

VASILE GOLDIȘ WESTERN UNIVERSITY OF ARAD

HABILITATION THESIS

FIELD - BIOLOGY

**ADVANCED RESEARCH ON THE ANTIMIROBIAL EFFECT OF SOME
MATERIALS WITH APPLICATIONS IN THE BIOMEDICAL FIELD**

SUMMARY

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The habilitation thesis *Cercetări avansate privind efectul antimicrobian al unor materiale cu aplicații în domeniul biomedical/ Advanced Research on the Antimicrobial Effect of Some Materials with Applications in the Biomedical Field* synthetically presents the results of the scientific research activity that I have carried out in the last 12 years, after obtaining the scientific title of doctor in Biology in 2006.

Following the defense of the doctoral thesis, the scientific research activity was oriented in three major, interconnected directions, demonstrating a strong inter- and transdisciplinary character. This habilitation thesis aims at all three directions, namely:

1. Microbiological studies on the effects of non-antibiotic prevention and treatment in some dental conditions;
2. Study of the antimicrobial activity of some biocomposite hydrogels for the purpose of effective use in the modern treatment of wounds caused by burns;
3. Study of the antimicrobial activity of some biopolymers for the purpose of effective use in the biomedical field, including as disinfectants.

The habilitation thesis is structured in three parts, based on 14 works considered representative of the 23 personal scientific articles published in the ISI Web of Science stream after the defense of the doctoral thesis: 11 as main author (3 as first author and 2 as corresponding author, 6 as last author), and 12 as co-author, respectively.

Part I of the habilitation thesis presents in the three subchapters the main professional, academic and scientific achievements, i.e., the current scientific context regarding the importance of the research fields addressed, not only with references to our own publications, but also to numerous studies recently published by other research groups.

The first research direction aimed at microbiological studies on the effects of prevention and non-antibiotic treatment in some dental conditions.

Microbiological studies on the effects of prevention in some dental conditions refer to the usefulness of salivary tests for detecting and monitoring the risk of dental caries.

Semiquantitative determination of *Streptococcus mutans* and *Lactobacilli*, along with other tests based on different principles, can be useful in the most accurate assessment of an individual's cariogenic risk.

In the subchapter "Study of the antimicrobial activity of controlled drug delivery systems for effective use in the modern treatment of periodontitis" we presented the antimicrobial effect of some polysaccharide-based drug delivery systems.

After a review, it is highlighted that polymer-based controlled release systems, incorporating various substances with antimicrobial effects, developed to date due to the benefits of

nanotechnology, are viable alternatives for the prevention and treatment of periodontal disease, but require in-depth testing in vivo on animals and, ultimately, on human patients.

The antimicrobial effect of some nanocomposite hydrogels based on: chitosan/PVA obtained by double crosslinking with embedded silver nanoparticles; PVA/chitosan/oxalic acid (obtained by ecological methods) incorporating silver nanoparticles; chitosan and polyvinyl alcohol, ibuprofen, containing AgNp with a chitosan coating; PVA, oxidized CS both as a component of the matrix and as a crosslinking agent, silver nanoparticles, ibuprofen; CS and PVA (obtained by the double crosslinking method – with glutaraldehyde and magnesium sulfate) in which ZnONp is incorporated.

As a result of these pieces research, the following conclusions are drawn:

- when choosing a material for bioapplications, it is good to identify the lowest possible concentration of metal nanoparticles that provides an adequate antibacterial effect;
- new biocomposite hydrogels obtained based on natural and synthetic polymers and inorganic nanoparticles have proven to be effective on some anaerobic bacteria (*Porphyromonas gingivalis*), Gram positive (*Staphylococcus aureus*) and Gram negative (*Pseudomonas aeruginosa*, *Klebsiella pneumoniae*, *Escherichia coli*).
- samples that showed antibacterial activity, good bioadhesive properties, were not cytotoxic and were chosen for drug loading for use in the treatment of periodontitis.

The results obtained in the study of the antimicrobial activity of some biocomposite hydrogels for the purpose of effective use in the modern treatment of burn wounds (the second research direction) are encouraging, and it is recommended to be complemented by additional in vitro and in vivo tests.

The third research direction aimed at studying the antimicrobial activity of some biopolymers for effective use in the biomedical field, including as disinfectants.

We approached this topic because the potential application of composites containing metal nanoparticles in the medical field requires the evaluation of their biosafety.

When choosing a material for bioapplications, it is good to identify the lowest possible concentration of AgNp that provides an adequate antibacterial effect.

Part II of the habilitation thesis presents in the two subchapters the plans for the evolution and development of the professional and scientific career, the academic one, respectively. The main aims are: building an academic career not only by developing existing skills, but also acquiring new ones, along with technological and scientific progress; completing current research projects in which I am a team member and participating in grant/project competitions with national funding (UEFISCDI) or international funding (Horizon Europe Program of the European Commission) as a team manager or specialist.

Part III of the habilitation thesis is represented by the list of the 248 bibliographical references consulted.