Biomethanization of Coal

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MINISTRY OF COAL

GOVT. OF INDIA

(Funded under S&T Grant of MoC)

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PROJECT COMPLETION REPORT

1. **Title of the project**: Biomethanization of coal

2. **Project Code:** CE-36

3. **Date of commencement**: 3rd Jan, 2023

4. **Approved date of completion (As approved originally):** 2nd Jan, 2025

5. **Actual date of completion**: 2nd Jan, 2025

6. **Objectives as stated in the Proposal**:

The present investigation was carried out with following objectives:

- Biomethanization of various type/grade/rank of coal samples in laboratory condition at bench scale.
- To know the most suitable microbes responsible for biomethanization of coal.
- Characterization of coal before and after biomethanization and to understand the role of coal composition in biomethanization process.

7. The work programme as proposed and approved by SSRC:

(i) Field study:

Once the project is sanctioned, the coal samples shall be collected and procured from different coal field and lignite fields of the country.

(ii) Laboratory study:

The work shall be carried out in the Department of Botany, Institute of Science, Banaras Hindu University, Varanasi, and Department of Geology, Institute of Science, Banaras Hindu University, Varanasi. Extensive microbial work, like isolation of bacteria, algae, fungi, and archaea from coal, shall be carried out in the Bioremediation Laboratory, Department of Botany, Banaras Hindu University, Varanasi. Suitable microbes will be selected on the basis of its efficiency for coal methanization. These chosen microbes shall be identified on the basis of partial genome sequencing (PGS). Various optimization factors shall be used in the laboratory to enhance the efficiency of chosen microbes for the methanization of coal. Detailed information regarding genes involved in methanization shall be obtained through whole genome sequencing (WGS). It would indicate phylogenetic novelty of the chosen strain. The outcome of whole-genome-sequencing will reveal the role of microbial application in coal industry. Best microbial consortia would also be used for methanization of coal. This would open a new window of research for obtaining clean energy.

Methane speciation, quantification, will be carried out through Gas chromatography Mass Spectroscopy (GC-MS) on the payment basis from laboratories in India. Petrography, proximate and ultimate analyses of coal (before and after microbial treatment) shall be carried out in MPS Laboratory of Department of Geology, Banaras Hindu University, Varanasi.

Conclusions and recommendations with quantification of benefits to the industry.

The study reveals that methane production has no direct relation with coal grade or coal type or coal rank. The correlation calculated between them is insignificant which is clearly seen in the data as well as in the line graphs. This validates that the bacterial culture reacts with all the coals regardless of whether its rank (low or medium rank), grade (low or high in ash yield), or whether any maceral group dominates (coal type). However, with an increase in the incubation period, there is a gradual increase in methane production. Due to time constraints, we experimented for a maximum incubation period of 82 days, where a maximum of 61.22% of methane production was observed from one of the investigated coals (Turra coal seam of the Singrauli coalfield). As scientist, we believe this result to be very encouraging.