**REVIEW**
**of the official reviewer for dissertation work**
**_____Bauryzhan_Bukenov_Omirbekovich_on the theme «"Development of analytical methods for determination of unsymmetrical dimethylhydrazine transformation products in air"_» presented for the degree of Doctor of Philosophy (PhD) in the specialty «_8D05301 – Chemistry_».**

| № | Criteria | Eligibility (one of the options must be checked) | Justification of the position of the official reviewer |
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| 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: | |
| | | 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)**<br>2) The thesis was completed within the framework of another state program (indicate the name of the program)<br>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) | The dissertation was carried out within the framework of projects funded by the Ministry of Science and Higher Education of the Republic of Kazakhstan: "Development of analytical methods, materials and equipment for cost-efficient "green" environ mental monitoring" (2018–2020, AP05133158), and "Development of accurate methods for on-site gas chromatographic determination of volatile organic compounds in environmental objects using solid-phase microextraction" (2022– 2024, AP14871374). |
| 2. | Importance for science | The work **makes**/does not make a significant contribution to science, and its importance is well **disclosed**/not disclosed | The development of analytical methods for UDMH TPs in air makes a significant contribution to applied science, and its importance is disclosed. |
| 3. | The principle of independence | Self-reliance level:<br>1) **High**; | He has carried out most of the dissertation research on his own efforts. |

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| | | 2) Medium;<br>3) Low;<br>4) No independence | |
| 4. | The principle of inner unity | 4.1 Justification of the relevance of the thesis:<br>1**) Justified**;<br>2) Partially justified;<br>3) Not justified. | Its relevance was justified. |
| | | 4.2 The content of the thesis reflects the topic of the thesis:<br>1) **Reflects;**<br>2) Partially reflects;<br>3) Does not reflect | It reflected. |
| | | 4.3. The purpose and objectives correspond to the topic of the thesis:<br>1) **correspond;**<br>2) partially correspond;<br>3) do not correspond | Corresponded. |
| | | 4.4 All sections and provisions of the thesis are logically interconnected:<br>1**) completely interconnected**;<br>2) the interconnection is partial;<br>3) there is no interconnection | Interconnected. |
| | | 4.5 The new solutions (principles, methods) proposed by the author are reasoned and evaluated in comparison with the known solutions:<br>1**) there is a critical analysis**;<br>2) partial analysis;<br>3) the analysis does not represent one's own opinions, but quotes from other authors | There is a critical analysis. However, if newly developed methodologies can be compared to other current methodologies, e.g., USEPA 521, USEPA 8270, ISO20596-2018, the dissertation could provide a better and clearer understanding. |
| 5. | Scientific novelty principle | 5.1 Are the scientific results and provisions new?<br>1**) completely new**;<br>2) partially new (25-75% are new);<br>3) not new (less than 25% are new) | The results and provisions are new. |
| | | 5.2 Are the dissertation findings new? | The findings are new. |

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| | | 1) **completely new;**<br>2) partially new (25-75% are new);<br>3) not new (less than 25% are new) | |
| | | 5.3 Technical, technological, economic or management decisions are new and reasonable:<br>1) **completely new**;<br>2) partially new (25-75% are new);<br>3) not new (less than 25% are new) | Technical decisions are new.<br><br>* The necessity of air sampling of the targets and TPs can be evaluated in regard to their water and soil monitoring with the meteorology of the contaminated sites. |
| 6. | The validity of the main findings | 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) | Main conclusions are based on significant evidence. |
| 7. | The main provisions for the defense | It is necessary to answer the following questions for each provision separately: 7.1 Is the provision proven?<br>Provision 1<br>1**) proven**;<br>2) rather proven;<br>3) rather not proven;<br>4) not proven<br>7.2 Is it trivial?<br>1) yes;<br>2) no<br>7.3 Is it new?<br>1**) yes;**<br>2) no<br>7.4 Application level:<br>1) narrow;<br>2**) medium**;<br>3) wide<br>7.5 Is it proven in the article?<br>1) **yes;**<br>2) no | 7.1.1 Proven<br><br>7.1.2 N/A, This might be different based on the expert's view.<br><br>7.1.3 New<br><br>7.1.4 Medium<br><br>7.1.5 Proven |

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| | | Provision 2<br>1**) proven**;<br>2) rather proven;<br>3) rather not proven;<br>4) not proven<br>7.2 Is it trivial?<br>1) yes;<br>2) no<br>7.3 Is it new?<br>1**) yes;**<br>2) no<br>7.4 Application level:<br>1) narrow;<br>2**) medium**;<br>3) wide<br>7.5 Is it proven in the article?<br>1) **yes;**<br>2) no | 7.2.1 Proven<br><br>7.2.2 N/A, This might be different based on the expert's view.<br><br>7.2.3 New<br><br>7.2.4 Medium<br><br>7.2.5 Proven |
| | | Provision 3<br>1**) proven**;<br>2) rather proven;<br>3) rather not proven;<br>4) not proven<br>7.2 Is it trivial?<br>1) yes;<br>2) no<br>7.3 Is it new?<br>1**) yes;**<br>2) no<br>7.4 Application level:<br>1) narrow;<br>2**) medium**;<br>3) wide | 7.3.1 Proven<br><br>7.3.2 N/A, This might be different based on the expert's view.<br><br>7.3.3 New<br><br>7.3.4 Medium<br><br>7.3.5 Proven |

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| | | 7.5 Is it proven in the article?<br>1) **yes;**<br>2) no | |
| 8. | The principle of reliability Reliability of sources and information provided | 8.1 Choice of methodology - is justified or the methodology is described in sufficient detail<br>1) **yes;**<br>2) no | It is justified and described in detail. |
| | | 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:<br>1**) yes;**<br>2) no | The results were obtained using modern analytical hi-tech, including the GC/MS, GC/HRMS. |
| | | 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):<br>1**) yes;**<br>2) no | They were proven and confirmed. |
| | | 8.4 Important statements are **confirmed** / partially confirmed / not confirmed by references to current and reliable scientific literature | Confirmed. |
| | | 8.5 Used literature sources are **sufficient**/not sufficient for a literature review | Sufficient. |
| 9 | Practical value principle | 9.1 The thesis has theoretical value:<br>1**) yes**;<br>2) no | Yes.<br>* Please rewrite “the theoretical significance of the thesis”. This is more like a practical significance. |
| | | 9.2 The thesis is of practical importance and there is a high probability of applying the results obtained in practice:<br>1) yes;<br>2) no | Yes. This research is very practical. |

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| | | 9.3 Are the practice suggestions new?<br>1) **completely new;**<br>2) partially new (25-75% are new);<br>3) not new (less than 25% are new) | The practical suggestions are new with new commercial product combinations. |
| 10. | The quality of writing and design | Academic writing quality:<br>1**) high**;<br>2) average;<br>3) below average;<br>4) low. | It was already evaluated by the research journals and published with 3 research articles. |
| 11. | Notes on a thesis | *Minor comments should be answered and revised. | N/A |
| 12. | Scientific level of the doctoral student's articles on the topic of research (in case of defense of the dissertation in the form of a series of articles, the official reviewers comment on the scientific level of each article of the doctoral student on the topic of research) | | 3 research articles have been published in the 2Q2 and 1Q1 journals successfully. Q1 and Q2 couldn't be a standard of good and bad journals, but the candidate might need to learn more and better about the current needs of the research society. Then, he can try higher impact (level) journals next time. |
| 13. | Decision of the official reviewer (pursuant to paragraph 28 of the present Model Regulations) | | Based on all the evaluation results above and his successful publications in the scientific journals, Mr. Bauryzhan Bukenov could receive the Ph.D. degree. |

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

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

2) send the thesis for revision (except for cases of thesis defense in the form of a series of articles);

3) refuse 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:**



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|---|---|---|
| Professor / Nazarbayev University | | Woojin Lee |
| (place of work, academic title) | (signature) | (FULL NAME) |