

THE ANALYSIS OF DIOXIN COMPOUNDS USING SELECTIVE DIOXIN CAPILLARY COLUMNS

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INTRODUCTION

Dioxin type compounds are a serious health concern throughout the world today. Dioxins are mainly by-products of industrial processes and from natural processes such as volcanic eruptions and forest fires. Industrial processes such as smelting, bleaching of paper pulp and the manufacturing of some herbicides have the potential of producing Dioxins. But in terms of dioxin release into the environment, solid waste incinerators are the worst culprits due to incomplete combustion. Dioxins tend to bio-accumulate within the food chain due to their ability to dissolve in fats and to their extreme chemical stability. Their effects on human health include some of the Dioxins being classified as known carcinogens along with other effects such as interfering with the endocrine and immune systems. Dioxins are found throughout the world in practically all media, including air, soil, water, sediment, and food, especially dairy products, meat, fish and shellfish due to the bio-accumulation of dioxins. The highest levels of these compounds are found in some soils and animals; as a result Dioxins are an important issue for governments to consider in relation to public health worldwide. These classes of compounds are the subject of strict monitoring in the environment and ultimately the food chain throughout the world.

WHAT ARE DIOXINS?

Dioxins have the dubious distinction of belonging to the "dirty dozen club" – a special group of dangerous chemicals known as persistent organic pollutants. Dioxins refer to a group made up of polychlorinated dibenzo-p-dioxins (PCDDs), polychlorinated dibenzofurans (PCDFs) (**Figure 1**) and co-planar polychlorinated biphenyls (PCBs).

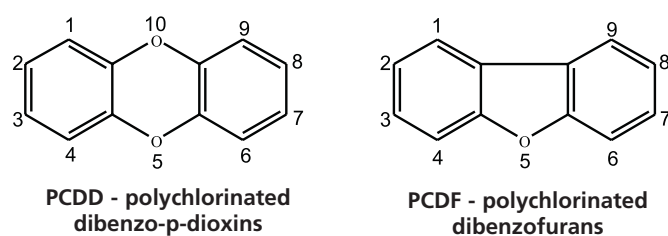


Figure 1.

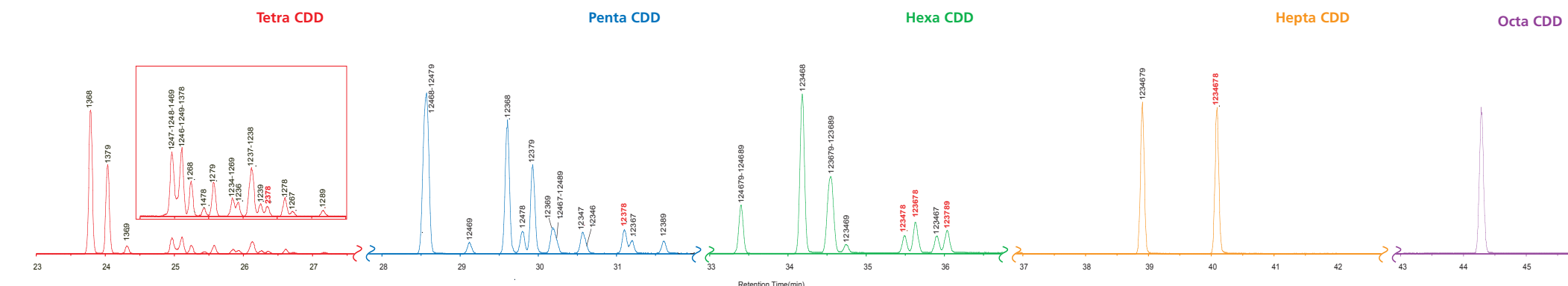


Figure 2.

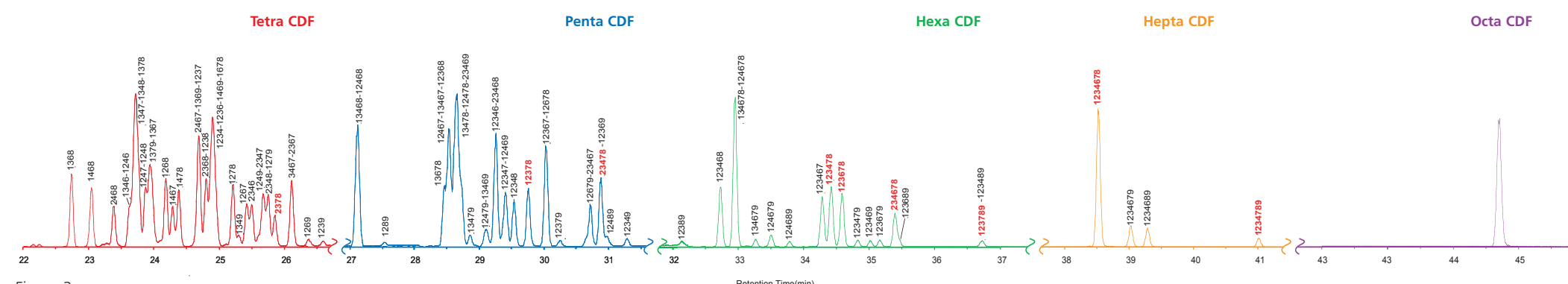


Figure 3.

The most toxic of these Dioxins has been found to be 2,3,7,8-tetrachlorodibenzo-para-dioxin (TCDD). Among the 419 dioxin related compounds only about 30 of these have been found to have serious health effects with TCDD being the most toxic.

THE ANALYSIS

Due to the highly toxic nature of Dioxins, very low level detection limits are required for the analysis of Dioxins. This requires extremely low bleed columns and a high-resolution mass spectrometer (HRMS) to detect such low levels. The low detection limits required, coupled with a large number of isomers that need to be separated makes the analysis of Dioxins one of the most challenging analyses to perform.

The BPX-DXN capillary column from SGE has been specifically developed for the analysis of Dioxins with these criteria in mind.

Figure 2 shows a chromatogram of a number of polychlorinated dibenzo-p-dioxins and their retention times as analysed using a BPX-DXN 60m x 0.25 mm ID capillary column. The chromatogram clearly shows the excellent resolution of the 2,3,7,8-TCDD from potential overlapping isomers. The excellent separation of the various PCDDs provides easy quantitation of the dioxin isomers. The important polychlorinated dibenzofurans are easily separated on the BPX-DXN capillary column (**Figure 3**). The 2,3,7,8-TCDF, 1,2,3,7,8-PCDF are easily quantified. The excellent separation of the various isomers of PCDFs gives the analyst excellent quantification of the difficult to separate isomers.

CONCLUSION

The use of the SGE's specifically designed Dioxin column BPX-DXN is ideal for low level analyses required for Dioxins. Extremely low bleed and

excellent separation, make the BPX-DXN the first choice column for the analysis of Dioxin type compounds such as polychlorinated dibenzo-p-dioxins and dibenzofurans.

ACKNOWLEDGEMENT

Matsumura, T., Masuzaki, Y., Seki, Y., Ito, H. and Morita, M. (2003):

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