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RESTRICTED ENGLISH

TECHNOLOGIES OF DIRECT COAL LIQUEFACTION

PHASE II

DP/CPR/83/002

THE PEOPLE'S REPUBLIC OF CHINA

Technical Report *

Mission 30 April to 11 May 1986

Prepared for the Government of the People's Republic of China
by the United Nations Industrial Development Organization,
acting as executing agency for the United Nations Development Programme

Based on the work of Y. Sanada
Consultant on Techniques of Catalytic Coal Liquefaction

United Nations Industrial Development Organization
Vienna

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Post title	**Consultant on Techniques of Catalytic Coal Liquefaction**
Duration	**10 days in Beijing**
Date	May 1 - May 10, 1986
Duty station	Beijing, China
Purpose of project	To strengthen and support the Government's on-going R+D programmme on techniques of direct coal liquefaction carried out at the Central Coal Mining Research Institute (CCMRI), Beijing.
Duties	I was assigned to CCMRI and, in consultation with research workers from CCMRI, review their work programme including practical laboratory work and give lectures and advice on the following topics:

1) Principle of catalysis in coal liquefaction and methods of selecting catalysts;

2) Evaluation and testing methods of the hydrogen-donor property of solvent in coal liquefaction;

3) Reaction engineering of coal liquefaction and the scaling up of the reactor;

4) Study on making carbonaceous materials from coal.

Upon my completion of my duties, I prepare and submit to UNIDO a report summarizing my activities.

Report of results

During my stay at CCMRI in Beijing, I executed the following activities:

1. Visit to facilities and discussion

   1.1 Coal liquefaction process development units (0.1 ton/day capacity, continuous flow reactor type),
   1.2 Support facilities for coal liquefaction R and D,
   1.3 Analytical instrumentation for coal feedstocks and for liquefaction products.

2. Lecture

   In order to review CCMRI's work programme including practical laboratory work, I gave lectures on following areas:

   2.1 Coal liquefaction catalyst, its assessment and design,
   2.2 Characterization of solvent in coal liquefaction, its hydrogen donor ability,
   2.3 Reaction kinetics and mechanism of coal liquefaction for the reaction engineering and scaling-up of the reactor,
   2.4 Carbonization and coking reaction focussing to making carbonaceous materials such as carbon fiber, needle coke and active carbon from coal-derived liquids or coal.

I used a slide projector and overhead projector with more than 500 figures and tables.

Attendees of my lecture were more than 25 persons who are scientists and engineers belonging to research laboratories of coal liquefaction and analysis.

After each lecture I had deep discussions of the matters relevant to my lecture. We had added much favourable knowledge on coal liquefaction.

3. My recommendations to UNIDO and activities in my rea are as follows:

3.1 As well as routine analytical instrumentation for coal and coal-derived liquid, such sophisticated analytical instruments as CHN analyser, sulphur analyser, gas chromatography with data processor, high pressure liquid chromatography, gel permeation chromatography and nuclear magnetic resonance spectroscopy and infra-red spectroscopy are available in the well-equipped laboratories at CCMRI. However, the last two instruments are not of the up-to-date type. Replacement would be favourable if possible. CCMRI has a project to purchase GC-MS, which is capable of analysing at the molecular level, coal derived liquids and upgraded oil. This is an instrument capable of the characterization of oil, and the evaluation of upgraded catalysts.

I strongly believe that all the facilities described above will become useful for coal liquefaction R+D with well-trained personnel. It is expected that CCMRI will acquire a deep knowledge and good experience through running the facilities and equipment. They will reach a high level in the coal utilization research field.

Lastly, I would like to add a remark that coal liquefaction is the method supplying not only an alternative source of energy to oil but also indispensable feedstocks of aromatic chemicals and carbonaceous materials with high quality.

3.2 CCMRI has received a book and more than 40 research papers issued from Hokkaido University, and I have sent the materials described on evaluation of coal liquids by NMR, hydrogen transfer ability and hydrogen donor property of solvent after I came back to Japan.