

Review for the PhD dissertation

“Polycyclic aromatic hydrocarbons (PAHs) in water and sediments of three major rivers: Spatial distribution, pollution source apportionment, ecological risks and human health impacts”

written by

Ruqayah Ali Naser Grmasha

The *topic of the dissertation* is current and scientifically relevant. PAHs are ubiquitous environmental pollutants originating predominantly from anthropogenic sources. Many of these compounds have toxic, mutagenic and/or carcinogenic properties, therefore measurement of their concentration in the environment, identification of their sources and assessment of their ecological risks are crucial.

The *structure of dissertation* is logical and length and of different chapters is proportionate.

The *introductory chapter* provides an overview about PAHs, their resources and short-term and long-term health effects, measurement methods suitable for their determination and relevant regulations. I find that part of the chapter particularly valuable in which PAH measuring methods are summarised and compared. The dissertation contains 181 references in total. The author not only cites these references, but also critically evaluates the results summarized in them and compares these with her own scientific results. All this proves that the author is familiar with the scientific background of the chosen research topic.

The *„Materials and methods” part* provides a description about the sampling sites, methods of sample collection and pretreatment, the applied extraction procedure and measurement methods and methods used for ecological risk assessment and the calculation of Incremental Lifetime Cancer Risk (ILCR) values. The applied methods are in accordance with the objectives of dissertation, and they have been described in sufficient detail. The analytical methods are also supported by appropriate Quality Control (QC) and Quality Assurance (QA) background.

In the *chapter about results* the candidate presents the measured PAH concentrations for the different sampling sites by seasons and compares the results with data in the scientific literature and with the toxicity guidelines, furthermore, provides an assumption for the sources of these contaminants. ILCR

levels are also calculated and visualized. The discussion of the results is clear, logical and meets the requirements of PhD dissertations. Results are compared with those in the literature. Visualisation methods were selected in accordance with the results to be presented and the high quality of visualisation has a significant contribution to the high standard of the dissertation.

It is important that the candidate identified the uncertainties and limitations related to the analysis of PAHs. These also support the comparison of the results with later research.

The *conclusions* drawn from the results are correct, and several recommendations are made for the future. I found it particularly promising that the dissertation proposes not only regular monitoring in regions contaminated with PAHs and further assessment of health risks, but also the development of applied analytical methods, which includes the development of these methods in a green and sustainable manner.

Thesis points are divided into three groups according to the three sampling areas. I found it a bit unusual that thesis points are presented without numbering, but this does not detract from their correctness, or the value of the excellent scientific results achieved.

All thesis points are accepted and after a successful defense I recommend to award the PhD degree to Ruqayah Ali Naser Grmasha.

The quality of the candidate's research work is also illustrated by the fact that she is the first author of two D1 and one Q1 publications related to her dissertation. Her publication list contains 26 publications in total with an accumulative impact factor of 91.96. This is an outstanding achievement.

My questions are the following:

- Why did you choose the USEPA's ILCR model to estimate the human cancer risk posed by exposure to environmental PAHs? Are there other available models for the assessment of health effects of these compounds?
- Please, provide a more detailed explanation, why PAH content of Tigris River sediment samples are different from sediment samples of Danube and Euphrate in terms of correlation with TOM (total organic matter) content (Figure 28)?

- During the research 16 PAHs (selected as priority PAHs by the EU and the USEPA) are measured. The candidate proposes additional research to develop analytical methods and toxicological information for other non-priority PAHs. Do you have any suggestion for which non-priority PAHs the analytical methods and toxicological information should be extended?

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