

C-3 Studies on the Impacts of Controlling Techniques for the Emission of Acid-Precursors on the Formation Processes of Acidic and/or Oxidative Substances (Final Report)

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The objectives of the studies are to propose practical and effective control techniques for SO₂ and NO_x emissions from coal combustion in East Asia and to evaluate the effects of the application of emission-control techniques on indoor and/or urban atmosphere, materials, plants, as well as human health. Following results have been achieved in FY1997-1999.

(1) A new low cost flue gas desulfurization process using a circulating fluidized bed was studied. Higher performance and SO₂ removal efficiency achieved (85% at Ca/S=1.7). This new process is very competitive among low cost flue gas desulfurization processes.

(2) A coal-biomass briquette technology with desulfurizer was developed in Chongqing, China. Its production cost and the improvement of environment were evaluated. A new electrostatic dry coal-cleaning technology was also investigated. The technologies of coal-biomass briquette and the dry coal cleaning are simple, economical, and efficient, and are applicable for air-pollution control of coal combustion in developing countries.

(3) The emission factors (EF) of SO₂, CO, NO_x and CH₄ were calculated from the combustion tests of coal briquette used in China and in Japan. The emission of CO could be reduced to half by putting a ceramic disk above the briquette with 2-3 cm space. SO₂ emission was reduced by more than 85% by adding 5-10% lime powder to coal powder.

(4) The manufacturing technique of bio-briquette with added slaked lime, which can fix sulfur dioxide in high efficiency, was investigated. Emission amounts were 35-912 and 52-1764 mg for HCl and SO₂ per 1 kg of biomass, respectively. The strength of the bio-briquette increased with increase of lignin content.

(5) There are many respiratory diseases in the residents in Chongqing. Physical check of the 81 families in Longjingun (Bio group) and 95 Tongxingun (Control group) was carried out before and 9 months after the start of using bio-briquettes. The rate of adult female with positive nasopharyngeal findings of the Bio group sufficiently decreased compared with that of the Control group. That of children of the Bio group also tended to decrease.

(6) The reduction efficiencies of air pollutants by bio-briquetting and the evaluation methods for indoor and outdoor pollution were investigated. Further, the amounts of personal exposure to NO₂ and SO₂ were estimated based on the concentration of air pollutants in Chongqing, China. Indoor SO₂ amounted to 13 times of annual average of Chongqing outdoor-air under raw coal usage, but they dropped to 1/2-1/3 by using bio-briquettes.

(7) The results of the atmospheric corrosion test suggest that the corrosion rates of the copper samples are useful for monitoring the qualitative and quantitative acid depositions over a long-term period.