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ANALYSIS OF EFFLUENT STREAMS FROM FEP

Because of the need for environmental emissions data for Project 8533, "Dordrecht Copolymer Finishing Facilities," a program was initiated to collect and analyze samples from all of the FEP plant effluent streams. Several additional samples were taken and analyzed so that material balances could be determined. Also, since Project 8533 includes a scrubber for the exhaust from the humid heat treatment oven it was necessary to assemble a small scrubbing apparatus so that pilot scale scrubbing of HHT oven exhaust could be done. Scrubber water from this unit was analyzed for chemical composition and was tested for aquatic toxicity at Haskell Laboratory. Harry Cooper of FEP Technical assisted with sample collection in this program.

The aqueous samples tested are listed in Table TJL-1. These samples were analyzed for residual C-8 surfactant, organic and inorganic carbon, total fluoride ion content, and pH. Samples were collected during production of T-100 FEP at normal production rates. The fluoride ion figures for the first two samples listed (coagulator effluents) are a factor of 10 higher than is expected for this stream. Repeat samples of coagulator effluent and raw dispersion supernate, which should have the same fluoride content, agree with historical figures of 300 mg/l fluoride or less. This is pointed out since this data was transmitted to you earlier. The two high fluoride levels should probably be discarded. The other analyses on these two samples are consistent with expected values.

Vent samples were collected from the following locations: torus disc dryer exhaust (ahead of the exhaust scrubber), torus disc

dryer exhaust (after the exhaust scrubber), #1 humid heat treatment cooling tower exhaust, and the #1 humid heat treatment oven exhaust. Samples from each location were analyzed directly by electron capture gas chromatography and then by scrubbing the gas samples through water and analyzing the water for extracted compounds.

The humid heat treatment oven cooling tower exhaust was analyzed only by electron capture GC. The only compound which could be detected was the C-8 decomposition product $C_7F_{15}H$ at 3 moles per million.

At the torus disc dryer exhaust we expected to see primarily C-8 surfactant and perhaps some oligomeric dicarboxylic acids which are expected to be formed in the polymerization. As expected, GC analysis showed no volatile fluorocarbons. Analysis of water through which exhaust samples were scrubbed gave the results shown in Table TJL-2. The major component was C-8 surfactant. The HF and CO_2 were just at the detection limits of the methods employed for their analysis - the figures given are upper limits to the actual levels. No oligomers could be detected in these samples.

Results of the analysis of the humid heat treatment oven exhaust are shown in Table TJL-3. The CO_2, C-8, HF, and oxalic acid were measured by analyzing water collected from the pilot scale exhaust scrubber. The other compounds were detected directly by GC.

This data was taken with the oven operating under normal conditions as listed here:

Product	FEP T-100
Oven Feed	500 lb/hr
Oven Temperature	360°C
Air Make Up Rate	500 cfm
Humidity	60° to 65°C, wet bulb (about 5% H_2O)

Historical data on the composition of the humid heat treatment oven exhaust is sketchy at best so comparisons with historical data are difficult. The best historical data are those of J. F. Doughty, collected in 1978. Doughty detected TFE, HFP, F-23, K-125, and PFIB in the oven exhaust at levels which are comparable to my measurements as listed in Table TJL-3. This supports the sampling and measurement techniques used in this project.

By summing all of the components found in the oven exhaust to get the total exhaust loading of vented volatiles and multiplying this by the temperature corrected oven exhaust rate one can calculate the rate at which these materials are vented from the system. This exercise was performed and summarized in Table TJL-3. The resulting material loss rate was ratioed to the oven feed rate, and it was found that about 0.95% of the oven feed is vented as volatiles. This figure is in very good agreement with measurements of polymer weight loss performed in 1979 by R. A. Morgan. Morgan's data shows an average weight loss of 1.13% for dried FEP samples in the humid heat treatment process.

The pilot scale scrubbing of humid heat treatment oven exhaust was run at a low rate to be sure that a high scrubbing efficiency was attained. Altogether 127.4 ft^3 of exhaust air was scrubbed through 60.5 l of water.

This scrub ratio resulted in a fluoride level of 16 mg/l in the scrubber water. Scrubbing was stopped at this point to keep the fluoride below its aquatic toxic level of 60 mg/l for fish. The analysis of the water is shown in Table TJL-1 and in the attached Haskell Laboratory report.

The 60 liters of scrubber collected was shipped to Haskell Laboratory for aquatic bioassay with fathead minnows and water fleas (Daphnia Magna). These tests show that the full strength scrub water was toxic, but when diluted about 1:1 with pure water the scrub water was rendered non toxic. The toxicity appears to be a result of the combination of the oxalic acid, hydrogen fluoride and perhaps the low levels of iron and nickel leeched from the sampling line during scrubbing. From these results it is clear that aqueous scrubbing and discharge of a diluted effluent stream to the river can be managed in an acceptable fashion.

The Haskell Laboratory reports are attached.

TJLECK:ssb
Attachments