



# Review Report on PhD Thesis

Faculty: **Central European Institute of Technology  
Brno University of Technology in Brno**

Academic year: **2024/2025**

Student: **Xia Peng**

Doctoral study program: **Advanced Materials and Nanosciences**

Field of study: **Advanced nanotechnologies and microtechnologies**

Supervisor: **Prof. RNDr. Martin Pumera, Ph.D.**

Reviewer: **Prof. Alberto Escarpa**

**PhD thesis title:** Micro and nanorobots based on photocatalytic materials for environmental and biomedical applications

**Topicality of doctoral thesis:** The aim of the thesis is to provide a battery of micromotor-based environmental degradation approaches. This topic is timely, and the topicality is related to the current sustainability issues of scientific and social relevance. A myriad of micromotors is designed for the elimination of explosives, microplastics and bacteria biofilms, essential to assure safe water and to protect the society and global population. On a second set of strategies, the micromotor based approaches proposed are directed for their use in cancer treatment, with study of the propulsion in the cancer media, which is of even more societal and biomedical impact.

**Meeting the goals set:** All the goals have been successfully achieved. The results derived are impressive, with 8 articles in high impact peer review journal and several communications to conferences. The student has demonstrated as well the capacity to obtain grants and independent funding.

**Problem solving and dissertation results:** The thesis is well structure and focused on two main important problems: environment protection and controlled drug delivery. The dissertations results are highly clear, with experimental proofa and a balance discussion. All the problems chosen in the two different fileds have been adequately adressed.

**Importance for practice or development of the discipline:** The thesis solve environmental remediation problems, still at early developments. With adequate scalability, the results derived will lead to future strategies for water treatment.

**Formal adjustment of the thesis and language level:** All the formal aspects and language are correct, so no additional formal adjustment are needed.

(4) The study is duly completed by a state doctoral examination and the defense of a dissertation, which proves the ability and readiness for independent activity in research or development or for independent theoretical and creative artistic activity. The dissertation must include original and published results or results accepted for publication. )

**Questions and comments:**

1. How to scale up the micromotor based approaches for water treatment in drinking water treatment plants and pipes.
2. How to track the hematite micromotors within the human body? Compatibility studies?

**Conclusion:** Excellent thesis, with good structure, a good literature balance, including appropriate results discussions and solid conclusions. The scientific production is impressive.

In my opinion, the reviewed thesis **fulfill** all requirements posed on theses aimed for obtaining PhD degree. This thesis **is ready** to be defended orally, in front of respective committee.

In Alcalá de Henares, date 17/03/2025



**Prof. Alberto Escarpa**