

# Congener distribution of polychlorinated naphthalenes in municipal solid waste incineration fly ash

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## INTRODUCTION

Polychlorinated naphthalenes (PCNs) are unintentionally produced during the combustion process. In this study, the PCNs content of fly ash from 11 types of municipal solid waste incinerators (MSWIs) was analyzed, and the distribution of the ratio of each congener to total PCNs was compared.

## MATERIALS AND METHODS

In this study, 11 types of MSWI fly ash (six from a stoker incinerator (SA–SF) and five from a fluidized bed incinerator (FG–FK)) were analyzed. All ash samples were collected by a fabric filter and sampled between 1999 and 2020. PCNs were extracted from 1 g of fly ash by Soxhlet extraction, and their contents were determined by GC-HRMS. The analysis conditions were as follows: automated sample preparation system, SPD-600GC (Seeds Tec); GC, 7890 B (Agilent Technologies); HRMS, JMS-800D (JEOL); column, RH-12ms, 0.25 mm i.d. × 60 m, (InventX), and selected ion monitoring mode (SIM).

## RESULTS AND DISCUSSION

**Figure 1** shows the congener distribution of PCNs. The sample name and sampling year are indicated in the label. The low-chlorinated homologs are arranged in order from left to right. The vertical dashed lines show the division of the homologs. The vertical axis shows the ratio of the content of each compound to the total PCN content, and the red bar graph indicates the isomer with the highest proportion among each homolog. Most ash samples showed a high proportion of low (mono- to tetra-) chlorinated substances. In some stoker ash samples, the proportion of five chlorinated substances was high. Further, a few ash samples contain a high concentration of hepta- and octa- chlorinated isomers. The “average chlorination numbers”—the value of  $\Sigma$  (number of chlorine) × (the proportion of the homolog to the total content)—shown in the label in parentheses were 2.52–3.37 and 2.24–4.05 for stoker ash and fluidized bed ash samples, respectively. For homologs of highly (hexa- and hepta-) chlorinated naphthalenes, the isomers showing the highest proportion were the same for all fly ash. No clear difference was detected considering the sampling year. The next step requires the study of the relationship between the distribution and chlorination pathway of PCNs.

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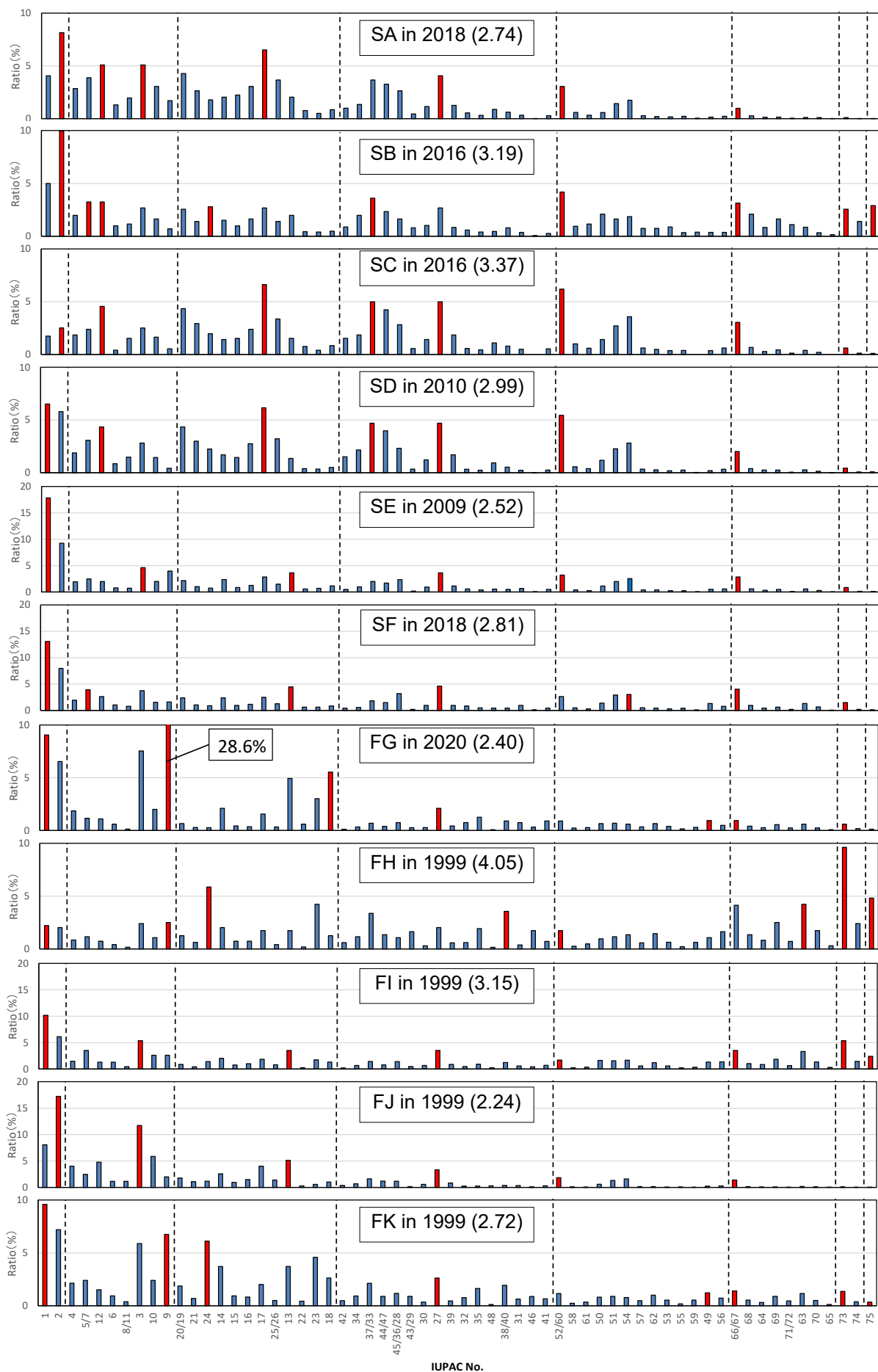


Figure 1 Congener distribution of PCNs in fly ash