancement of hydrogen yield downstream of oxy-steam biomass gasifier and separation of hydrogen". The project involved design of isothermal tubular reactors for catalysts. Industrially available catalysts were used for the enhancement of hydrogen yield from the gasification process. Though the process of catalyst use for such applications is well known, the use in case of oxy-steam gasifiers has not been studied so far. This presents a new challenge especially with high carbon dioxide concentrations. Also work was done on the use of various chemical adsorbents used for CO_2 sequestration.
- Conducted the laboratory classes for the course Energy and environment lab, as a teaching assistant. The role involved helping the undergraduate and postgraduate students acquainted with the different protocols for methane potential estimation and water quality.
- Teaching assistant for the course "Modern bioenergy technologies". The role involved preparing slides and notes for the class, and grading. The course had two sections focussing on the structure of biomass and biological conversions and the second part involved thermochemical conversions.
- Biomass estimation of the village Male Mahadeshwara hills, under the Chamarajanagar district. The study involved the estimation of agro-feedstocks to estimate the biomethane potential and subsequent implementation of biogas for rural electrification.
- Biomass estimation for the biogas recovery potential from the green feedstocks in Kushalnagar (Dubare camp), under the RHEES project. Fiber production potential from the elephant dung and estimation of the chemical composition and determination of the physical properties.

RELEVANT COURSEWORK:

- Renewable energy: Technology and economics.
- Energy and environment lab.
- Micro and Nano Characterization methods.
- Alternate fuels for reciprocating engines.
- Engineering Thermodynamics.
- Reliability analysis and methods.

SKILLS:

- Experience in handling Gas chromatograph, and gas analysers. Good knowledge of the working principle.
- Hands-on experience handling FTIR and FTIR data analysis.
- Biomass estimation and chemical techniques for biomass chemical composition determination.
- Hands-on experience with SPSS, ORIGIN Pro.
- Good interpersonal skills.

PERSONAL DETAILS:

Date of Birth: 25th March 1986
Gender: Male
Languages known: English, Hindi, Telugu, and Odiya.