

● R&D on Coal Utilization by Clean Coal Combustion

I. Outline of the Project

Regarding the industrial waste disposal, of which amount has been becoming quickly increasing year after year, much has been accomplished effectively in such environmental conservation activities as its disposal etc., rearrangement of facilities, and some other technical development, which are all supported by those laws related to Resource Recycling, Air contamination Prevention and Water Quality contamination Prevention, etc.

However, there still remain some problems regarding deficiency and urgent need of its disposing site acquisition as the same as before. In addition, industrial waste is generally dumped away for some land reclamation. It means that its containing energy material, unburned carbon, has not been utilized properly up to now, indicating that the amount of it, for effective or useful uses, has been kept very low in total amount.

The technology survey aims at **Effective Utilization of Unused Combustibles for an energy source with reduction of accompanying Environmental Burdens**. For this purpose, R & D on mixed combustion of coal and unused combustibles, applicable technology for the mixing of those combustibles, in addition, behavior study of those harmful materials contained in the exhaust gases, fly ash and molten slag, together with their countermeasures for expelling such harmful materials, have been under implementation.

II. Contents of the R & D

Regarding the establishment of a power generation operated by mixed combustion of coal with unused waste combustibles and the need to reduce environmental burdens, the following items have been studied to meet the above-mentioned purposes.

- (1) Reviewing of the system (survey of occurrences of the unused combustibles, feasibility study on its urban type power generation)
- (2) Fuel manufacturing techniques (raw materials mixing)
- (3) Cleaning technology of exhaust gas and ash
- (4) Mixed combustion technology of coal and unused combustibles
- (5) Mixing utilization technology of coal and unused combustibles (activating carbonizing furnace technology)
- (6) Reviewing of practicability (study on a demonstration plant)

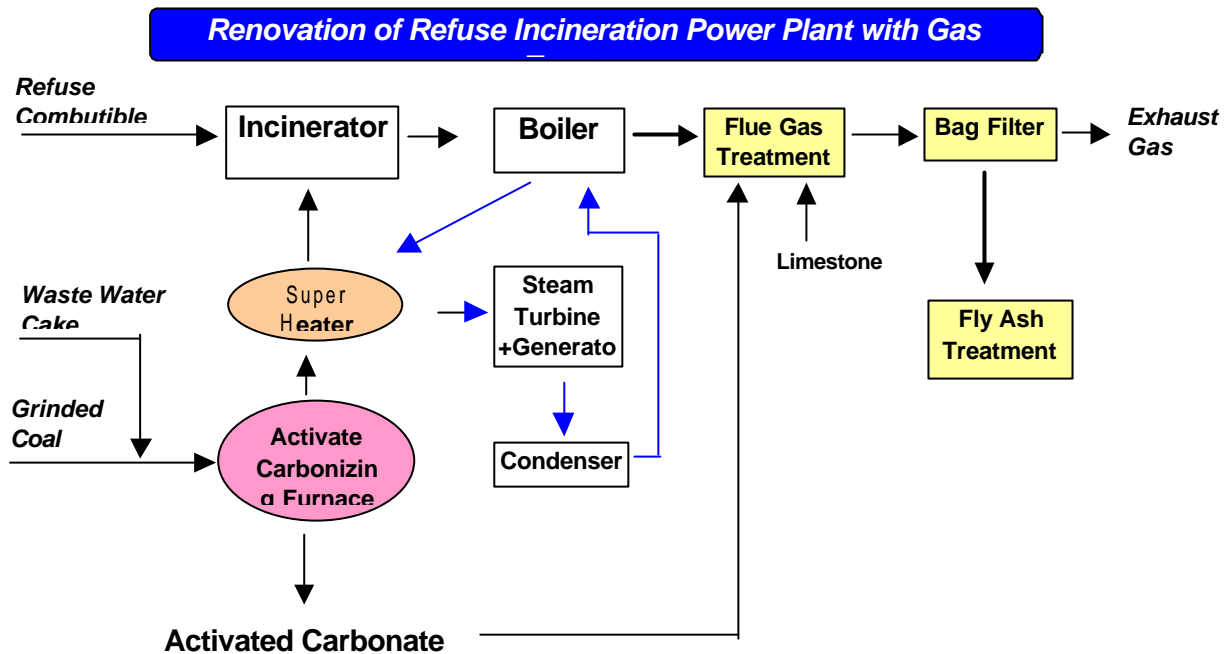
However, during the period of this R & D, the regulation has become more strict year after year in general trend by the legislation of, “extraordinary enacting law on countermeasures for Dioxin”, etc. which has much enforced those related regulation regarding combustion of waste materials. On other hands, recycling business has become vividly promoted which has decreased the merit of coal utilization a little in relying solely on the appropriation of the prevailing combustion technologies, which uses the conventional coal co-combustion technology. In this regard, materialization of coal using waste burning power generation seems to encounter more difficult situation nowadays.

For materialization of the technology of a highly economic coal mixed waste combustion power generation with less environmental burden, it has been found that **the Activated carbonizing furnace technology can be effectively applied for burning the mixed fuel of coal and unused combustibles**, then the current research has been undergoing in focusing the external heat based screw-type activated carbonizing furnace technology, depending on those facts and knowledge obtained during the period from FY1996 until FY2000.

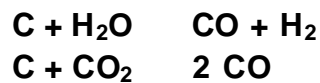
III. Results of the Research

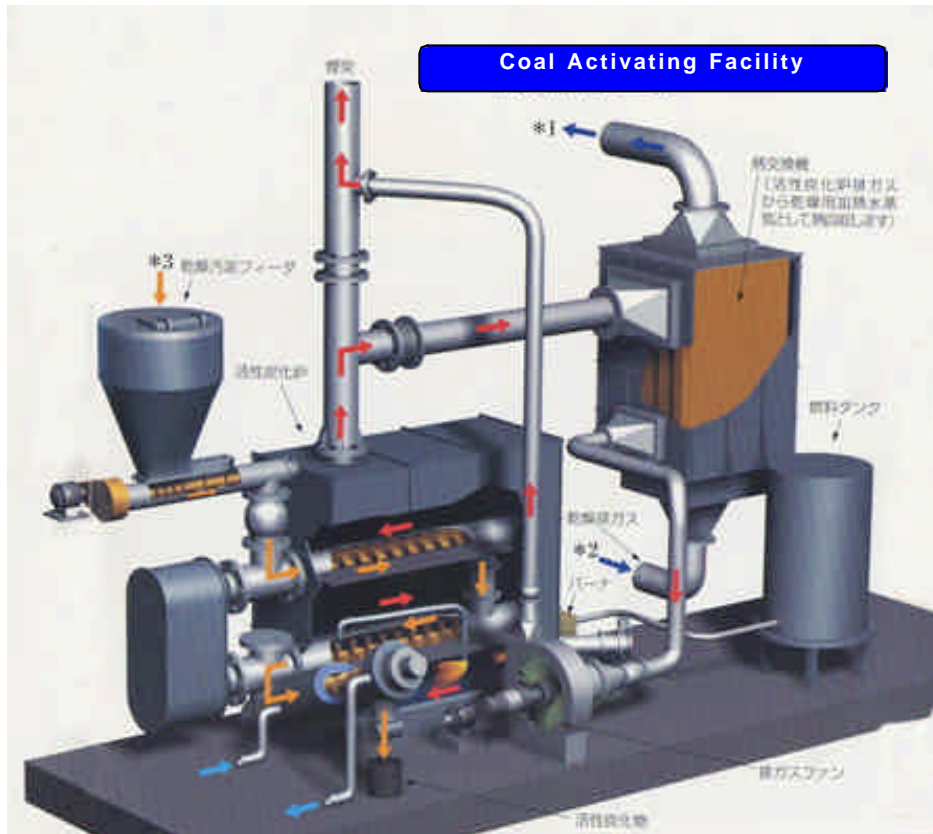
1. Designing and Checking of the System .

The system flow is illustrated as follows, which uses an activated carbonizing furnace made by using an old incinerating facility, and the generated high temperature portion is used to raise the steam temperature to make a higher power generating efficiency. The colored portion of the figure is what has been newly installed in the research.



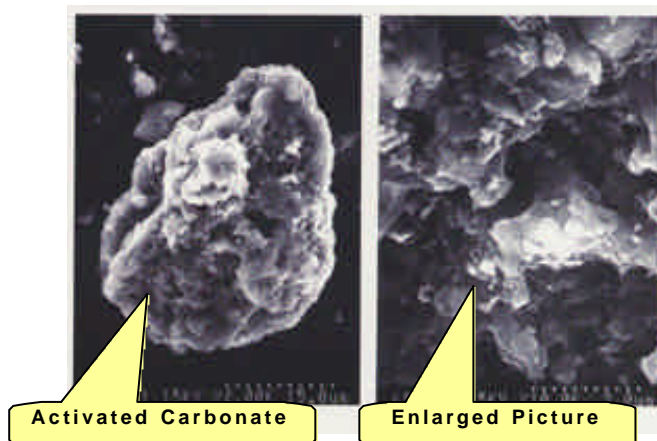
The carbonizing unit is shown in the following figure, which constitutes the central portion of the carbonizing material producing facility by which the material is produced from the sewage sludge and the feeding coal. By both the supplied steam by the sewage sludge and the carbon coming from the sewage sludge /coal, in obtaining an activation capability by the following reaction, an absorbing potential can be obtained by the formation of countless micro-pores and the chemically reacting radicals created close to the surface of the produced carbon material.





2. Results of the Major laboratory test

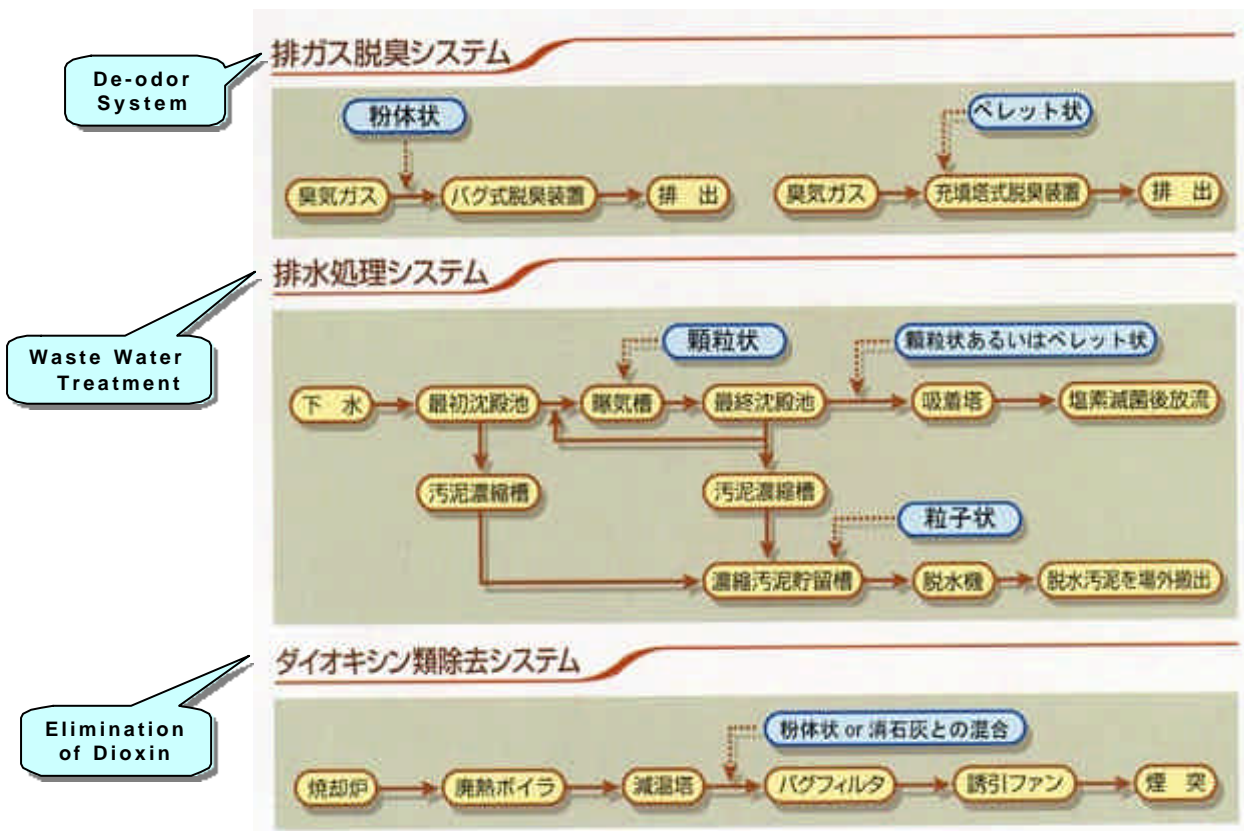
- (1) Activated carbonates have been manufactured by the sludge and coal, similarly with the case of single treatment of sewage sludge, which were treated together through a mixing process. It was also found that both coal sizes of about 3 mm in average grain diameter and the preliminarily treated pulverized coal (grain size 0.05mm in average) is both usable for the activated carbon manufacturing.
- (2) In comparison with sewage sludge, coal contains more amount of fixed carbon, which has made the production amount of the activated carbon larger in a great deal.
- (3) The water contained in the sewage sludge seems to initiate an activating reaction of the carbon, and the steam supply being automatically regulated by the mixed use of the sludge and coal.



In addition, as a link of the usage development survey of the generated mixture of the said carbonized material, overflowing stack gas was measured of its containing dioxin concentration by spraying the activated mixture to the exhaust gas line which comes from the environment cleaning center on whether it can be used to substitute the conventional activated carbon or not in order to reduce the accompanying dioxin. And the results have been found as follows:

- (4) By using the floured activated carbon material through an exhaust gas splaying, which is manufactured by mixing the sludge with coal, it has been ascertained that a little over 60% of HCl, about 90 % of the contained mercury (Hg) and 80% of the dioxin could be removed.
- (5) Furthermore, it was also confirmed in a basic test that by spraying ammonia gas into the combustion flue gas using powdery arranged activated carbonate, which was manufactured by the sludge/coal mixture, decreasing of the contents of SOx by 90% or so, and NOx by about 30% was confirmed by using the said powdered activated carbonate in passing through the preliminary coating of the bag filter.

IV. Assumed Usages of the Activated Carbonates



V. Development Framework

This R & D is under implementation by Center for Coal Utilization, Japan (CCUJ) supported by subsidies of the Ministry of Economy and Trade and Industry (METI)

[Studying Group (Collaborating Companies)]

Ishikawajima-Harima Heavy Industries Co., Ltd. (IHI)

Idemitsu Kosan Co., Ltd.

Ebara Corporation

Kawasaki Heavy Industries, Ltd. (KHI)

Takuma Co., Ltd.

Electric Power Development Co., Ltd. (EPDC)

Babcock-Hitachi K.K.

Mitsui Mining Co., Ltd.

VI. Related Technical Paper

The following technical paper is available on this R & D. If you like to know this technology more, please click the following title of the paper to link it.

→ **Cleaning of Exhaust Gas by utilizing Waste Material and Coal**