

## **RESEARCH THEME**

Industrial Biotechnology is meant to produce biomaterials or performing industrial processes, using organisms or their physiological processes. Combining recombinant DNA techniques and biotechnology has competitively paved the way to change future industry. The industrial biotechnology division of the centre has been established to apply these capabilities of the organisms to meet the industrial demands of the country. In general, the aim of this division is to conduct basic and applied researches on physiology, and genetics of microorganisms and the manipulation of them to produce biomaterials needed in food, paper and pulp, pharmaceutical, textile, animal feed, medical, and agriculture industries. The activities include researches in laboratory levels to pilot plant and industrial stages and test the biological products to suite the targeted industries.

## **RESEARCH FOCUS**

The current research focus of Industrial Biotechnology Division encompasses following areas:

- Biotechnology and rDNA technology of alpha-amylase for food and textile industries
- Biotechnology of Cellulases and xylanases for textile and feed industries
- Cellulase-less xylanases for paper and pulp industry
- Exploration of gene pool of *Aspergillus niger* for food industries
- Exploitation of yeast gene pool for various industries
- Engineering of enzymes for industrial implications
- Immobilization of enzymes and cells for commercial exploitation
- Translation of laboratory results to industrial scale product formation

## **SALIENT ACHIEVEMENTS**

- ❖ PAEC Scientist of the year award and gold medal 2004, Dr. Muhammad Ibrahim Rajoka.
- ❖ Developed syntrophic co-culture for methane production from distillery slops and grown in industrial scale bioreactors first time in Pakistan

- ❖ Cloned, sequenced and gene sequence deposited in gene bank for thermophily, xylanase, and endo-glucanase with accession no M 86662 HMTI & M86663 HM2, AY344429, and D00546 respectively
- ❖ Detailed kinetics of enzymes production and their properties performed first time in the country
- ❖ Fabricated and automated electrophoresis unit for non-destructive removal of polysaccharides from enzymes
- ❖ Discovered NEMSA, denaturation and renaturation PAGE
- ❖ Engineering of enzymes to suite industrial applications
- ❖ For  $\alpha$ -amylase production, mutants have been isolated and grown in 1800 L Fermentor
- ❖ Mutant of *Chaetomium thermophile* with 1.5-fold improvement in enzyme yield achieved, tested in feed and textile industry
- ❖ Developed thermotolerant yeasts for sugar industry for industrial production of ethanol
- ❖ Methane gas was produced on industrial scale first time in Pakistan using known organisms (7 *Clostridium* spp, *Syntrophomonas*, *Desulfovibrio* sp. and 8 methanogens) by Habib Sugar Mills which produced 27,000 m<sup>3</sup> gas per day and in lab bioreactor studies got 100% theoretical yield of methane.
- ❖ Mutants of *Bacillus thurigiensis* resistant to UV achieved and tested in NIBGE insectory.
- ❖ Mega project on  $\alpha$ -amylase production.
- ❖ USAID project on molecular biology of cellulases.

#### **COMMERCIAL ACTIVITIES:**

Supply of microbial cultures for industrial production of methane gas from agro-industrial wastes, Supply of thermotolerant and conventional yeasts for industrial production of ethanol and dairy products, Supply of microbial cultures for commercial production of citric acid, xylitol and industrial enzymes (cellulases, xylanases & amylases), Facility for purification of biomolecules, Analytical assistance for volatile

fatty acids, carbohydrates, proteins, amino acids & edible acids, characterization and protein engineering of industrial enzymes, Facility for mutagenesis and genetic engineering of industrial enzymes, Facility for mutagenesis and genetic engineering of industrial organisms, Designing of fermentation processes, consultancy services for improvement of fermentation processes, determination of microbial loads in different industrial samples. MoU signed on August 9, 2005 for commercial production of citric acid using  $dgr^{-1} asp^{-1} cit^{-1}$  mutant derivative of *Aspergillus niger*.