
Consultant's Review and Recommendation for PhD Degree Conferral

Candidate: *Fariza Khozhanepessova*

Dissertation Title: *Development of a Method for Cleaning Oil-Contaminated Soil Using Adsorption-Immobilized Microorganism-Destructors*

Degree Sought: Doctor of Philosophy (PhD)

Field: Environmental Science / Environmental Biotechnology / Environmental Microbiology

1. Scientific Novelty and Relevance

The dissertation demonstrates a **clear and original contribution** to the field of environmental biotechnology, particularly in the area of **bioremediation of hydrocarbon-contaminated environments**. The candidate introduces an innovative approach by employing a **microbial consortium (Rhodococcus–Dietzia)** immobilized on **agricultural waste materials** as a low-cost, sustainable carrier system for enhanced oil biodegradation.

The scientific novelty lies in:

- The **combined use of immobilized bacterial consortia** rather than single strains, improving degradation efficiency and system robustness.
- The **utilization of agricultural waste as an immobilization matrix**, addressing both waste valorization and environmental remediation simultaneously.
- The integration of **microbial ecology, environmental microbiology, and applied bioprocess design**, which advances current remediation strategies beyond conventional bioaugmentation methods.

The research addresses a **globally relevant environmental problem**, namely petroleum hydrocarbon pollution, which affects soil and water resources worldwide. The proposed solution aligns with **sustainable development goals**, circular economy principles, and environmentally responsible remediation practices. The topic is therefore **highly relevant**, timely, and impactful for both academic research and practical environmental management.

2. Research Methodology

The research methodology is **well-structured, scientifically sound, and appropriate** for a doctoral-level investigation. The candidate demonstrates strong command of experimental design and laboratory techniques relevant to environmental microbiology and biodegradation studies.

Key methodological strengths include:

- Systematic **selection, cultivation, and characterization** of hydrocarbon-degrading bacterial strains.
- Development and optimization of **immobilization techniques using agricultural waste substrates**.
- Application of **controlled laboratory experiments** to assess biodegradation efficiency under varying conditions.
- Use of **quantitative and qualitative analytical methods** to evaluate hydrocarbon degradation performance.

The experimental procedures are described in sufficient detail to ensure **reproducibility**, and appropriate controls are incorporated. The methodology reflects a **critical understanding of both biological and environmental variables**, and potential limitations are acknowledged and addressed logically.

Overall, the methodological framework meets and exceeds expectations for PhD-level research and demonstrates the candidate's ability to independently conduct rigorous scientific investigations.

3. Results and Their Significance

The results are **clearly presented, logically interpreted, and scientifically meaningful**. The findings provide compelling evidence that immobilized *Rhodococcus*–*Dietzia* consortia significantly enhance oil biodegradation compared to non-immobilized or single-strain systems.

Notable outcomes include:

- Demonstrated improvement in **hydrocarbon degradation efficiency**.
- Enhanced microbial stability and activity through immobilization.
- Validation of agricultural waste materials as effective and sustainable immobilization supports.

The candidate effectively connects experimental results to existing literature, highlighting both consistencies and advancements beyond prior studies. The conclusions are well-supported by data and avoid overgeneralization.

Importantly, the results have **practical applicability**, offering scalable insights for environmental remediation projects. This translational potential further strengthens the significance of the research.

4. Publications Quality

The research has resulted in **peer-reviewed scientific publications** that reflect the quality and originality of the doctoral work. The publications are:

- Published in **relevant, reputable scientific journals** within the field.
- Clearly written, well-structured, and methodologically robust.
- Aligned with international standards for scientific reporting.

The publication record demonstrates the candidate's ability to **communicate complex scientific findings effectively** and contribute to the scholarly community. This output meets the expectations typically associated with successful PhD candidates in environmental and biological sciences.

5. Overall Recommendation for PhD Degree Conferral

Based on the **originality of the research**, the **rigor of the methodology**, the **significance of the results**, and the **quality of scholarly publications**, it is my professional opinion that the dissertation fully satisfies the requirements for the award of the **Doctor of Philosophy (PhD)** degree.

The candidate has demonstrated:

- Independent research capability
- Critical scientific thinking
- Strong technical competence
- Meaningful contribution to knowledge in environmental biotechnology

I therefore **strongly recommend** that the PhD degree be **conferred without reservation**.

Consultant / External Reviewer

Name: *Arezo Dadras*

Title: *Research Fellow*

Affiliation: University of Vic

Date: *December 24th 2025*

