FLUE GAS CONDITIONING TECHNOLOGY FOR REDUCTION IN SUSPENDED PARTICULATE MATTER

Suspended Particulate Matter (SPM) constitute one of the major air pollutants and cause many respiratory diseases including the dreaded silicosis. Vehicular traffic the coal fired thermal power stations and cement industries are the major culprits which contribute maximum SPM pollution in the ambient air. The flue gas from a coal fired thermal power station contains fine particles of ash with size varying from 80 microns to less than 5 microns. Electro Static Precipitators (ESP) are used to knock down the ash particles from the hot flue gas through a high voltage charge creating a transverse motion of the particles and getting attached to the collecting electrode. ESP's are designed to maintain SPM concentration within permissible limits specified by the State Pollution Control Boards which are normally less than 115 mg/nm^3 in majority of the states in India. However, in many power stations, the concentration of the SPM exceeds the specified limits. The high ash content in our coals (40-45%), low sulphur content in our coal (<0.4% - better of course from SO_2 emission), acidic to neutral nature of ash (6.8pH), humidity variation and above all, gradual deterioration in the performance in the ESP are few of the reasons for SPM concentration even in some increase in well managed power stations. Several options have been tried out including retrofit of the ESP itself but with limited success. This is where the flue gas conditioning

Stack#2 (first from right) is with ammonia conditioning at Punjab State Electricty Board (PSEB) Plant, Bhatinda, Punjab

technology developed in India for the first time, by DAE finds excellent application.

The elegance of this technology is that it is simple, robust and can be implemented with minimum downtime once the initial characterization and system design is finalised scientifically based on the site specific conditions. That this technology can be incorporated in new or existing installations makes it really a boon to this country where thermal power stations still continue to be our main stay in power generation and where unfortunately coal contains high ash in some cases, excess of 40-45%.

This spin-off technology was developed by the Heavy Water Board when in one of its heavy water plants having a coal fired captive co-generation plant had an excess of SPM emission levels during its initial days (500-600 mg/nm^3 compared to a limiting value of 115 mg/nm^3). The most appropriate solution was to externally alter the resistivity of the ash particles in the charged flue gas medium through weak alkali conditioning agents. A pilot level study with ammonia as a conditioning agent was followed by actual plant set up based on in-house design and engineering. A full fledged technology demonstration plant was set up for the first time in 1999 in the Captive Power Plant with spectacular success. The SPM which was hovering nearly at 500-600 mg/nm^3 came down to less than 70 mg/nm^3 making the stack exhaust almost invisible (smokeless stack).

Subsequent to the demonstration of this technology and completing the formalities of patenting (patent is likely to be available in near future), the technology was demonstrated at some more power stations within the country with successful results. A systematic scientific approach followed at all these places in terms of selection of dosing rate, types of distributor of the ammonia and air mixture resulted in bringing down the SPM concentration in all these power stations. The comparison with other flue gas conditioning chemicals indicated that ammonia or its derivatives would be the most appropriate flue gas conditioning chemical for Indian conditions.

After successful commissioning of this system at HWP, Manuguru, this technology was demonstrated at the power plants of Punjab State Electricity Board, Bhatinda and the Gujarat Electricity Board, Ukai through technology transfer channel. In all these power stations the technology was demonstrated as a retrofit option to existing ESPs, and could bring down the SPM concentration to well below 100 mg/nm^3 without any retrofit of ESP itself.

M/s Chemithon India Pvt. Ltd. to whom this technology has been transferred, is currently in the process of implementing this technology at number of power stations. Pilot scale tests have already been completed at Kolaghat Power

Station and Badel Power Station. Trial runs are likely to start at Madhya Pradesh State Electricity Board, Korba, Durgapur Power Station, West Bengal as well as in some of the southern power stations. Efforts are currently on to implement this in NTPC power stations.

R&D being a continuous process, work is pursued for directly dosing aqueous ammonia. R&D on implication of ammonia fly ash in cement and concrete is also being taken up at IIT Delhi through Fly Ash Mission in order to ensure that the ammonia dosing has no effect on the process of cement making using fly ash.

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