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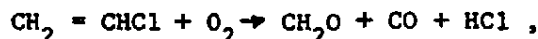
Dear Dr. Johnson:

The Fate of Vinyl Chloride

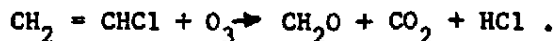
This letter will serve as Battelle's Columbus Laboratories unsolicited proposal on a study to determine the principal oxidation and reaction products of vinyl chloride in the atmosphere.

The recent concern over the possible health hazards of vinyl chloride is obviously very disconcerting, especially as regards the potential of vinyl chloride to cause serious liver damage, enlarged spleens and deleterious blood diseases, and skin eruptions. Therefore, evaluation of the potential hazards of vinyl chloride as an in-plant emission product, as well as an out-of-doors air pollutant, becomes of major concern. It is the purpose of this proposal to evaluate the stability of vinyl chloride emissions under both dark and sunlight-irradiation conditions, and to attempt to categorize all, or at least the major reaction products of vinyl chloride in the atmosphere.

Vinyl chloride is a fairly reactive organic material. For example, it polymerizes and copolymerizes very readily, which accounts for it being such a major product in plastics technology. In general, one expects vinyl chloride to oxidize with the atmosphere in the manner



or in the presence of ozone



Battelle's Columbus Laboratories has examined the smog reactivity of vinyl chloride in our large (aluminum-Teflon) smog chamber. At levels of 1 and 4 ppm (volume basis) the smog reactivity of vinyl chloride was very dependent

on organic / NO_x ratio, more ozone being produced at the higher ratio. This early work, since it was directed to defining the smog reactivity, did not examine the fate of the vinyl chloride. Aldehyde analyses in this study, however, indicate that some 25-50 percent of the vinyl chloride was converted to aldehyde in a 5-hour irradiation period, suggesting that vinyl chloride may have a limited lifetime in sunlight atmospheres.

Another interesting feature of this initial work was the evidence of PAN, or possibly a chlorinated organic product among the smog products.

Proposed Program

Objective

It is proposed that the principal objective of this program be a definition of the major oxidation and decomposition products of vinyl chloride. It is suggested that the program first establish the extent to which formaldehyde, carbon monoxide, and hydrogen chloride can account for the removal of vinyl chloride from any atmosphere. Depending upon the ability of these three products to account for the breakdown of vinyl chloride, more detailed analysis of other species would be undertaken to help define the fate of vinyl chloride.

Experimental Program

It is proposed that this study be conducted in Battelle's two 50-cu-ft all-Teflon chambers - not in the large smog chamber. At some later time, one may desire to carry out some experiments in the large chamber to determine the extent to which the aluminum-oxide coated walls of the large chamber may influence the stability of vinyl chloride. (Recognizing that all chambers exert some type of wall effect, we have not seen any especially severe effects of our aluminum walls on sulfuric and nitric acid deposition.)

We propose that four general sets of conditions be examined in this program

100 ppm (v/v) vinyl chloride
lighted and dark

2 ppm (v/v) vinyl chloride
lighted and dark.

The above systems would be examined in relatively clean air (using our chamber air purification train) at about 50 percent relative humidity to which we would add 0.5-1.0 ppm NO_x (about 10 percent NO₂). The high concentration systems, besides providing for easier analysis, will also provide the necessary information for the role of concentration effects on the reactions of vinyl chloride. Also, if it should turn out that the chemistry and kinetics are not substantially different at 100 ppm and 2 ppm vinyl chloride, the high concentration system would allow one to collect and identify the minor products more readily.

Analyses of the major substances in this program would be as follows:

vinyl chloride	FID - G.C.
CH ₂ O	chromotropic acid method
CO	FID - G.C.
HCl	IR, wet chemical, or micro-coulometric.

Attempts to identify other products, such as PAN, chloraldehydes, and unknowns not established as yet, would be carried out by G.C., mass spectrometry, and infrared (Fourier transform analysis) as required.

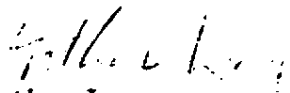
Time and Costs

Inasmuch as the importance of other than the three major products, CH₂O, CO, and HCl is not known as yet, it is suggested that this program, as proposed here, be considered as a Phase 1 study. It is suggested that this initial program be carried out over a period of 3 or 4 months at an estimated cost of approximately \$25,000. Pending the outcome of this program, one will then be in a position to ask what the health hazards of the reaction products might be, and what the importance of other environmental variables might be.

Anticipating that members of MCA may want to discuss the proposed program further, this proposal is sent as a preliminary document. After further discussions, Battelle will be pleased to submit a formal proposal and appropriate agreement forms, subject, of course, to our other commitments at that time.

We hope that this document will serve as a basis of further discussion with you and your staff. Please call me at Extension 2939 for further information.

Very truly yours,


Arthur Levy
Senior Research Leader
Chemistry Department

AL:mec

In duplicate