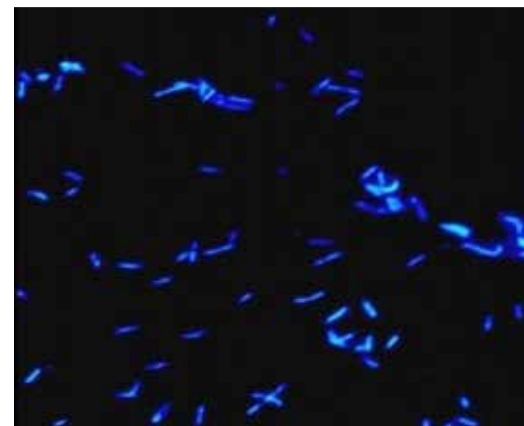
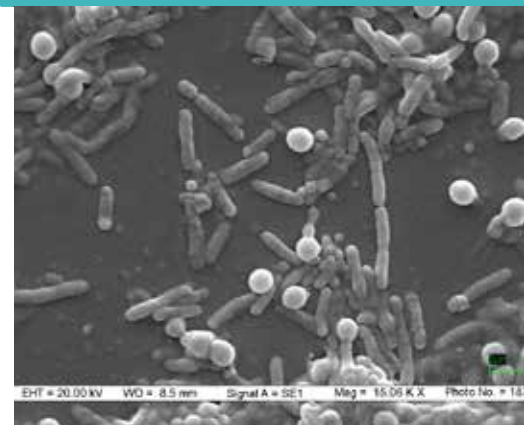


Industrial Biotechnology Programme



The **Industrial Biotechnology (IB) Programme** is committed to providing green, sustainable solutions for the protection of the environment and developing cutting-edge technologies to help boost the rapidly expanding Indian economy towards a fruitful future. The programme provides bio-technological solutions for their wider application to address environmental concerns. Besides providing smart solutions for industry issues, we also work towards developing bio-based products that help businesses grow in a manner that is both environmentally conscious and commercially successful.



Bio-augmentation in CBM well site at Jharia, Jharkhand

Our Key Areas

- Bioremediation by customized microbial technology for pharmaceuticals, pesticides, and other organic pollutants

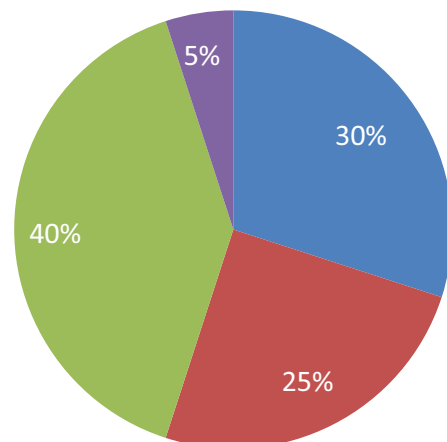
Before Bioremediation: Oil Spill site at Farmer's field in Mehsana, Gujarat



After Bioremediation: Farmer's field at Mehsana, Gujarat



- Demonstration of microbial methane generation/ enhancement in poor to marginally producing wells in CBM fields
- Microbial enhanced oil recovery (MEOR) from oil reservoirs for tackling the problem of oil-well stripping
- Viscosity reduction of heavy oil in oil reservoir and flow line
- Prevention of paraffin deposition in oil well tubing
- Development of eco-friendly oil well drilling fluid: XC polymer (xanthan gum)
- Exploitation of metagenomics for production of biodegradable plastics
- Development of potential probiotics from novel sources



- Research Project
- Implementation Project
- Demonstration Project
- Consultancy

Sustainable Solutions

Fermentation Technology Research Centre (FTRC): This is a modern fermentation facility with a series of capacity bioreactors ranging from 3.2 to 15,000 litres. The production facility at FTRC was created to conduct research at TERI Gram and has a capacity of up to 1000 tonnes of oil-degrading microorganisms (Oilzapper) per year.



Bioreactor at the Fermentation Technology Research Centre

Microbial enhanced oil recovery (MEOR) technology: To tackle the stripper oil well problem, the IB programme has developed duly tested microbial solutions for enhanced oil recovery—up to 90°C of reservoir temperature. Microbial consortia metabolites in the oil wells, thus increasing the sweep efficiency of crude oil from reservoir leading to enhanced oil production. It has been investigated that microbes can reduce the viscosity of heavy oil; technology has been developed and tested in the Lanwa and Becharaji heavy oil fields. Additionally, there are efforts to enhance oil recovery from heavy oil reserves.

Creation of a Joint Venture: Oil and Natural Gas Corporation Limited (ONGC) joined hands with The Energy and Resources Institute (TERI) to form ONGC-TERI Biotech Limited (OTBL); a joint venture, with an aim to find sustainable solutions and provide 'green' technology services to the oil and gas sector.

OTBL is rendering the service of large-scale application of Oilzapper (a consortium of crude oil and oily sludge degrading bacteria), microbial enhanced oil recovery (MEOR), and prevention of paraffin deposition technologies to ONGC, Oil India Limited (OIL), and other companies in India and abroad, especially in Middle East countries. For details, please visit www.obtl.co.in

Enhanced biological methanation at the Raniganj: For improved methanation beneath the subterranean coal, IB has developed a biological approach called 'enhanced biological methanation'. Results from the demonstration recently carried out at the EDGEPL Raniganj CBM block, in five poor to marginal CBM wells, indicate two-fold enhancement in methane production.

Development of green corridor (plantation) on highways and greening of schools for environment sustainability: As a CSR initiative, we are working for a green corridor development initiative by conducting outreach and awareness programmes, engaging schools, community, government organizations, and other stakeholders for environment awareness and mass movement.

Carbon dioxide sequestration for platforms chemical: At present, research has been initiated with succinic acid production, as a platform chemical for plastics, textiles, pharmaceuticals, and solvents industries. The developed process was demonstrated at a scale of 10 litres which witnessed a significant reduction in CO₂ released into the environment.



MoU signing for OTBL: ONGC-TERI Biotech Limited



Bio-stimulation in CBM well site at Raniganj, West Bengal

Thematic Domain

Working through the two areas—Microbial Biotechnology (MB) and Bioremediation Technology (BT)—the Industrial Biotechnology programme focuses on basic and applied research; particularly research addressing issues related to oil and gas industries.

The Microbial Biotechnology (MB) Area

Actively engaged in exploring sustainable approaches for development of innovative technologies; this area mainly focuses on basic and industrial application research. It is involved in enabling clean energy production for large scale industry application, as well as exploring advanced solutions; particularly in the oil and gas sector.

Thrust areas under MB are:

- In situ bioconversion of carbon dioxide into methane in CBM wells
- Biological enhancement of methane production in underground coal reservoir
- Industrial-scale production of alkaline-protease
- Safeguarding natural gas pipelines and LPG pipelines from microbial-induced corrosion (MIC) in oil/gas pipelines

The Bioremediation Technology Area

This area is dedicated towards utilizing microbial resources for restoring the environment. With a focus on achieving environmental remediation for sustainable development, the research area also deals with the large-scale implementation of environmentally-friendly technology.

BT focuses on:

- Large-scale bioremediation of hydrocarbon-contaminated soil and oily sludge-contaminated sites
- Production of Oilzapper: a cocktail of natural hydrocarbon degrading bacteria for bioremediation of oil-contaminated sites
- Bioremediation of pesticide-contaminated dumpsite
- Assessment of environmental damages caused due to oil spills
- Development of enzyme-based technologies for degradation of micro pollutants
- Development of bio-based product(s) for application in drilling of oil wells, fracturing of reservoir rocks, and water shut off jobs.

The research and activities carried under the IB programme endeavour to cover the following Sustainable Development Goals: SDG 7, SDG 9, SDG 13, and SDG 17



Biotech Product & Process Development for Commercialization Award 2018

Accomplishments

» We completed a mega-project for soil bioremediation with the Kuwait Oil Company (KOC) in Kuwait. The oil spill site was lying waste for many years and could not be utilized. After TERI's restoration of the site, the drilling of oil wells has now started.

- » Our laboratory has an **NABL accreditation** in the discipline of chemistry and biology underwater testing (drinking, surface, and ground water/hydrocarbon analysis).
- » We received the **National Research Development Corporation Award 2005**—awarded by the Minister of Finance, Government of India— as well as the **National Bioscience Award for Career Development** (by the Department of Biotechnology) for the invention Oilzapper.
- » Awarded by the Department of Biotechnology, Government of India, **Biotech Product & Process Development for Commercialization Award 2018** for the enhanced biological methanation technology. The award comprised citation and cash award.



Restoration of oil spill site at KOC oil field



Biotech Product & Process Development for Commercialization Award 2008

» The IB programme was presented the **Biotech Product & Process Development for Commercialization Award 2008** by Department of Biotechnology, Government of India. The Award was presented by Dr A P J Abdul Kalam, Former President of India, for the development of Microbial enhanced oil recovery (MEOR) technology.

Way Forward

At the IB programme, we have always worked towards strengthening the link between research and commercialization, through leveraging our strategic partnerships: both national and international.

We specialize in the development of innovative models to offer services at attractive market rates. Currently, we are working on the development of an economical, sustainable microbial process for carbon dioxide assimilation and conversion to platform molecules. At present, research has been initiated with succinic acid production, as a platform chemical for plastics, textiles, pharmaceuticals, and solvents industries.

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