CALGON CORPORATION
SUBSIDIARY OF MERCK & CO., INC.

ACTIVATED CARBON DIVISION CALGON CORPORATION CALGON CENTER BOX 1346 PITTSBURGH, PA. 15230 (412) 923-2345

August 2, 1974

Mr. Raymond Chartier
Manager of Quality Assurance
OLIN CORPORATION
238 South Main Street
Assonet, Massachusetts 02702

Dear Mr. Chartier:

Subject: Controlling Vinyl Chloride Emissions

The enclosed technical bulletin summarizes the results of laboratory studies conducted at Calgon Corporation to demonstrate the effectiveness of activated carbon in controlling vinyl chloride emissions.

The important conclusions that appear warranted on the basis of these studies are stated in the first two paragraphs. While these remain to be validated in actual industrial plant installations, we believe you will be interested in having this information which may prove useful in your efforts to develop a practical solution for the control of VCM emissions at your facilities.

Calgon adsorption specialists are working right now to contact all PVC and VCM manufacturers to personally present the results of these studies in detail. If a Calgon representative has not already contacted you, you should hear from him soon.

If timing is critical, please don't hesitate to contact the activated carbon specialist in the Calgon office nearest you. We've attached a sheet listing their addresses and telephone numbers.

Or, if you would prefer, please feel free to write or telephone me at our Pittsburgh headquarters.

As the world's leading manufacturer of granular activated carbon, we are most interested in being some assistance to you.

Very truly yours,

ACTIVATED CARBON DIVISION
CALGON CORPORATION

W. D. Lovett

William D. Lovett
Development Engineer

PITTSBURGH ACTIVATED CARBONS

OLI 2422

CALGON

CONTROLLING VINYL CHLORIDE EMISSIONS WITH GRANULAR ACTIVATED CARBON

ACTIVATED CARBON DIVISION

Laboratory studies conducted at Calgon Corporation have demonstrated that activated carbon will readily adsorb vinyl chloride in concentrations ranging from 50 parts per million (ppm) to over 30 percent by volume. Using dual beds of activated carbon, 100 percent removal of VCM from both air and nitrogen streams has been shown to be technically possible.

The studies further demonstrate that VCM-saturated activated carbon can be regenerated in-place using either steam or hot nitrogen to desorb the VCM. By condensing the VCM vapors in the regeneration stream, the adsorbed vinyl chloride could be recovered and reused, allowing PVC and VCM manufacturers a payback on their investment in the control equipment.

Cyclic Test Results

The data in Table I represent the results of tests conducted to determine the adsorption and desorption characteristics of activated carbon for a proposed VCM recovery system. A nitrogen stream containing 1 percent by volume VCM was passed through a 4.5-inch deep bed of Pittsburgh Type PBL 6x16 mesh activated carbon at ambient temperature and pressure at a flow of 30 feet per minute (fpm) until VCM breakthrough occurred. At this point, the VCM was desorbed by passing either steam or nitrogen at 300°F through the carbon bed. The system was operated for fifteen cycles—using steam as the regenerant for the first ten cycles and hot nitrogen for the last five.

As the data in Table I indicate, no loss in adsorptive capacity was observed over the entire 15 cycles of operation. The fluctuations in capacity resulted from variations in the 1 percent VCM flow and, in some cases, from incomplete water removal from the carbon following regeneration.

On the basis of analyses of the carbon conducted prior to and following the test, it was concluded that VCM had not polymerized in the carbon bed (Table II).

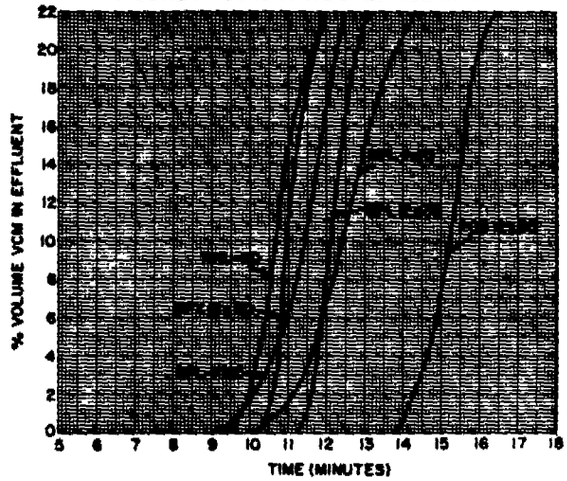
TABLE I
CYCLIC ADSORPTION OF
1% VINYL CHLORIDE ON BPL 6x16

Cycle	% Adsorbed—Wt.
1	12.1
3	9.7
5	11.9
7	12.4
9	9.9
11	11.8
13	12.3
15	12.3

TABLE II
CARBON ANALYSIS

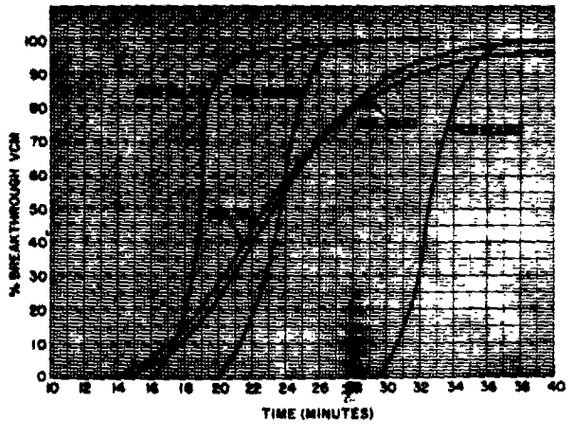
	Virgin	After Test
Apparent Density, g/cc	0.499	0.501
CCl_4 No.	64.1	63.2
Iodine No.	1113	1106

FIGURE 1 – 33% VINYL CHLORIDE IN AIR



Test gas for this study was a 750 BVH air stream containing 33 percent by volume VCM. This stream was passed through a 9-inch deep bed of activated carbon (60 cc) at 9 fpm. VCM breakthrough was monitored with Bacharach explosion meter with a lower detectable limit of 50 ppm.

FIGURE 2 – 1% VINYL CHLORIDE IN AIR



Test gas for this study was a 6000 BVH air stream containing 1 percent by volume VCM. This stream was passed through a 9-inch deep bed of activated carbon (60 cc) at 75 fpm. A gas chromotograph with a sensitivity of 25 ppm was used to monitor VCM in effluent air from the carbon bed.

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VCM Breakthrough Studies

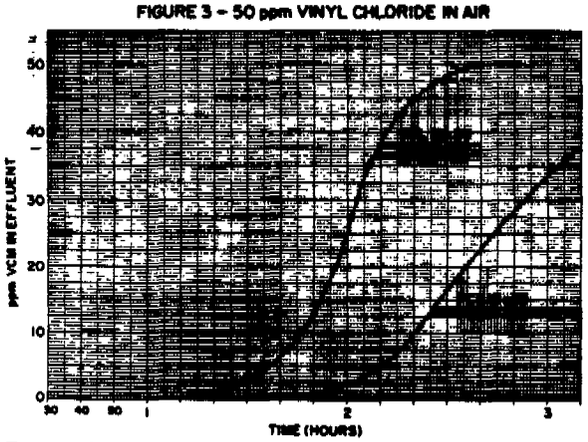
A series of tests conducted to compare the VCM breakthrough capacities of various grades of activated carbon under conditions of interest to VCM and PVC manufacturers indicates that fine-pore, high surface area carbons such as Pittsburgh Type BPL and Type PCB are the most efficient; and, that fine mesh size carbons produced longer break times and steeper breakthrough curves (Figures 1 and 2). Using a gas chromatograph with a sensitivity of 25 ppm, no VCM was observed in the effluent air prior to breakthrough.

Tests were also conducted to determine minimum breakthrough characteristics for Pittsburgh Type PCB 12x30 and Type BPL 12x30. The results of these tests, using a Flame Ionization Detector with a sensitivity of 0.1 ppm VCM, are depicted in Figure 3 and Figure 4.

On the basis of these breakthrough studies, it was concluded that activated carbon can remove essentially 100 percent of VCM in air until breakthrough occurs, at which time over 90 percent of the carbon bed is saturated with VCM vapor.

Using the data generated during this series of tests, Figure 5 was developed using a computer correlation to determine the adsorptive capacity of Pittsburgh Type PCB 12x30 as a function of VCM concentration. Note that even in concentrations as low as 10 ppm, Type PCB carbon's capacity for VCM is 1 percent by weight. The adsorptive capacity of Pittsburgh Type BPL 12x30 as a function of VCM concentration is depicted in Figure 6.

FIGURE 3 – 50 ppm VINYL CHLORIDE IN AIR



Test gas for this study was a 15,000 BVH air stream containing 50 ppm VCM. This stream was passed through a 3.5-inch deep bed of activated carbon at 73 fpm. A Flame Ionization Detector with a sensitivity of 0.1 ppm was used to monitor for VCM in effluent from the carbon bed.

For further information write to
Activated Carbon Division
Calgon Corporation, P.O. Box 1346,
Pittsburgh, Pa. 15230

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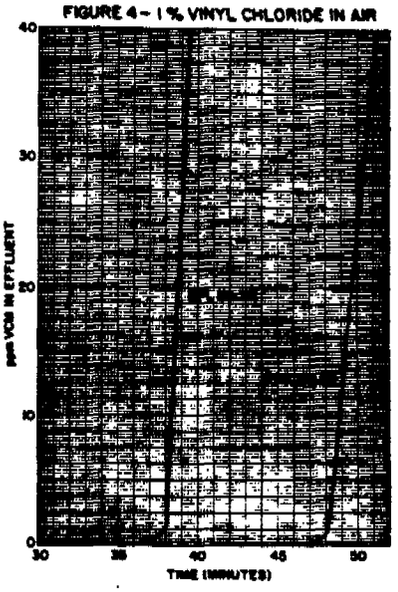
FIGURE 4 – 1 % VINYL CHLORIDE IN AIR



Test gas for this study was a 3000 BVH air stream containing 1 percent by volume VCM. This stream was passed through a 3.5-inch deep bed of activated carbon at 14.5 fpm. VCM in the effluent from the carbon bed was monitored with a Flame Ionization Detector with a sensitivity of 0.1 ppm.

FIGURE 5 – ADSORPTION OF VINYL CHLORIDE ON PCB

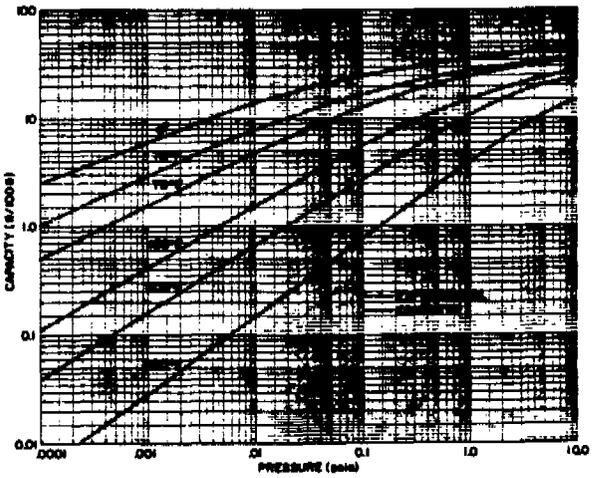
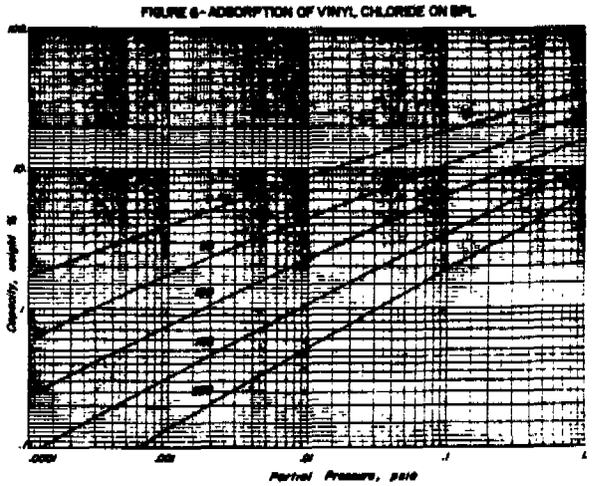


FIGURE 6 – ADSORPTION OF VINYL CHLORIDE ON BPL



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