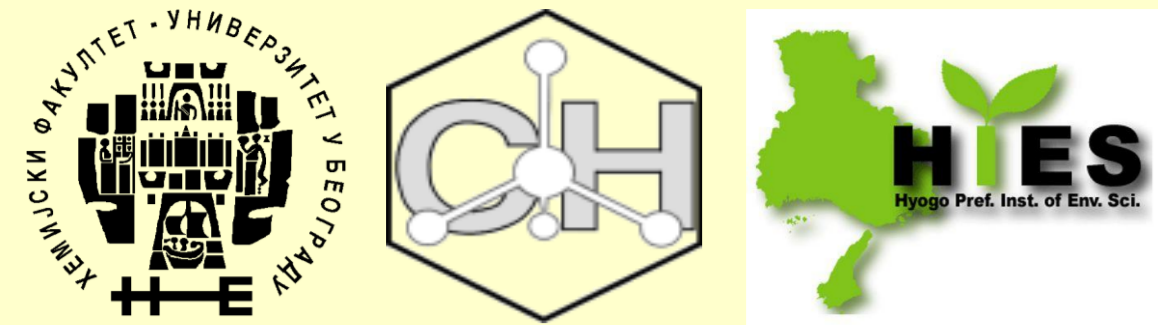


BIODEGRADATION OF SELECTED PCBs BY MICROORGANISMS ISOLATED FROM PCBs POLLUTED ENVIRONMENT



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Introduction

Many studies had confirmed that all known natural substances are degradable by abiotic or biotic processes. Some are degradable within of seconds, and for some years are needed. Also, for many man-made substances and xenobiotics it is confirmed that biotic biotransformation, biodegradation and complete mineralization is possible.¹

The aim of this study was to analyze the biotransformation of the standard mixture of 7 PCBs (from trichloro- to octachlorobiphenyl) using consortium of indigenous microorganisms isolated from environment known for long-term pollution with PCBs, by altering aerobic and anaerobic conditions and the analysis of the process by comprehensive GCxGC-MS.

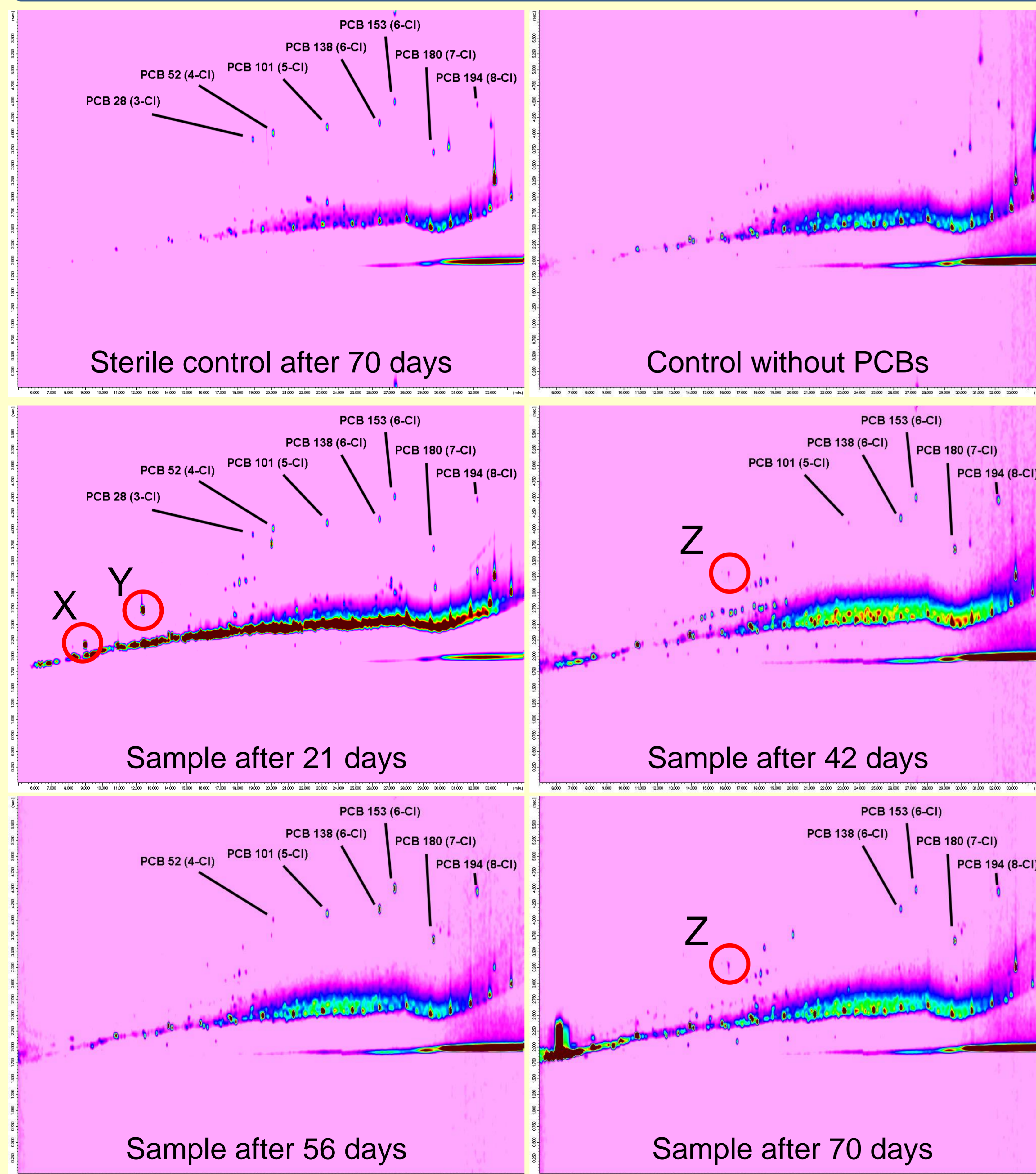
Materials and methods

For the study of biotransformation of PCBs, Bushnell - Haas medium (modified, chloride-free) was used, inoculated with consortium of indigenous microorganisms (10⁷ CFU/mL) and supplemented with 100 µL of PCB standard - ISO6468-PCB (10 µg/mL in n-Hexane). The ISO6468-PCBs standard contain:

- (PCB#28) 2,4,4'-Trichlorobiphenyl (CAS: 7012-37-5);
- (PCB#52) 2,2',5,5'-Tetrachlorobiphenyl (CAS: 35693-99-3);
- (PCB#101) 2,2',4,5,5'-Pentachlorobiphenyl (CAS: 37680-73-2);
- (PCB#138) 2,2',3,4,4',5'-Hexachlorobiphenyl (CAS: 35065-28-2);
- (PCB#153) 2,2',4,4',5,5'-Hexachlorobiphenyl (CAS: 35065-27-1);
- (PCB#180) 2,2',3,4,4',5,5'-Heptachlorobiphenyl (CAS: 35065-29-3);
- (PCB#194) 2,2',3,3',4,4',5,5'-Octachlorobiphenyl (CAS: 35694-08-7).

The study lasted 70 days with alternating anaerobic - aerobic cycles using the following procedure: anaerobic - 3 weeks (21 days – sample designation CR-21); aerobic - 3 weeks (42 days – sample designation CR-42); anaerobic - 2 weeks (56 days – sample designation CR-56); aerobic - 2 weeks (70 days – sample designation CR-70). For the aerobic treatment, the stopper was removed after 21st and 42nd day from headspace vials and aeration was obtained by mixing in the sterile atmosphere. The anaerobic conditions were obtained by using sterile nitrogen. In total 4 inoculated headspace vials per study were used and the study was conducted in triplicate. Inoculation at the beginning was performed by a consortium of indigenous microorganisms containing strains from the following microorganisms: *Pseudomonas* (sp. NS009 – GenBank: JF826528.1 and CHNSH-17 – GenBank: JQ292806.1), *Rhodococcus* (sp. RNP05 – GenBank: JQ065876.1 and CHP-NR31 – GenBank: JX965395.1) and *Achromobacter* (sp. NS014 – GenBank: JF826529.1)²

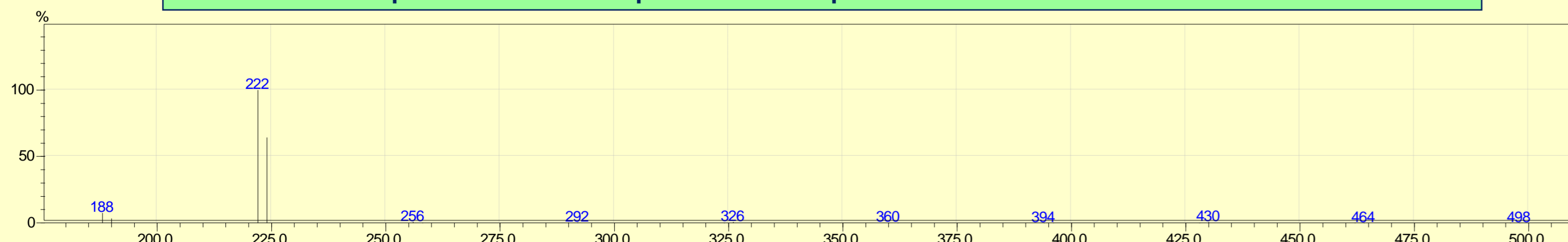
Results & discussion



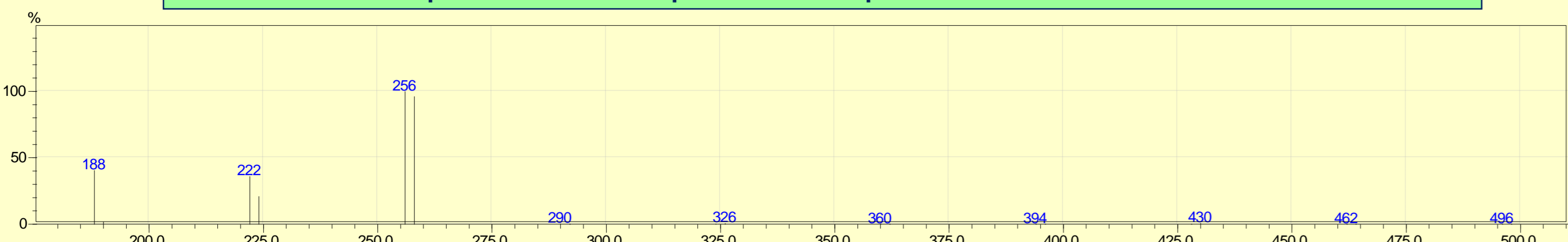
2D chromatograms obtained using GCxGC-MS



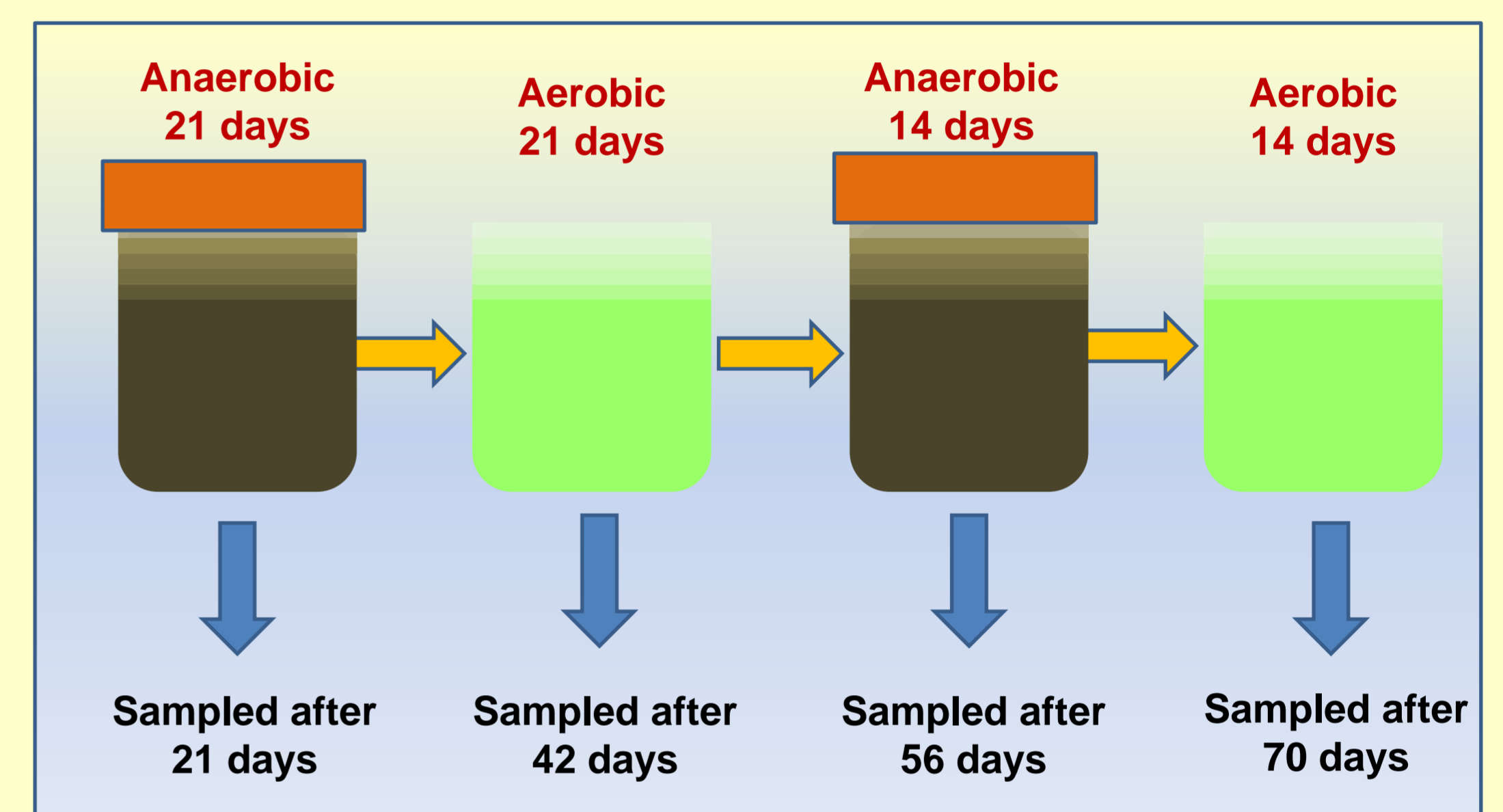
Mass spectra of compound X – possible monochlorinated PCB



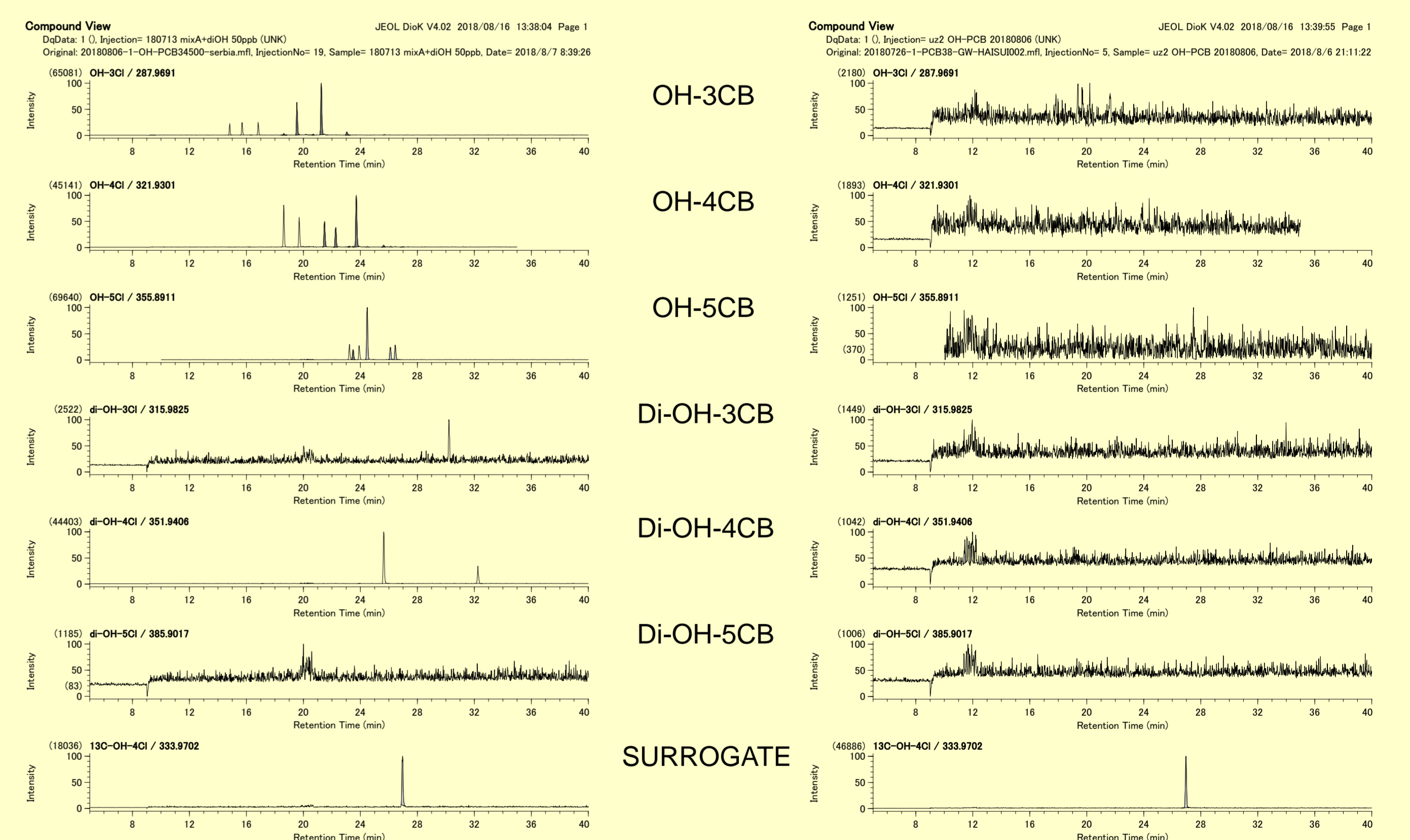
Mass spectra of compound Y – possible dichlorinated PCB



Mass spectra of compound Z – possible trichlorinated PCB



Change in PCBs concentration					
(ppb)	0 days	21 days	42 days	56 days	70 days
PCB#28	100	87	<LOD	<LOD	<LOD
PCB#52	99	92	<LOD	50	<LOD
PCB#101	101	99	48	50	<LOD
PCB#138	101	99	92	93	92
PCB#153	101	100	98	96	99
PCB#180	100	99	92	94	95
PCB#194	99	96	84	98	97



GC/HRMS of OH- and Di-OH-PCB standard and sample after 70 days

Conclusion

After thorough search of target compounds and based on GC/HRMS no hydroxylated or methylsulfonyl metabolites of PCB were detected. This suggests that reduction in concentration of 7 PCBs analyzed is possible sorption on biomass. However, it should be emphasized that congeners with the lowest number of attached chlorine atoms depleted first (3Cl) and that besides trichlorobiphenyl in the sample CR-70, tetrachloro- and pentachlorobiphenyl were also below limit of quantification.

References

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