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CHOSEN ORGANIC MICROPOLLUTANTS IN DRINKING WATER

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Introduction

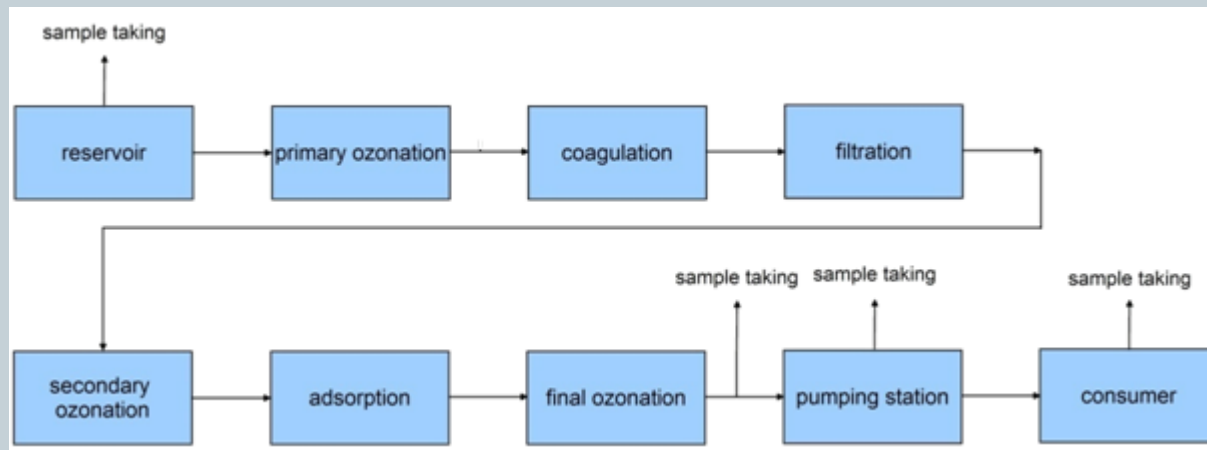
Water is one of the most important chemical compounds on earth. The water quality has big impact on all of the living organisms. Awareness of danger which comes with water contaminated with organic substances causes the actions to stop the water quality from deterioration. Organic micropollutants present in surface water are a wide group of chemical compounds, which are toxic and dangerous for living organism. The group includes substances such as PAH. There are about 300 polycyclic aromatic compounds but the most frequently analyzed is the group of 16 PAH listed by The Environmental Protection Agency (EPA). The substances on the EPA list are highly toxic and must be monitored in the environment. PAH are widely present in the environment which is the main effect of pyrolytic processes. The main sources of those compounds might be natural (wildfire, volcanic activity) or anthropogenic (industrial operations: coke plants, refineries, steel mills, power plants). The presence of PAH in surface waters intended for human consumption is connected to anthropogenic sources, such as industrial and municipal wastewater.

Materials

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For the research the water from water treatment plant in Silesian Voivodeship was used. Water samples from water treatment plant were taken in the fall and then in the spring, in chosen places of the technological system of the plant:

- water sample from the reservoir,
- water sample after final ozonation,
- water sample from the pumping station,
- water sample from the consumer.



Analytical procedure

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For PAH extraction from the water, the solid phase extraction method was applied, using 500 mg Octadecyl C₁₈ 6 mL Bakerbond columns. For this purpose 0.5 L of water was taken. Petroleum ether and dichloromethane were added to the water samples in the ratio 3:2 (52,5 mL of petroleum ether and 35 mL of dichloromethane). The samples were passed through preconditioned SPE extraction columns. To prepare the columns for PAH extraction 6 mL of hexane were passed through the columns filling, then the columns were dried in vacuum for 2 minutes. After that 6 mL of methanol and 6 mL of distilled water were passed through the column filling. After the water samples were passed through them, the columns with PAH trapped on sorbent were dried in vacuum for 30 minutes. PAH were then eluted from the columns filling using 3x1 mL of hexane. Extracts were condensed to the volume of 1 mL. Prepared samples were analyzed with the use of gas chromatography and mass spectrometer (GC-MS). Standard mixture of 16 PAH by RESTEK company was used. 0,002 mL of extract were inject on DB-5 column.

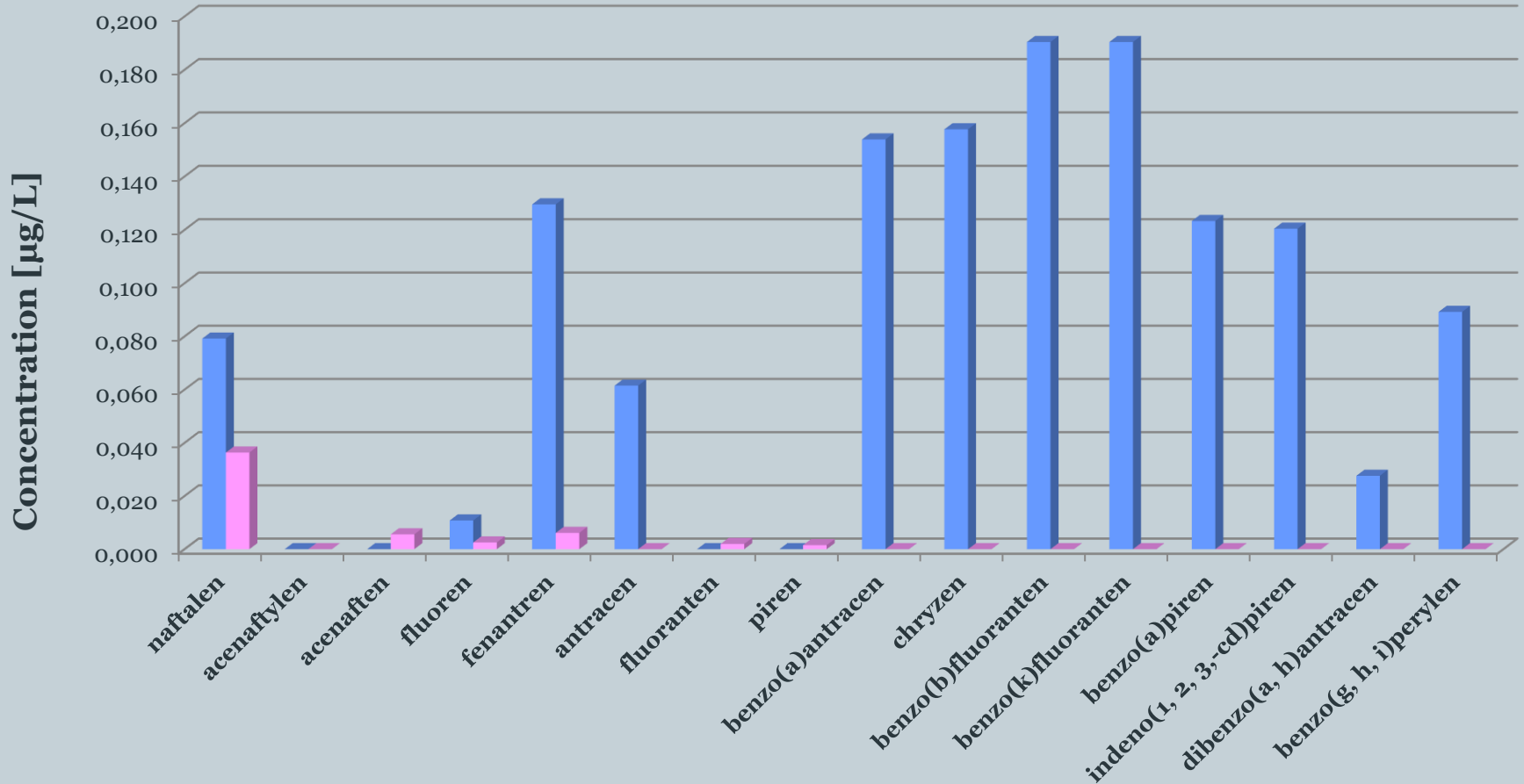
Analytical procedure

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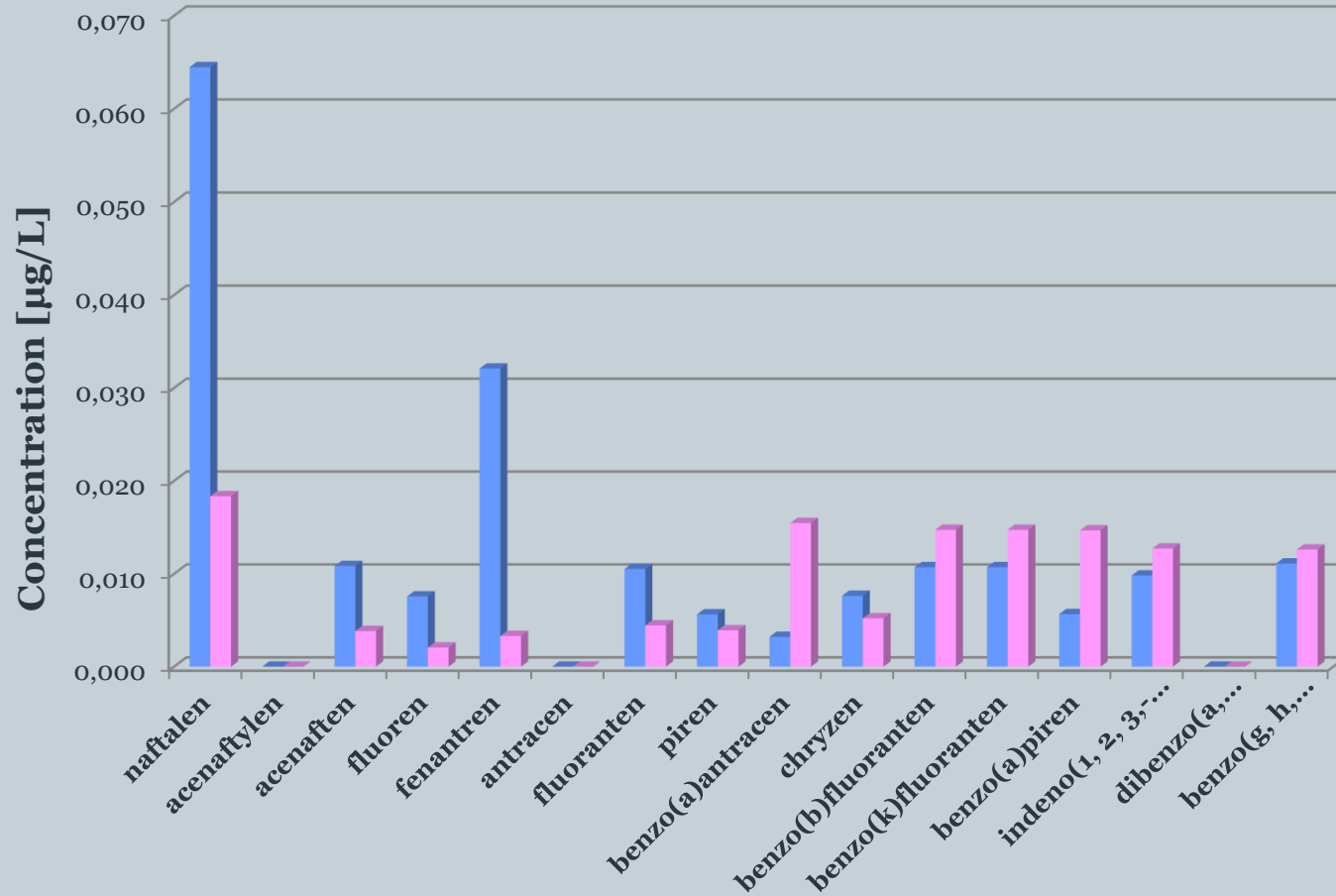
Results

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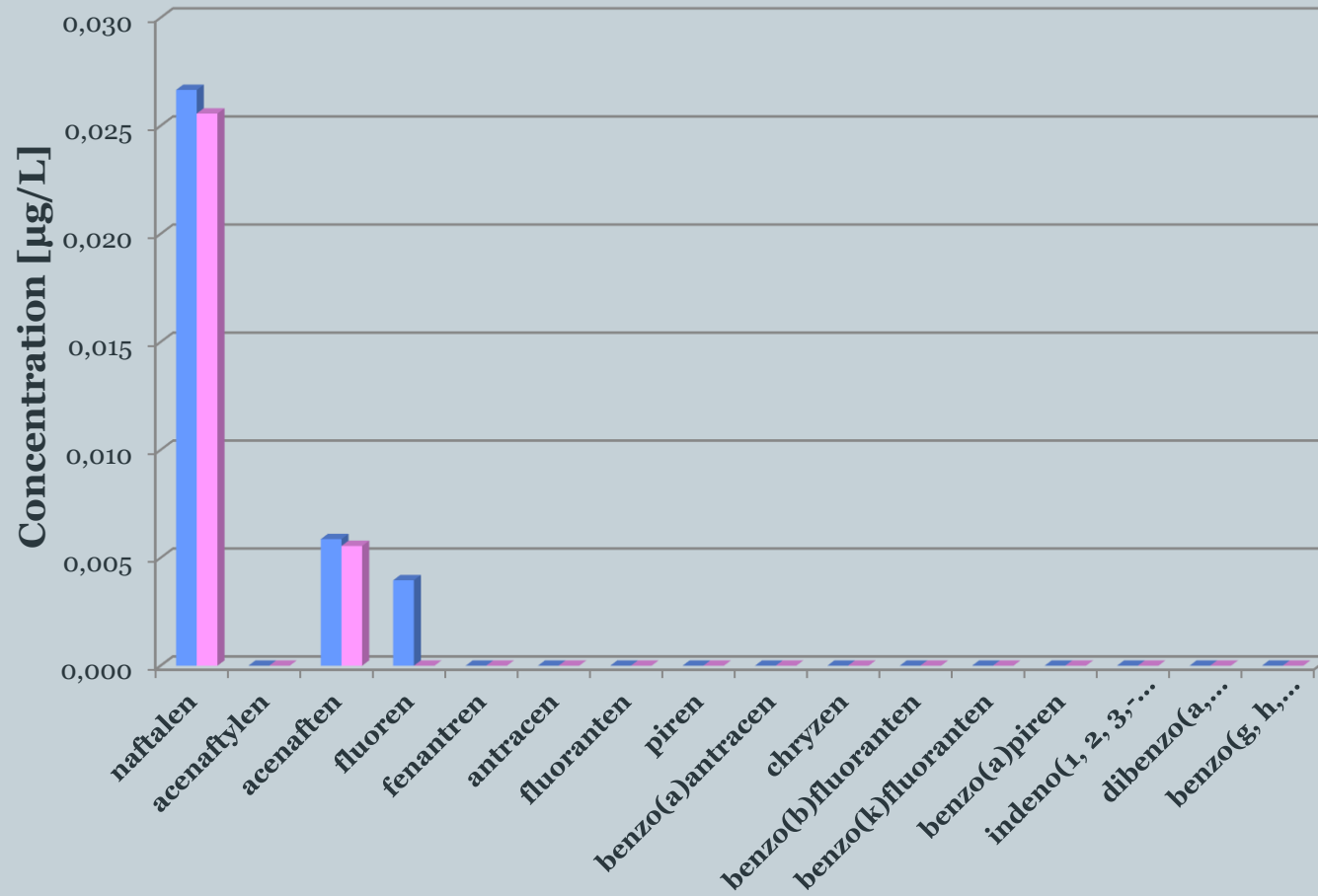
Results

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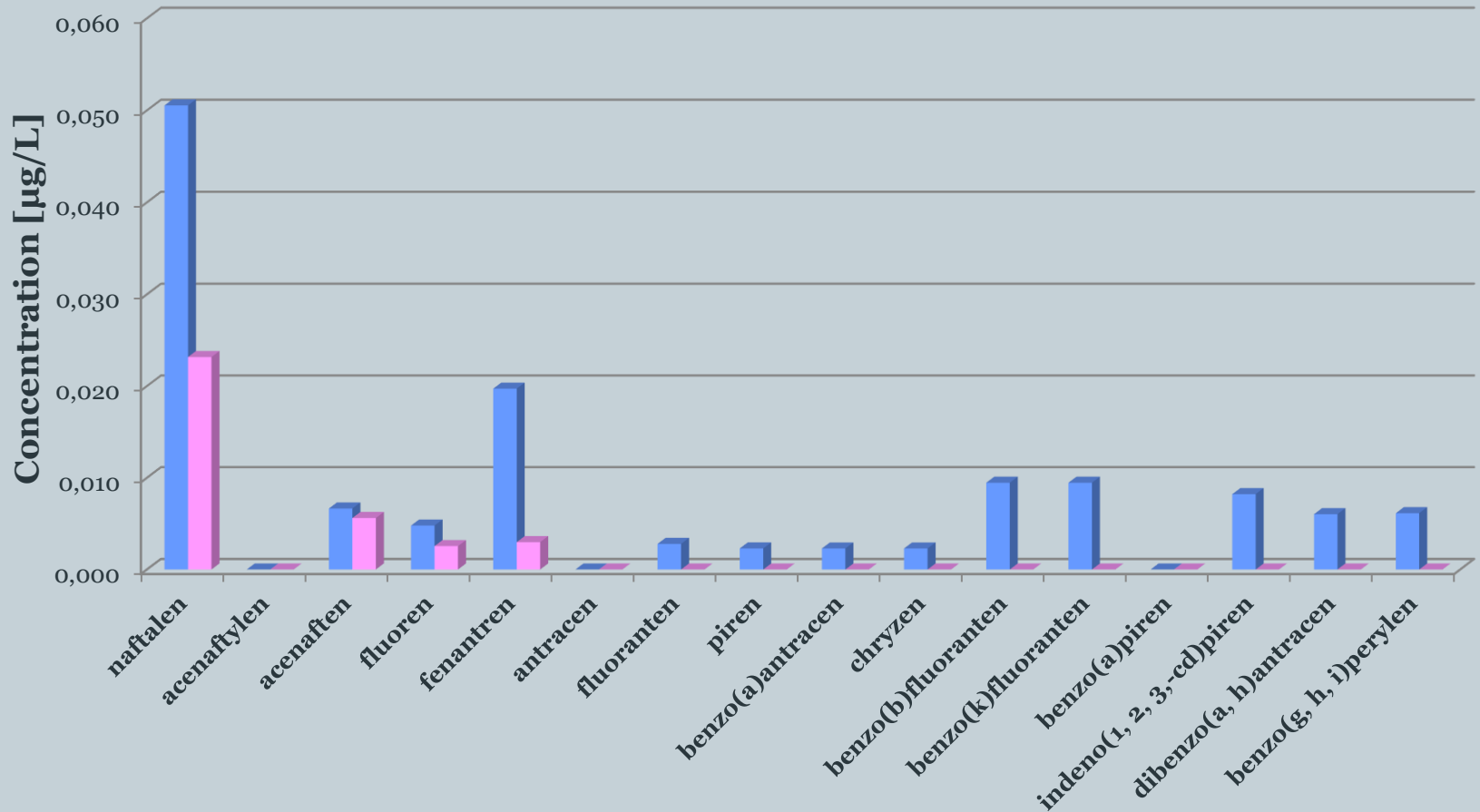
Results

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Results

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Conclusions

- All the water samples taken from water treatment plant contained PAH.
- Concentration of chosen PAH compounds was depending on the time and place in the technological system of the plant that the water sample was taken.
- The only substance that was present in all the water samples was naphthalene.
- The highest concentration of PAH was detected in the water sample taken from the reservoir in the fall.
- The highest concentration of the substance from the PAH group in all the taken water samples was noted for benzo(b)fluoranthene and benzo(k)fluoranthene – 190 ng/L.
- In the water sample taken from the pumping station in the spring, the concentration of chosen PAH was the lowest.
- Concentration of benzo(a)pyrene in the water sample taken from the reservoir in the fall and the water sample taken after final ozonation in the spring was higher than the acceptable concentration contained in the Council Directive 98/83/EC of 3 November 1998 on the quality of water intended for human consumption and Regulation of the Minister of Health of 7 December 2017 on the quality of water intended for human consumption.
- The concentrations of PAH in the water might depend on a season and changes in ambient temperature what connects with higher combustion of fossil fuels (e.g. for heating houses) when the temperature is lower.