

REVIEW
of the official reviewer for dissertation work of
Ibragimova Olga on the theme “Development of simple and accurate methods for organic pollutants determination in the air based on solid-phase microextraction”,
submitted for the degree of Doctor of Philosophy (PhD) in the Educational Program “8D05301 - Chemistry”

№	Criteria	Eligibility (one of the options must be checked)	Justification of the position of the official reviewer
1.	The topic of the thesis (as of the date of its approval) corresponds to the directions of development of science and/or state programs	1.1 Compliance with priority areas of science development or government programs: <u>1) The thesis was completed within the framework of a project or target program financed from the state budget (indicate the name and number of the project or program)</u> 2) The thesis was completed within the framework of another state program (indicate the name of the program) 3) The dissertation corresponds to the priority direction of the development of science, approved by the Higher Scientific and Technical Commission under the Government of the Republic of Kazakhstan (indicate the direction)	This research work was conducted within the framework of projects funded by the Science Committee of the Ministry of Education and Science of the Republic of Kazakhstan: Grant No. AP05133158 “Development of analytical methods, materials and equipment for cost-efficient “green” environmental monitoring” (2018-2020 yy.) and Grant No. AP09058606 “ Development of method for determination of organic pollutants time-weighted average concentrations for monitoring of ambient air of Almaty” (2021-2023 yy.).
2.	Importance for science	The work makes/does not make a significant contribution to science, and its importance is well disclosed/not disclosed	The research significantly contributes to the development of effective measurement methods for organic contaminants in the atmosphere using the SPME. It also showed a new quantification methodology of > 20 VOCs by GC/MS; developed new SPME coatings; seasonal contaminant variations; decreased diffusion path diameter with better accuracy.
3.	The principle of independence	Self-reliance level: <u>1) High;</u> 2) Medium; 3) Low; 4) No independence	All of the experimental tasks, analyses of data, verification of hypotheses have, and preparation of thesis have been done independently. The main results already have been published in high impact scientific journals. Based on these results, the level of independence in the Self-reliance level would be evaluated as “High”.
4.	The principle of inner unity	4.1 Justification of the relevance of the thesis: <u>1) Justified;</u>	The topic of the dissertation is very relevant to the one of the most impending environmental chemistry research topics in Kazakhstan and the world. So the relevance of the thesis can be “Justified”.

		2) Partially justified; 3) Not justified.	
		4.2 The content of the thesis reflects the topic of the thesis: <u>1) Reflects;</u> 2) Partially reflects; 3) Does not reflect	All of the content of the thesis “Reflects” the topic of the thesis. The experimental tasks were very well designed for the verifications of thesis hypotheses.
		4.3. The purpose and objectives correspond to the topic of the thesis: <u>1) correspond;</u> 2) partially correspond; 3) do not correspond	The purpose of the study: development of simple and accurate methods based on solid-phase microextraction, which can improve the current methods, for the determination of single and time-weighted average concentrations of organic pollutants in the air and the objectives: methods for quantification of multiple VOCs in air using SPME correspond to the thesis topic well.
		4.4 All sections and provisions of the thesis are logically interconnected: <u>1) completely interconnected;</u> 2) the interconnection is partial; 3) there is no interconnection	As explained earlier, the thesis was well organized and its logical flow was acceptable. The sections and thesis provisions are logically interconnected.
		4.5 The new solutions (principles, methods) proposed by the author are reasoned and evaluated in comparison with the known solutions: <u>1) there is a critical analysis;</u> 2) partial analysis; 3) the analysis does not represent one's own opinions, but quotes from other authors	The author provided new methodologies and solved and explained simply and easily with the known theories and reported discussions. The novel ideas and methodologies were experimentally and computationally verified with the critical analyses.
5.	Scientific novelty principle	5.1 Are the scientific results and provisions new? <u>1) completely new;</u> <u>2) partially new (25-75% are new);</u> 3) not new (less than 25% are new)	Most of the ideas introduced as the scientific novelty of the research were novel and tested with experiments and simulations.

		<p>5.2 Are the dissertation findings new?</p> <p>1) completely new; <u>2) partially new (25-75% are new);</u> 3) not new (less than 25% are new)</p>	<p>The author introduced 5 novel points with their verifications and critical analyses. Those can be mostly acceptable with the international standards in the international environmental analytical chemistry societies.</p>
		<p>5.3 Technical, technological, economic or management decisions are new and reasonable:</p> <p>1) completely new; <u>2) partially new (25-75% are new);</u> 3) not new (less than 25% are new)</p>	<p>Most of the decision protocols for the technical and economic managements used for the thesis are novel and acceptable.</p>
6.	The validity of the main findings	<p>All main conclusions are/are not based on scientifically significant evidence or well-grounded (for qualitative research and areas of training in the arts and humanities)</p>	<p>The major conclusions the author made in her dissertation were extracted from proper experimental and computational simulation results. They were logically described and reasonably obtained from the adequate verification protocol.</p>
7.	The main provisions for the defense	<p>It is necessary to answer the following questions for each provision separately: 7.1 Is the provision proven?</p> <p><u>1) proven;</u> 2) rather proven; 3) rather not proven; 4) not proven</p> <p>7.2 Is it trivial? 1) yes; <u>2) no</u></p> <p>7.3 Is it new? <u>1) yes;</u> 2) no</p> <p>7.4 Application level: 1) narrow; 2) medium; <u>3) wide</u></p> <p>7.5 Is it proven in the article? <u>1) yes;</u></p>	<p>The 1st provision provided in the dissertation, (PDMS/DVB) SPME fiber better provides the DM and RSDs was verified by the well-organized experimental tasks and their results. It was well proven, not trivial, novel, and widely applicable and adequately proved in the articles.</p>

7.	The main provisions for the defense	<p>2) no</p> <p>It is necessary to answer the following questions for each provision separately: 7.1 Is the provision proven?</p> <p><u>1) proven;</u> 2) rather proven; 3) rather not proven; 4) not proven</p> <p>7.2 Is it trivial?</p> <p>1) yes; <u>2) no</u></p> <p>7.3 Is it new?</p> <p><u>1) yes;</u> 2) no</p> <p>7.4 Application level:</p> <p>1) narrow; 2) medium; <u>3) wide</u></p> <p>7.5 Is it proven in the article?</p> <p><u>1) yes;</u> 2) no</p>	<p>The 2nd provision provided in the dissertation, (PDMS/DVB) SPME shows spike recoveries, was verified by the well-organized experimental tasks and their results. It was well proven, not trivial, novel, and widely applicable and adequately proved in the articles.</p>
7.	The main provisions for the defense	<p>It is necessary to answer the following questions for each provision separately: 7.1 Is the provision proven?</p> <p><u>1) proven;</u> 2) rather proven; 3) rather not proven; 4) not proven</p> <p>7.2 Is it trivial?</p> <p>1) yes; <u>2) no</u></p> <p>7.3 Is it new?</p> <p><u>1) yes;</u></p>	<p>The 3rd provision provided in the dissertation, The seasonal variation in winter is significant with maximum concentrations of 9 VOCs was verified by the well-organized experimental tasks and their results. It was well proven, not trivial, novel, and widely applicable and adequately proved in the articles.</p>

		<p>2) no</p> <p>7.4 Application level:</p> <p>1) narrow;</p> <p>2) medium;</p> <p><u>3) wide</u></p> <p>7.5 Is it proven in the article?</p> <p><u>1) yes;</u></p> <p>2) no</p>	
7.	The main provisions for the defense	<p>It is necessary to answer the following questions for each provision separately: 7.1 Is the provision proven?</p> <p><u>1) proven;</u></p> <p>2) rather proven;</p> <p>3) rather not proven;</p> <p>4) not proven</p> <p>7.2 Is it trivial?</p> <p>1) yes;</p> <p><u>2) no</u></p> <p>7.3 Is it new?</p> <p><u>1) yes;</u></p> <p>2) no</p> <p>7.4 Application level:</p> <p>1) narrow;</p> <p>2) medium;</p> <p><u>3) wide</u></p> <p>7.5 Is it proven in the article?</p> <p><u>1) yes;</u></p> <p>2) no</p>	<p>The last provisions provided in the dissertation, The decreased diffusion diameter provides better accuracy of TWA concentrations, was verified by the well-organized experimental tasks and their results. It was well proven, not trivial, novel, and widely applicable and adequately proved in the articles.</p>
8.	The principle of reliability Reliability of sources and	<p>8.1 Choice of methodology - is justified or the methodology is described in sufficient detail</p> <p><u>1) yes;</u></p> <p>2) no</p>	<p>The methodologies used in the dissertation were described sufficiently and explained in detail.</p>

	information provided	8.2 The results of the thesis were obtained using modern methods of scientific research and methods of processing and interpreting data using computer technologies: <u>1) yes;</u> 2) no	The experimental and computational simulation results were obtained with well-designed and properly organized recent technical protocols.
		8.3 Theoretical conclusions, models, identified relationships and patterns have been proven and confirmed by experimental research (for areas of training in pedagogical sciences, the results have been proven on the basis of a pedagogical experiment): <u>1) yes;</u> 2) no	They were proved adequately as previously described.
		8.4 Important statements are <u>confirmed</u> / partially confirmed / not confirmed by references to current and reliable scientific literature	The discussions and results were confirmed by relevant scientific references.
		8.5 Used literature sources are sufficient/not sufficient for a literature review	The literature sources of the dissertation are sufficient.
9	Practical value principle	9.1 The thesis has theoretical value: <u>1) yes;</u> 2) no	The hypotheses were adequately verified with experimental and computational simulation tasks and discussed with scientific theories and conceptual ideas.
		9.2 The thesis is of practical importance and there is a high probability of applying the results obtained in practice: <u>1) yes;</u> 2) no	The (PDMS/DVB) SPME can be widely applied to the measurements of VOCs in the atmosphere right away.
		9.3 Are the practice suggestions new? 1) completely new; 2) partially new (25-75% are new);	Yes they are quite novel ideas and well proven theories, now.

		3) not new (less than 25% are new)	
10.	The quality of writing and design	Academic writing quality: 1) high; 2) <u>average</u> ; 3) below average; 4) low.	It is well written and organized dissertation. However, it needs some revisions by adding and deleting the contents and correcting some minor errors.

In reviews, official reviewers indicate one of the following solutions:

1) to award the degree of Doctor of Philosophy (PhD) or Doctor of Specialization.

Copies of the reviews of the official reviewers are handed over to the doctoral student no later than 5 (five) working days before the defense of the thesis.

Official Reviewer:

____Nazarbayev University____

____Professor____
(place of work, academic title)



(signature)

____Woojin Lee____
(FULL NAME)