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Mechanism of Carbonaceous Deposition in the Ethylene Dichloride Pyrolytic Process

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This study attempted to reproduce the particular morphological features of the carbonaceous material deposited on the shell wall of heat-exchangers in the commercial pyrolytic process converting ethylene dichloride (EDC) into vinyl chloride monomer to investigate the mechanism and factors affecting the deposition. Scanning electron microscope shows the carbonaceous material as an aggregate of nanospheres which coat the whole wall of the reactor. The effects of time and temperature in the heat-treatment were examined in an stainless steel reactor at 220-250°C using pure EDC and commercial feed EDC in the process. The yield of carbonaceous material from pure EDC increased almost proportionally with the period of heat-treatment from 0.12 wt% at 6 h to 0.73 wt% at 48 h. The aggregate of the spheres found on the wall also increased in diameter according to the period of the heat-treatment. The higher temperature increased both yield and size of the carbonaceous spheres. The feed EDC which contained chloro-olefins and dienes provided a much higher yield of carbonaceous deposition. Addition of 1% benzene to pure EDC at 250°C reduced the yield and particle size of deposited carbonaceous material. Addition of 1-methylnaphthalene to pure EDC produced a higher yield of carbonaceous particles than pure EDC at 250°C, maintaining the shape of the individual spheres. Biphenyl and tetralin slightly reduced the yield. Oxidized iron surface (Fe_2O_3) increased the yield, whereas glass surface reduced the yield of carbonaceous material. Dehydrochlorination, which occurs in this temperature range, appears to increase the yield of carbonaceous material. Based on the morphology and yield of deposited carbonaceous

material, the mechanism and reduction of carbonaceous deposition are discussed.

Keywords: Ethylene dichloride pyrolysis, Vinyl chloride, Carbonaceous deposition, Heat exchanger

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