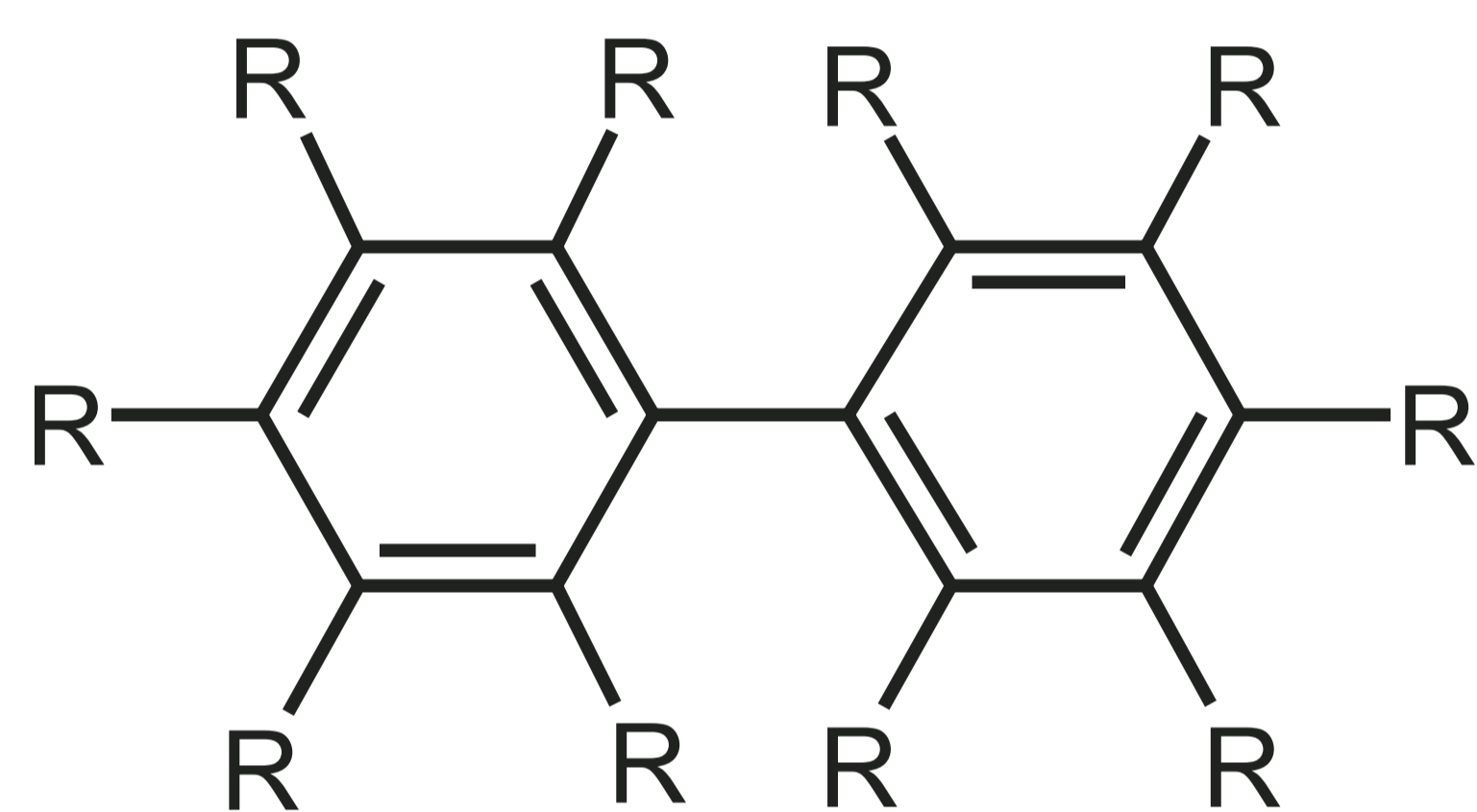


# COMPARISON OF CARBORANE AND 5% PHENYL PHASES FOR THE ANALYSIS OF POLYCHLOROBIPHENYL (PCB) CONGENERS

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## Introduction

PolyChlorinated Biphenyl (PCB) compounds have been found to have serious health implications and be extremely persistent in the environment. PCB mixtures called Aroclor mixes were previously used in a variety of applications such as heat transfer, hydraulic and vacuum pump fluids, dielectrics (insulators), in transformer cooling liquids, lubricants, plasticisers, sealants, pesticide extenders and copy paper. The use of PCB compounds was common pre-1970, before their health effects were publicised. As a result, the use of Aroclor mixtures is restricted and in some countries banned from use. The PCBs are often analysed as Aroclor samples. Aroclor samples are mixtures of specific PCB congeners and are given a specific number such as Aroclor 1242.



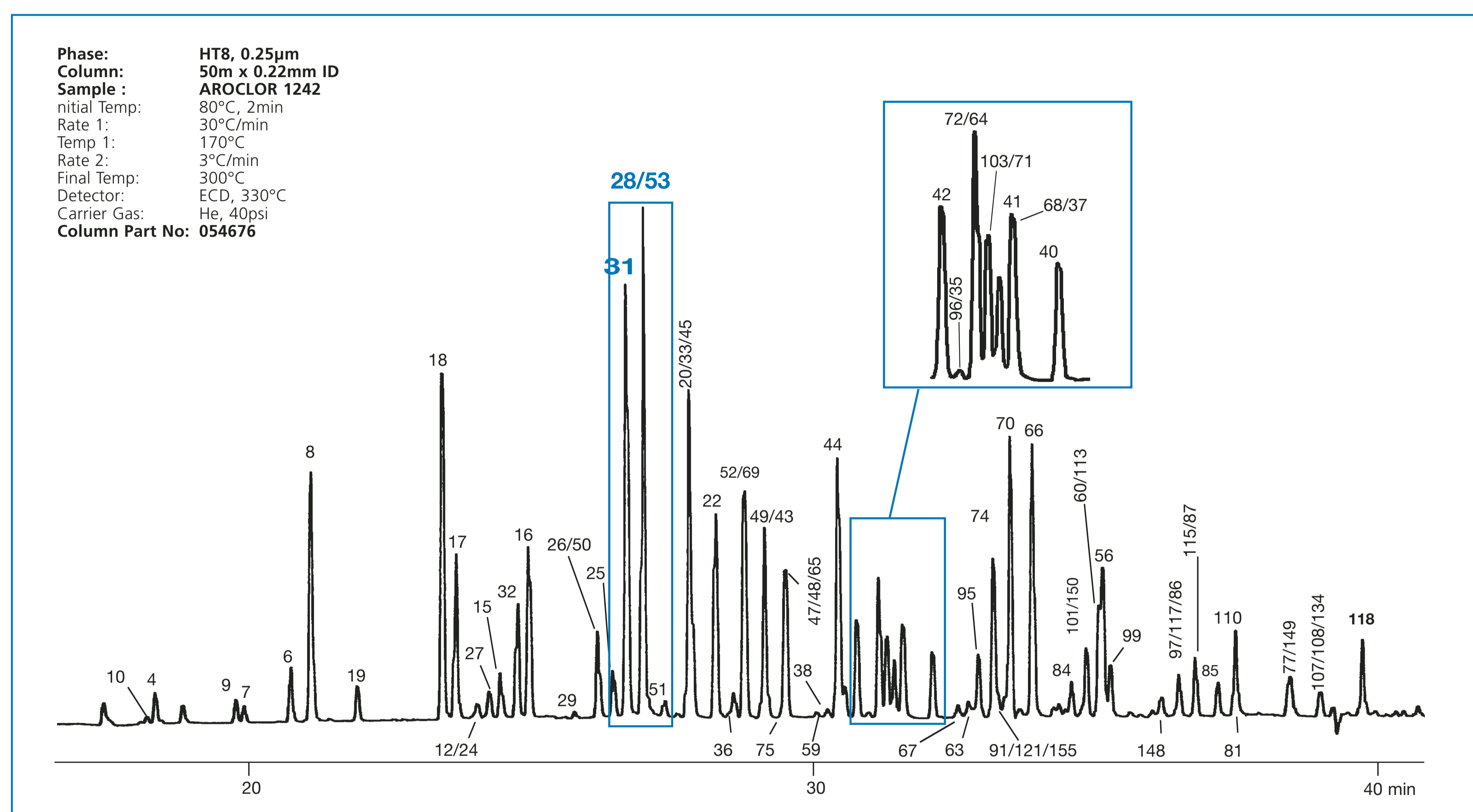
**Figure 1.** PCB basic structure, any combination of Hydrogen and Chlorine will give 209 different congeners.

There are 209 possible congeners that are subject to strict monitoring procedures within worldwide environmental regulating bodies. Monitoring of food stuffs for PCBs is common in many laboratories.

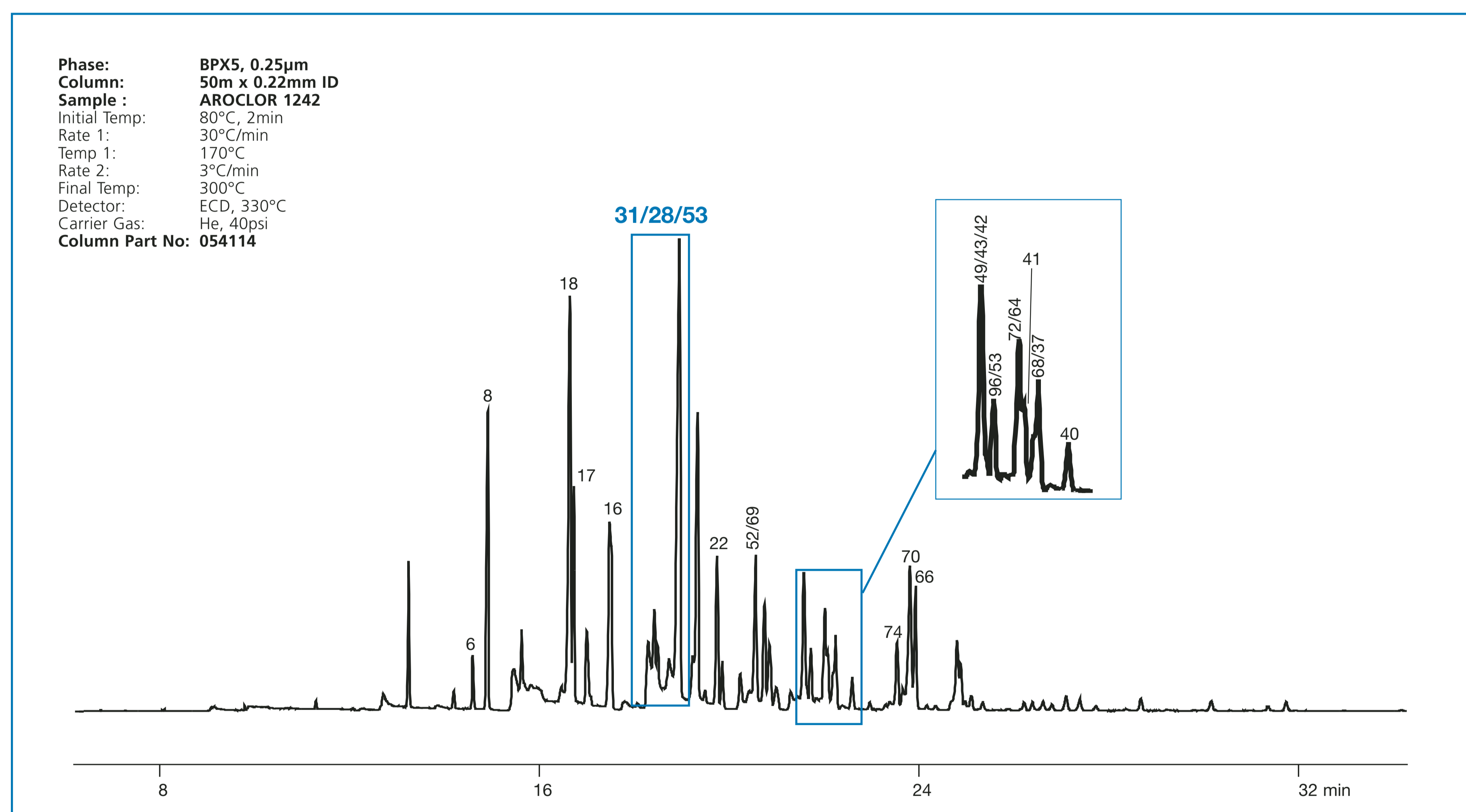
The standard columns used for the analysis of PCBs in samples are the 5% Phenyl phase or an SGE HT8 Carborane phase. The PCB samples are predominantly analysed by GC-ECD, specific for halogenated compounds or a GC-MS system for identification of the congeners.

## Analysis

PCB congeners are non-polar compounds that separate predominantly on boiling point when analysed on a 5% phenyl column. Due to similar structures of many of the PCBs, the boiling points are very similar and many of the congeners are unable to be separated on non-polar columns. The analysis of Aroclor mixtures using an SGE HT8 capillary column gives unique separation of several difficult-to-resolve congeners. The unique partitioning properties of the HT8 capillary column comes from the Carborane phase incorporated into the polysiloxane backbone. The Carborane phase interacts preferentially with ortho substituted PCBs resulting in separation of these components to a greater extent than given by the conventional 5% phenyl capillary columns. This can be seen in Figures 2 and 3, which show chromatograms of Aroclor 1242 analysed on a HT8 and a 5% Phenyl (BPX5) column, respectively.



**Figure 2.** Aroclor 1242 analysed on an HT8 capillary column. Note the separation of the difficult-to-separate congeners, e.g. 28/31. The peak numbers refer to PCB congener numbers.



**Figure 3.** Aroclor 1242 analysed on a standard 5% phenyl column. Excellent for fingerprint pattern analysis. The peak numbers refer to PCB congener numbers.

This chromatogram demonstrates a unique separation which can be achieved for congeners 31 and 28 on a HT8 column, compared to a conventional 5% phenyl column where these isomers are unable to be separated (Figure 3). The added advantage of the HT8 column is that even with the slightly extra polarity and specific interactions with the PCB congeners, there is no sacrifice of thermal stability. The HT8 column has a maximum temperature of 360/370°C, compared to most 5% phenyl columns. Eluting the high boiling PCB congeners on an HT8 column is not a problem.

The BPX5, 5% phenyl column from SGE is a high temperature, inert and robust capillary column ideal for analysis of PCB congeners where an elution pattern (finger printing) is required.

## Summary

The SGE HT8 capillary column provides highly selective separation of difficult-to-separate PCB congeners that cannot be separated on conventional phases such as the 5% phenyl columns. The Carborane phase allows preferential ortho substituted interactions of the PCB congeners; providing unique separation. The HT8 is an excellent choice column for pattern identification of Aroclor groups such as the 1242 shown here.



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