



Prof. Dr. Md. Khalekuzzaman
Professor

Research AreaWaste to Energy; Production of Biocrude from Waste through hydrothermal liquefaction Environmental Biotechnology Bioreactor Landfill, Landfill Leachates Environmental Site Assessment and Remediation Geoenvironmental Engineering

Biography

Dr. Khalekuzzaman, P.Eng. is a civil and environmental engineer with more than twenty (20) years of extensive research, professional and academic experiences both in Bangladesh and Canada. His current research focuses on waste to energy, environmental biotechnology, anaerobic wastewater treatment, faecal sludge management, hydrothermal liquefaction (HTL), algal biofuels. Currently, he is leading the **“Sludge to Oil (SOIL)”** research group and is working as the **Principal Investigator** of the SOIL hydrothermal liquefaction (HTL) Pilot Plant funded by **Bangladesh Energy and Power Research Council (BEPRC), Ministry of Power, Energy, and Mineral Resources, Government of the People's Republic of Bangladesh**. His research interest focuses on high-quality biocrude production from different wet-waste streams (microalgae, fecal sludge, organic solid waste, plastic waste, etc.) and peat.

In addition, he worked as a senior environmental project manager/engineer for more than ten (10) years in the water and environment division at Canadian construction and engineering giant SNC-Lavalin Inc., one of the leading engineering and construction groups in the world. At SNC-Lavalin, he used to manage large scale complex environmental projects related to contaminated hydrogeological study, remediation of contaminated groundwater, water supply and sanitation project, water and wastewater treatment, environmental health and safety, liquid hazardous waste management, environmental compliances, environmental site assessment and complex remediation of contaminated lands. He has extensive management experience through various environmental projects (from \$400K to \$5M) from planning to implementation stages.

His research interest also focuses on hybridization of anaerobic wastewater treatment systems (e.g., Anaerobic Baffled Reactor (ABR), Upflow anaerobic sludge blanket (UASB), etc.); and optimization of waste to energy production through HTL process; microalgae biofuels/biocrude production focusing on low-cost microalgae harvesting techniques. In addition, he is keen on finding a low-cost faecal sludge treatment technology/approach resulting in a high-value end product for sustainable faecal sludge management (FSM) system in the context of subtropical-tropical climate regions. Moreover, he was former (2019-2022) the program coordinator for the **Global Sanitation Graduate School (GSGS)** Program with IHE Delft, Netherlands for MSc Programme in Sanitation, which is funded by Bill & Melinda Gates Foundation (BMGF). He is also an active participating member of the Sustainable Urban Water and Sanitation (SUWAS) program since held in Sweden & Cambodia (2016) jointly organized by NIRAS AB and WaterAid, Sweden, on behalf of the Swedish International Development Cooperation Agency (SIDA). He is also working as a project director on several projects related to advance wastewater treatment towards meeting Goal 6 of Sustainable Developments Goals (SDGs) for Bangladesh funded by the University Grant Commission (UGC), Bangladesh, and WaterAid Bangladesh.

He also works as a technical advisor/team leader for the design and construction of WASH projects, including industrial (e.g., textile) wastewater/effluent treatment plants in order to provide a potentially low-cost, highly efficient, sustainable effluent treatment process for a safer environment. As a researcher, he has high-class research experience treating water and wastewater. He was also involved in designing and implementing an in-situ groundwater bioremediation treatment system for the complex situation of contaminated industrial lands, bio-pile design, and evaluation for contaminated soil, Remediation by Natural Attenuation (RNA) for contaminated groundwater.

He is an expert on waste to energy, both domestic and industrial wastewater treatment processes for his comprehensive research work and practical experiences in several environmental projects. He is proficient in the environmental field and laboratory analyses for water, wastewater, microalgae characterization, microalgal lipid extraction, biocrude characterization and analysis including the Quality Assurance/Quality Control (QA/QC) sampling program. He has about one and a half years of laboratory testing experience in a Canadian laboratory and more than five years in a Bangladesh laboratory for water quality parameters of wastewater samples, according to **“Standard Methods for the Examination of Water and Wastewater.”** Dr. Khalekuzzaman was a licensed professional engineer in Ontario and Manitoba, Canada, and a fellow member of the Institution of Engineers, Bangladesh (IEB).

Education

Doctor of Philosophy in Civil Engineering

Khulna University of Engineering & Technology (KUET), Bangladesh (2019)

Thesis Title: A Hybrid Anaerobic Baffled Reactor (HABR) for the Treatment of Domestic Wastewater in Subtropical Climate

M.A.Sc. in Environmental Engineering

CARLETON UNIVERSITY, OTTAWA, ONTARIO, CANADA, Canada (2005)

Thesis Title: A Bench-Scale Sequential Aerated Peat Biofilter System Treating Landfill Leachate Under Varied Loading Rates.

B.Sc. in Civil Engineering

Khulna University of Engineering and Technology, Bangladesh ()

Prime Minister Gold Medal (First Class First Position with Honours Marks)

Service Records

- **Associate Professor**
Department/Section: Civil Engineering
Khulna University of Engineering & Technology From 01-01-1970 to 01-01-1970

Working Area:Environmental Engineering
Responsibility:

Major Activities/Projects:

Global Sanitation Graduate School (GSGS) Programme of IHE Delft MSc Programme in Sanitation and related Diploma Programme and Short Courses, IDM, KUET, Project Funded by Bill & Melinda Gates Foundation (BMGF) through IHE Delft, (July 2019 - Ongoing)

Working as a Program Coordinator for entire management and organization of the GSGS program.

Sustainable Urban Water and Sanitation (SUWAS) Program (Sweden & Cambodia), Funded by SIDA, (2016 - Ongoing)

Actively participating member of Sustainable Urban Water and Sanitation (SUWAS) program held in Sweden (May-June, 2017) & Cambodia (October 2017) jointly organized by NIRAS and WaterAid, Sweden, on behalf of the Swedish International Development Cooperation Agency (SIDA).

Optimization of Biodiesel Production from Wastewater Using a Hybrid Anaerobic Reactor and Photobioreactor (HAR-PBR) System, Project Funded by University Grant Commission (UGC), Bangladesh (2019 - Ongoing)

Involved as Project Director of the above mention project funded by UGC, Bangladesh towards innovation for a sustainable wastewater management strategy.

A Hybrid Anaerobic Baffled Reactor (ABR) Treating Domestic Wastewater, An Innovation towards Sustainable Development Goals (SDGs) in Bangladesh, Project Funded by WaterAID Bangladesh (2017 - Ongoing)

Currently, working as Project Director (principal investigator/researcher) of the above projected towards meeting goals 6 of SDGs for Bangladesh funded by WaterAID Bangladesh.

Performance Evaluation of an Insulated Anaerobic Baffled Reactor Treating Domestic Wastewater, Project Funded by University Grant Commission (UGC), Bangladesh (2016-2018)

Involved as Project Director of the above mention bench-scale project funded by UGC, Bangladesh towards innovation for a sustainable wastewater management strategy.

- **Project Manager (Geoenvironmental Engineer)**

Department/Section: Environmental Group

SOIL ENGINEERS LTD., TORONTO, ONTARIO, CANADA *From 01-01-1970 to 01-01-1970*

Responsibility: i. Managed numerous projects including Client liaison involving Phase I and II ESAs, design and conduct site remedial investigation and site remediation for soil and groundwater i. Conducted detailed Phase II ESA and hydrogeological investigation to redevelop former auto service site for residential land use i. Conducted remedial excavation to remove petroleum hydrocarbon and tetrachloroethene (PERC) solvent contamination from portion of site i. Conducted methane landfill gas evaluations at one site to ensure that unacceptable conditions were not present i. Performed environmental site reconnaissance, building inspection, supervision of environmental field programs i. Prepared site reports including data evaluation, regulatory compliance, plans, drawings and lab results i. Provide technical and management support to environmental team for complex site condition with contamination

- **Sr. Project Manager / Engineer**

SNC LAVALIN INC., TORONTO, ONTARIO, CANADA *From 01-01-1970 to 01-01-1970*

Working Area:Environment & Water

Responsibility:

Major Projects:

Former Marine Terminal, Undisclosed Client, Ontario, Canada, CA \$5 000 000, (2011 - 2015)

Complex environmental remediation project for a former marine terminal with multiple stakeholders. Major project components involved excavating approximately 25,000 tonnes of impacted soil and disposing offsite, installation of shoring system along the property line and existing building, removal and decommissioning of former infrastructures and underground product piping as well as the segregation, screening, washing and crushing of impacted soil and blast rock, and in-site bioremediation groundwater treatment.

Remediation Projects Across Ontario, Various Clients, Ontario, Canada, CA \$1 000 000, (2009 - 2015)

Projects involve deep excavation below the water table in coarse-textured soil, implementation of shoring systems to support building foundation and/or beside major road way, relocation of utilities and the addition of chemical oxidant to address residual petroleum hydrocarbon contamination.

Phase II Environmental Site Assessments (ESAs) for Petroleum Facilities, Various Clients, Canada, (2008 - 2015)

Manage several Phase II ESA projects for petroleum facilities including for project management, coordination with the contractor, site reconnaissance, building inspection, supervision of environmental drilling, conduct soil, and groundwater sampling, monitoring wells design and installation, surveying, hydraulic testing, soil vapor surveys using risk assessment approach.

Environmental Services for Former Petroleum Retail and Bulk Plant, Undisclosed Client, Red Lake, Ontario, Canada, CA \$200 000, (2008 - 2011)

Managed environmental management strategy in accordance with Ontario Ministry of the Environment (MOE) Certificates of Approval (CofA) for the site; the CofA was issued for the site to operate as a waste disposal site for the processing of onsite bio-piles constructed with petroleum hydrocarbon impacted soil.

Research Interest

Waste to Energy: Production of Biocrude from Waste through hydrothermal liquefaction

co-hydrothermal liquefaction

Wastewater-grown microalgae

Faecal sludge

Lignocellulosic biomass

Peat (partially decomposed Lignocellulosic biomass)

Plastic waste

Environmental Biotechnology

My current research focuses on the followings: (1) hybridization of anaerobic wastewater treatment systems (e.g., Anaerobic Baffled Reactor (ABR), Upflow anaerobic sludge blanket (UASB), etc.); and (2) optimization of microalgae biofuels production focusing on low-cost microalgae harvesting techniques (e.g. gravity settling, auto/bio flocculation, etc.); and (3) optimization of hydrothermal liquefaction process. The primary objectives of my research are to develop a simplistic sustainable approach for wastewater treatment and bioenergy (as biofuels) production for most of the developing countries located in subtropical-tropical regions.

Bioreactor Landfill, Landfill Leachates

A Bench-Scale Sequential Aerated Peat Biofilter System Treating Landfill Leachate Under Varied Loading Rates.

Environmental Site Assessment and Remediation

Environmental Site Assessment and Remediation of contaminated land with Chlorinated Solvents, Petroleum Hydrocarbons, and Metals

Geoenvironmental Engineering

Geoenvironmental Engineering: Contaminant Hydrogeology, Behavior of DNAPLs (Bunker-C) in fractured limestone bed rock.

Publication

Books

Journals

8. Hasan,M. , Khalekuzzaman,<. K. , Alamgir,M. , Datta,P. and Kabir,S. B. (2021) , " **A new energyâ€™positive technological approach for wastewater treatment and bioenergy generation using a photo anoxic baffled reactor (PABR),**" *International Journal of Environmental Science and Technology*(*H Index = 75, IF = 3.08*), Springer

7. Hasan,M. , Khalekuzzaman,<. K. , Hossain,N. and Alamgir,M. (2021) , " **Anaerobic Digested Effluent Phycoremediation by Microalgae co-culture and Harvesting by Moringa oleifera as Natural Coagulant,**" *Journal of Cleaner Production*(*H Index = 200, IF = 9.30*), Elsevier

6. (2020) , " **Enhancing Microalgal Productivity and Quality by Different Colored Photobioreactors for Biodiesel Production Using Anaerobic Reactor Effluent.,**" *Biomass Conversion Biorefinery.*(*H Index = 27, IF = 5.00*), Springer

5. (2019) , " **A Simplistic Approach of Algal Biofuels Production from Wastewater Using a Hybrid Anaerobic Baffled Reactor and Photobioreactor (HABR-PBR) System. ,**" *PLOS ONE (H Index = 332, IF = 3.24)*, PLOS, vol14, no.12

Conference

5. (February 23-24, 2019,) , " **Sustainable Biofuels Production and Wastewater Treatment by A Proposed Low-cost and Energy Positive Technological Approach,**" *Proc. of 6th Intl. Conf. on Integrated Solid Waste & Faecal Sludge Management in South-Asian Countries-* , WasteSafe 2019, M Alamgir, et al. (Eds.), ISBN: 978-984-34-6151-3, pp.pp 107-108

3. Haque*,R. , Khalekuzzaman,<. K. , Hasan,M. and F.Rabbi,K. & F. (19â€™21 December 2018) , " **Effect of Low Temperature On Hydrodynamics of a Hybrid Anaerobic Baffled Reactor (HABR),**" *4thInternational Conference on Advances in Civil Engineering 2018(ICACE 2018)* , CUET, Chittagong, Bangladesh