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High-Temperature Pyrolysis of Poly(vinyl chloride): Gas Chromatographic-Mass Spectrometric Analysis of the Pyrolysis Products from PVC Resin and Plastisols

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Synopsis

A pyrolysis–gas chromatographic–mass spectrometric technique for analyzing the pyrolysis products from polymers in an inert atmosphere is described. Initial studies encompassing the pyrolysis of poly(vinyl chloride) homopolymer and a series of PVC plastisols (based on *o*-phthalate esters) have provided a complete qualitative and semiquantitative analysis of the pyrolysis products from these materials. PVC resin yields a series of aliphatic and aromatic hydrocarbons when pyrolyzed at 600°C; the amount of aromatic products is greater than the amount of aliphatic products. Benzene is the major organic degradation product. A typical PVC plastisol [PVC/*o*-dioctyl phthalate (100/60)] yields, upon pyrolysis, products that are characteristic of both the PVC matrix and the phthalate plasticizer. The pyrolysis products from the plasticizer dilute those from the PVC portion of the plastisol and are, in turn, the major degradation products. There are no degradation products resulting from an interaction of the PVC with the plastisol. The pyrograms resulting from pyrolysis of the various plastisols of PVC can be used for purposes of "fingerprinting." Identification of the major peaks in a typical plastisol pyrogram provides information leading to a precise identification of the plasticizer. The pyrolysis data from this study were related to a special case of flammability and toxicity.

INTRODUCTION

The mechanism of the thermal dehydrochlorination of poly(vinyl chloride) has been the subject of many studies in the general area of polymer degradation. A number of the important contributions in this area have been reviewed by Levy in two excellent publications.[1,2] The present paper deals with the identification of the volatile, hydrocarbon pyrolysis products resulting from the thermal degradation of PVC at 600°C in an inert (helium) atmosphere.

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The objective of the current study was to obtain a complete profile of the degradation products from PVC resin and PVC plastisols. This study has acted as a starting point in an overall study of thermal degradation, combustion, and flammability of chlorinated polymers.

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