

STATEMENT

by prof. Vassil Borissov Delchev, DSc,
from the Department of Physical chemistry, University of Plovdiv
on the materials for the defence of a doctoral thesis
for the awarding of the academic degree *Doctor of philosophy* (PhD)
in the Department of Physical Chemistry, Chemical Faculty – University of Plovdiv

Field of higher education: 4: Natural sciences, mathematics and informatics

Professional area: 4.2. Chemical sciences

Scientific field: Physical chemistry

PhD student (aspirant): Mariya Genova Pimpilova

Title of the doctoral thesis: „Modification of glass carbon electrodes with electrodeposited gold or 2D-nanomaterials: characterization and applications”

Scientific supervisor: Assoc. Prof. Nina Dimcheva, PhD

Rector's order for the constitution of the Scientific jury: **ПД-21-245/30.01.2024 г.**

Decision of the first meeting of the Scientific jury: **to write an academic statement.**

All materials for the defence of the doctoral thesis for the awarding of the academic degree *Doctor of philosophy* of Mariya Pimpilova are presented in digital form. The documentation involves: 1) an official request to the Rector of the University of Plovdiv for start of the procedure for awarding of the academic degree *Doctor of philosophy* (PhD); 2) a standard *Curriculum Vitae*; 3) a protocol from the department council for the discussion of the thesis; 4) a statement of the scientific advisor; 5) an abstract of the PhD thesis in Bulgarian and English; 6) a list of publications; 7) a PhD thesis in Bulgarian.

Biographic information

Mariya Pimpilova graduated from the Chemical Department at the University of Plovdiv in 2017 with a bachelor's degree in "Chemistry". One year later, she holds a master's degree in "Food Chemistry" from the same university. She works as a researcher in the Center of Technologies at the University of Plovdiv from 2020 to 2023. Parallel with this, she works as an assistant professor at the Department of Physical Chemistry.

Importance of the theme

The dissertation contains essential and valuable results which are original for science and obtained for the first time. The proposed investigations have a practical focus and they are in the field of applied electrochemistry. Electrochemically modified electrode surfaces were examined and described using electrochemical methods. The electrodes were used to quantify the active components of medications as well as the toxic components of vegetable oils. I think that the aims and purpose of the research are clearly defined and the methods of implementation are correctly chosen.

PhD thesis

The PhD thesis is written on 134 pages total and it is structured in six chapters. On 30 pages in the beginning of the thesis, in the Literature review section, M. Pimpilova has given information about the actual achievements in the field of research. This section is based on 238 literature sources (references). The largest part of the thesis is that dedicated to the results achieved and the description of the experiments. In section I.3 are described the major electrochemical methods for characterization of processes and materials which are applied for the investigations in the PhD thesis. The major points of the research are summarized in three conclusions at the end of the dissertation.

Methodology of the research

Several electrode materials have been prepared (gold on glassy carbon, carbon nitride electrodes, enzyme-immobilized electrodes etc.) and tested for electrochemical activity and

ability for determination of different substrates. For this purpose the electrochemical impedance spectroscopy, differential pulse voltammetry, constant potential amperometry etc. were applied. I think that the methodology is well chosen and properly describes the studied processes and materials.

Major contributions of the PhD thesis

For the first time it has been constructed an electrochemical biosensor for dopamine determination using two distinct electrochemical techniques (differential pulse voltammetry and constant potential amperometry). A quantitative measurement of dopamine and L-epinephrine in commercial products (ampoules for intravenous usage) was performed using a designed electrode.

For the first time it is tested an electrode for electrochemical reduction of H₂O₂ and tert-butyl hydroperoxide on Co-g-C₃N₄ /Nafion (conductive polymer). The designed peroxide electrode is tested for the determination of catalase enzyme activity at pH=7. In addition, it has been demonstrated the power of electrochemical methods for the determination of the peroxide number of vegetable oils based on the catalytic peroxide electrode.

Publications included in the doctoral thesis and participation in conferences

The results from the PhD thesis are published in 2 journals with a deep impact: *Catalysts* (quartile Q1) and *Biosensors* (quartile Q1). According to Scopus database the paper in the first journal is cited 2 times in international journals, whereas the paper in the second journal is cited 6 times. The database Web of Science gives 7 citations. The large numbers of citations collected for such short time implies for the importance of the research, its actuality and practical application. It should be mentioned that the PhD candidate together with the PhD adviser have applied for a patent for invention No BG|P|2023|113803 for the development of electrochemical methods for quantitative determination of peroxide compounds. The application is registered with the Bulgarian Patent Office at the end of the last year.

The PhD candidate has reported orally the research results on two National conferences (organized by SU "St. Kliment Ohridski" - Sofia) and one virtual congress. Four posters have been presented on two local conferences of the Chemical faculty at the University of Plovdiv, one on the Sofia Electrochemistry Days, and one on the conference Novel enzymes in Greifswald, Germany.

PhD thesis summary

The PhD thesis summary in Bulgarian comprises 32 pages and it describes the major points of the dissertation. The English version of the PhD summary is also available as required by national and local regulations on the procedure for the awarding of the academic degree *Doctor of philosophy*.

CONCLUSION

The provided materials for the current procedure are in agreement with the Law for development of the academic staff in Republic of Bulgaria, the Rules for its application as well as with the minimal national requirements in the professional field. I consider that Mariya Pimpilova is a complete scientist in the area of research and she can guide an independent research in the field of electrochemistry and its applications for quantitative analysis. All this and the aforementioned facts drive me to give my **positive vote** for the awarding of the academic degree *Doctor of philosophy* (PhD) of Mariya Genova Pimpilova in the field of higher education: 4: Natural sciences, mathematics and informatics; professional area 4.2. Chemical sciences; scientific field: Physical chemistry.

22.03.2024 г.
Plovdiv