

An Analytical Method for Chlorinated Polycyclic Aromatic Hydrocarbons (CIPAHs) in Combustion Gas

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Chlorinated polycyclic aromatic hydrocarbons (CIPAHs) such as chlorobenz[*a*]anthracene and chlorobenz[*a*]pyrene have received worldwide attention because of their environmental persistence and widespread distribution. Recent reports have showed the occurrence of chlorinated or brominated polycyclic aromatic hydrocarbons in flue gas and fly ash from municipal and industrial waste incinerators. However, little is known about CIPAHs formation from combustion of chlorinated polymer such as polyvinyl chloride and polyvinylidene chloride alone or the influence of chlorinated polymer as a chlorine source in municipal and industrial waste incinerators. In this study, we have developed an analytical method for CIPAHs evolved from the combustion of polyvinyl chloride and polyvinylidene chloride.

Combusted Polyvinyl chloride (PVC) and Polyvinylidene chloride (PVDC) at 500 and 800 °C, in 20% Oxygen and 80% Nitrogen atmosphere, and residence time is 2 seconds, $5 \text{ kg} \cdot \text{h}^{-1} \cdot \text{m}^{-3}$ burning rate of the sample. Results of combust PVC and PVDC, Tetra- to octa-chlorinated naphthalenes and mono- and di-chlorinated phenanthrenes were detected in flue gas from combustion of PVC at 500°C. 9-ClPhe occurred at the highest concentration, which was 26 times higher than those of chloronaphthalenes. Anthracene and 4-5 ring CIPAHs was below the limit of detection. At 800°C, chloronaphthalenes were below the limit of detection, whereas concentrations of mono- and di-chlorinated phenanthrene showed no significant changes to those at 500°C. A decreasing trend from lower to higher chlorinated naphthalenes was observed at 500°C, whereas an opposite trend was observed in the sample from combustion of PVDC at 800°C. This result showed that higher temperature (800°C) could generate higher chlorinated PAHs. The highest 9-ClNap and 3,9-Cl₂Nap concentrations were measured in sample from combustion of PVDC at 500°C, which were 40- and 300-fold higher than those at 800°C, respectively. Compare CIPAH concentrations from combustion of PVC and PVDC, we can know that: (1) Higher CIPAHs concentrations were measured in sample from combustion of PVDC; (2) The concentrations of ClNap in sample from combustion of PVDC were over 1,000 times higher than those from combustion of PVC. (3) This result indicated the different mechanism of CIPAHs formation in combustion of PVDC as compared to PVC. Vary some temperatures and residence times to make a more detailer investigation in the future was planned.