



Project Proposal for Ph.D.

ProjectDetails(The research problem must clearly indicate the need for an interdisciplinary approach)

Project Title	<u>Breaking the barriers: Improvising the release of intracellular phycocyanin from cyanobacterial cells through cavitation bubble collapse</u>
Project Summary (Minimum 500 and maximum 2000 characters)	Microalgae and cyanobacteria are gaining importance as a source of high value compounds such as carotenoids, phycobiliproteins (including phycocyanin or PC), exopolysaccharides, polyunsaturated fatty acids, and small-molecule antioxidants with cosmetic/functional potential. These bioactives have anti-inflammatory, antioxidant, pigments, anti-cancerous, antimicrobial, photoprotectants and other pharmacological activities. Efficient and cost-effective extraction methods are crucial for commercial PC production. Development and optimization of green extraction methods is required on to overcome huge energy expenditures in conventional methods (freeze–thaw) for while retaining maximum PC yield and purity. At the same time, the low-cost extraction and purification protocols with no way compromising the purity, color stability, and bioactivity of PC. <i>Arthrospira platensis/Spirulina</i> and <i>Limnospira</i> sp, <i>Leptolyngbya</i> sp. will be cultivated under optimized conditions and resultant biomass will be characterized for biomass productivity and PC content. Cultivation conditions will be tweaked to maximize the PC content. Conventional ultrasonication followed by repeated Freez and Thaw cycle will be used as reference PC extraction method and the yield and purity of PC will be evaluated. The ultrasonication method which involves the formation of cavitation bubbles and their collapse, can lead to heating and destroying some cell parts. Excessive ultrasound exposure can damage protein and chromophore structures. Thus, quantifying how oscillating and collapsing bubbles mechanically damage individual cells is very important. A Kinetic mode will help in predicting extraction yield and degradation using experimentally determined kinetic coefficients. Further single-bubble modelling will be performed to investigate how ultrasonic frequency, acoustic pressure, and bubble size affect cavitation intensity and potential cell damage.

Ph.D. Supervisors* (Supervisor 1 and Supervisor 2 cannot be from the same department of IITD)				
Role	Name of Faculty	Date of Superannuation [§] (DD/MM/YYYY)	Academic Unit in IITD/Institute/University	Email ID (Official) & Contact Number
Supervisor 1*	Anushree Malik	31/07/2034	Center for Rural Development & Technology	anushree@rdat.iitd.ac.in
Supervisor 2	Bahni Ray	26/04/2047	Department of Mechanical Engineering	Bray@mech.iitd.ac.in ,

*Supervisor 1 must be from IIT, Delhi.

+All cells in this table are mandatory fields that need to be filled by faculty for consideration of proposal.

§The date of superannuation of supervisors should be at least three years from the date of registration of selected candidates.

Project requirements (Student qualifications, experience required, etc)

*The candidate will be shortlisted based on common shortlisting criteria decided by ScRC (SIRe)

- Degree in Environmental Engineering or Biotechnology/ Life Science subjects / Biochemical Engineering
- Knowledge of biological fluid dynamics, heat and mass transfer

Source of fellowship/fundingand project number (CSIR/UGC/DBT/ICMR/ICAR/NEET-PG/DST-INSPIRE/IRD/FITT Project details, if any)
Institute fellowship/UGC/CSIR

Role of Faculty Members involved:	
Supervisor-1	Dr. Anushree Malik will mentor on Algal cultivation, monitoring of growth, PC production, optimization of experimental conditions
Supervisor-2	Dr.Bahni Ray has expertise in bubble dynamics and modeling of multiphase flow. Her knowledge on biological fluid mechanics and mass transfer will guide in understanding the bubble-cell interaction.

Note:-

1. Approval from the respective DRC/CRC/ScRC of your Department/Centre/School will be required for using the "Full-time Institute Assistantship (Category-wise) (FIA)" for selecting the students in SRe.
2. Declaration:- Faculty members, please ensure that you have at least 3 years of service left before superannuation along with adequate sitting space & lab facilities for the SRe student.
3. PI/s are also encouraged to submit joint proposals with AIIMS, NII, JNU and institutes with which IITD has an existing MoU. If the Co-PI (Supervisor 2) is from outside IITD, kindly share his/her detailed CV.
4. If a research scholar is to be considered for selection under the project fellowship, then the project should have a minimum of two-year duration remaining.
5. A candidate applying with a valid JRF/INSPIRE/any national level fellowship should have at least two-year validity from the date of joining the Ph.D. program.
6. The third supervisor’s name (if required) can be added only after the formation of Student Research Committee (SRC) subject to a strong recommendation of SRC and subsequent approval from the competent authority.
7. If Institute fellowship is being sought, then DRC approval of the parent department of Supervisor 1 is required at the time of selection.