

**Expression of Interest (EOI)**  
**ANAEROBIC GAS LIFT REACTOR (AGR)**  
**A HIGH RATE BIOMETHANATION TECHNOLOGY FOR THE GENERATION OF BIOGAS &**  
**BIO-MANURE FROM FOOD WASTE & MARKET VEGETABLE WASTE**  
**DEVELOPED BY CSIR-IICT**

**Introduction**

India generates about 350 to 400 million tons of organic waste (food waste, livestock waste, agriculture waste etc.) per annum. Scientific disposal of this waste is highly essential to ensure environmental safety and ecological balance. In this context, recovery of resources through eco-friendly and economically viable processes such as anaerobic digestion (AD) is gaining significance under Swachha Bharath Mission (SBM) initiated by the Government of India (GoI). In this framework, anaerobic digesters currently employed for solid waste treatment are broadly classified into two distinct categories, such as conventional digesters and high rate digesters. Conventional anaerobic digesters such as floating dome type and fixed dome type digesters for solid waste treatment are slow rate digesters designed for very long hydraulic retention time (HRT) with large reactor volume and low volatile solids (VS) reduction. In many cases, conventional digesters have been found to be failed due to choking. For the biomethanation of organic solid waste in any case, conventional digesters are not suitable for the processing of large quantities of waste. High rate digesters are basically designed to minimize HRT and increase the rate of biogas production by incorporating the best features of anaerobic digestion. High rate digesters also address the bottlenecks involved in conventional digesters.

**AGR Technology developed by CSIR-IICT**

Keeping this in view, CSIR-IICT has made intensive research efforts and developed a novel high rate biomethanation technology based on “ANAEROBIC GAS LIFT REACTOR (AGR)” (Patent Number: 307102) for the generation of biogas and bio-manure from organic solid waste. AGR is basically designed to minimize HRT and increase SRT while enhancing the rate of biogas production by incorporating the best features of high rate biomethanation such as mixing, retention of high active biomass, buffering capacity, food to micro-organism ratio, feed slurry concentration, microbial culture inhibition mechanisms, delinking of HRT & SRT etc. This technology is superior in terms of biogas and bio-manure production as it incorporates novel pre and post processing technologies required for the biomethanation of organic solid waste as per its characteristics. This technology provides a decentralized treatment option for organic waste based on high rate biomethanation to generate biogas for combined heat and power (CHP) applications.

**Highlights of Technology**

- Advanced digester design
  - Smaller digester volume
  - Designed for 1 ton waste treatment and scaled up to 10 tons
  - Semi-automatic plant operation
- Higher biogas yield
- Generation of organic fertilizer
- Use of enriched microbial consortia
- Remunerative for decentralized application
- Distributive biogas plants at waste generation source
- Use of by-products will make the plant sustainable

**Technology Commercialization**

The AGR technology was licensed to M/s AESPL in Jan 2015 on exclusive basis and presently nine plants of different sizes (250 kg/day to 1 ton/day) are working at The Akshaya Patra Foundation (Bellary & Hubli in Karnataka; Rourkela in Odisha; Vrindavan in UP; Ahmadabad, Surat & Bhavnagar, Bhoj in Gujarat, Pondicherry) for the treatment of food waste based on AGR Technology. The biogas generated from these plants is being used to replace LPG in the kitchen. In addition to this, 8 more plants are working across India for the treatment of variety of organic wastes like organic fraction of MSW, food waste and market vegetable waste. Based on the performance output from the working plants, the AGR Plants are found to be a) Remunerative with a return on investment (ROI) within 4 to 5 years, b) Sustainable as biogas is being used to replace LPG/CNG/grid power and c) Digestate is being sold as soil conditioner/bio-manure.

**Licensing of the AGR Technology:** CSIR-IICT prefers to license the AGR Technology for the generation of biogas and bio manure from food waste and market vegetable waste on non-exclusive basis with the following terms and conditions.

## CSIR-Indian Institute of Chemical Technology

### **A. Responsibilities of CSIR-IICT**

- i. Preparation of schematic process flow diagram with description
- ii. Providing the dimensions of critical equipment including anaerobic digester.
- iii. Characterization of organic waste for Total Solids (TS), Volatile Solids (VS), pH and other important parameters.
- iv. Advice regarding the testing, selection of seed culture, process-commissioning of the plant etc.
- v. Overall technical advice for successful installation and operation of the plant.
- vi. Assistance in preparation of safe and standard operating procedure (SOP).
- vii. Periodic performance evaluation, testing the samples periodically to investigate the health of the digester and biogas production check during the course of project.
- viii. Issue of biogas and bio-manure characterization reports.
- ix. Supervision during the erection of the plant, inspection & testing of all critical equipment.

### **B. Responsibilities of Licensee**

- i. Preparation of P & I Diagram based on the process description given by CSIR-IICT. Preparation of layout with area and utility requirements.
- ii. Fabrication & procurement of all major equipment, bought out items and anaerobic digester(s)
- iii. Installation & commissioning of the plant including site preparation.
- iv. Conforming to all safety norms & regulations in design, installation and maintenance of the plant.
- v. Operation and maintenance of all the plants as per the agreements with client .
- vi. Preparation of SOP in association with CSIR-IICT.
- vii. Execution of the project as per all specifications and process flow prepared by CSIR-IICT.
- viii. Tasks not covered above, but relevant to the turnkey execution of the plant.

### **C. Confidentiality clauses**

During the tenure of the discussions and thereafter, the party undertake on their behalf and on behalf of their subcontractors/ employees / representatives / associates to maintain strict confidentiality and prevent disclosure thereof, of all the information and data exchanged / generated pertaining to work for any purposes.

### **D. Financial Obligations**

Capacity of the plant	Model Name	Upfront Technology fee	Royalty
25 to 200 kg/day	CSIR-IICT AGR: Bio-Home	Rs.2,50,000/- (Two lakhs and fifty thousand only) and taxes as applicable	5% of the cost on each installation during the period of agreement
Above 200 kg/day	CSIR-IICT AGR	Rs.10,00,000/- (Ten lakhs only) and taxes as applicable	5% of the cost on each installation during the period of agreement

### **E. MoU/ Duration**

CSIR-IICT shall enter into a Memorandum of Understanding/ Agreement (MOU/A) for licensing of the AGR technology on non-exclusive basis for a period of three years.

### **Selection Criteria:**

All the applicants (firms) would be screened through a technical committee constituted by Director, CSIR-IICT. The qualification criteria include engineering competence, financial background, track record in the past five years, capability of executing turnkey assignments (EPC projects) and other criteria as per the guidelines of the technical committee.

The firms who are interested in seeking license of the above technology from CSIR-IICT may send their application to the undersigned.

Head,

Business Development and Research Management

CSIR-Indian Institute of Chemical Technology, Tarnaka, Hyderabad-50007