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## Studying Flow Dynamics of Catalyst Powder in CCU for Troubleshooting

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Gamma scanning and radiotracer applications are very effective and inexpensive tools to understand and optimize the process as well as troubleshoot the various types of problems in many chemical, petrochemical industries and refineries. These techniques are noninvasive, hence the problems can be pinpointed online which leads to reduce the downtime, schedule the shutdown and maintenance of the plant equipment, rendering huge economic benefits. In a leading refinery of India, the Catalytic Cracking Unit (CCU) was malfunctioning. It was suspected by refinery engineers that the catalyst powder is being carried over to the fractionator which could have led to erosion of the fractionator column internals resulting their rupture, consequentially the fire hazard. To understand the flow behavior of catalyst powder and to ensure the mechanical integrity, catalyst accumulation and choking, both radiotracer study and gamma scanning of the CCU reactor was carried out. The reactor consists of a riser, three primary cyclones and three secondary cyclones. Gamma scanning of the reactor was carried out with the help of automatic gamma scanner using 1.8GBq of Co-60 sealed source. Results showed that catalyst powder was accumulated in one of the secondary cyclones and uneven density distribution was observed in another secondary cyclone. The radiotracer study was carried out using irradiated catalyst powder as a radiotracer which contains 0.9GBq of Na-24. The radiotracer was injected in the reactor through specially fabricated injection system. Radiation measurement was done using thermally insulated and collimated NaI(Tl) scintillation detectors located at various strategic locations coupled to multi-detector data acquisition system. The data were mathematically analysed. It was confirmed that the catalyst powder was accumulated in one of the secondary cyclones with no flow downwards. This resulted in excess powder available, to travel along with hydrocarbon towards fractionator. Since the quantity of powder released through hydrocarbon outlet of CCU was higher than the designed value, the catalyst powder was observed in various zones of the fractionator. Mathematical modelling of the radiotracer data obtained at various locations corroborated the scanning results.

### Country/Organization invited to participate

India

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