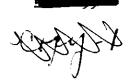
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234-5 Development, Process Assistance

Separations Technology Unit

Technical Section

RQ Orgale 3/10/99

TECHNICAL MENORANDUM REPORT

REMOVAL OF HYDROGEN FILIORIDE FROM AN AIR STREAM

BY ADSORPTION IN A DOREX CHARCOAL FILTER

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At the request of the Separations Section, a Dorsz charcoal filter was evaluated with respect to its use for removal of low concentrations (0.2 mole per cent) of hydrogen fluoride gas from an air stream.

Experimental

The Dorex cannister contained approximately 550 grams of charcoal in a volume of 0.044 cubic feet. Its especity for EF adsorption and working efficiency were determined by the method used previously (HV-23019). The capacity was measured for 0.2 volume per cent HF in air passing through the cannister at a velocity of ten cannister volumes per minute (0.43 CFM).

If the exhaust air from Hood 8, RG Line, 234-5 Building, were passed through one Dorex cannister, the air flow would be 194 cannister volumes per minute (250 ft/min through a 2 1/2 inch pipe). An attempt was made to simulate this flow rate, by taping 15/16 of a cannister, inside and out, for a measurement of the initial efficiency of adsorption. Use of a 0.5 CFM air flow gave an affective velocity of 180 cannister volumes per minute.

Results

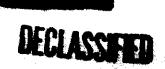
With an air flow (0.2 mole per cent HF) of ten cannister volumes per minute, the charcoal in a Dorer cannister adsorbed 48 grams of hydrogen fluoride before the efficiency dropped markedly from the 96 - 98 per cent level (See accompanying figure).

At 180 cannister volumes per minute, the charcoal had an operating efficiency of % - 95 per cent.

Discussion

It appears that a charcoal cannister will have a satisfactory efficiency for use in removing HF from hood exhaust air. Where the possibility exists, however, that relatively large quantities of HF may be released periodically into the hoods, the capacity of a single cannister may be so limited as to require frequent changing.

Judging from the results reported by du Pont personnel at Oak Ridge (DPO 75, November 19, 1951), marble chips appear to be more suitable than charcoal for removal of MF from air streams. These results are quoted: using 4 - 8 mesh marble chips, greater than 99 per cent absorption was obtained up to the break-through point, at which point 85 per cent of the CaCO, had been used at break-through. No details of absorber dimensions, flow rates, or MF concentrations were mentioned.





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The accompanying table indicates the relative capacities of charcoal and CaCO₂. Assuming 80 per cent usage of the CaCO₂ before break-through, a bed of marble chips of the same volume as a Dorex charcoal cannister would absorb 1 kg of HF.

The products of the CaCO₃ - HF reaction (CaF₂, E₂O, CO₂) should cause no trouble, unless the CaF₂ powders, packs and plugs the cannister. This eventuality should be considered in designing an absorber for this operation.

Capacities of Charcoal and Marble Chips to Absorb HF

	Density	Grams HF Absorbed	
Absorbent	g/cc	Per Gram Solid	Per Cm Solid
Charcoal (Dorex Cannister)	0.55	0.083	0.02
Marble Chips	1.38	0,32*	0.44

*Assuming the reaction 2HF + $CaCO_3$ = CaF_2 + H_2O + CO_2 and 80 per cent usage of $CaCO_3$ before break-through.

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