THE SUMMARY OF THE REVIEWED PUBLICATIONS OF ASSOCIATE PROFESSOR ILIANA A. IVANOVA, IN BULGARIAN LANGUAGE IN THE COMPETITION FOR PROFESSOR

1. *Martinov, B., Pavlova E.,* ***Ivanova I. A.,*** *Yocheva L., Kostadinova A., Staneva A. D.*, **BIOLOGICAL ACTIVITY AND BIOCHEMICAL PROPERTIES OF GRAPHENE NANOCOMPOSITES WITH ZINC OXIDE, Cu, AND Ag NANOPARTICLES** , Journal of Chemical Technology and Metallurgy , 2023, pages:327-339, ISSN (print):1314-7471, ISSN (online):1314-7978, Ref, IR , SCOPUS, SJR (0.25 - 2022), SCOPUS **Quartile: Q3 (2023)**

The aim of this research is to obtain collagene nanocomposites based on graphene, graphene oxide, GO, zinc oxide and metal nanoparticles and to evaluate their pro-, antioxidant and biological activities by luminescent and standard microbiological assays. The antimicrobial activity of graphene composites with added nanosized zinc oxide, silver and copper nanoparticles was tested on Firmicutes bacteria Staphylococcus epidermidis (ATCC 1228) and Gracillicutes Escherichia coli (ATCC 25922). The method of diffusion in agar was used in three variants - spot diffusion, well and paper-disc diffusion. The spot and diffusion disc approaches of the method have shown better effect than the well diffusion for testing the effect of graphene composites on bacteria. The composites with high ZnO content had the best antimicrobial properties against the tested bacteria. The cytotoxicity of the nanocomposites using normal MDCK and A549 epithelial sarcoma cells were tested for 24 h at a concentration of 100 mg mL-1. Cancer cells were found to be more sensitive than normal to the graphene composites, proving antitumor activity. The pro- and antioxidant effects of the tested nanomaterials depend on the pH level. At physiological conditions, in the Fenton`s system, all but RGO+Cu do not appear to be suitable as an implant nanomaterial. In the H_2O_2 oxidation system all materials present stable antioxidant effects; only ZnO+RGO+Cu is close to control prooxidant levels. When the nanomaterials are tested for oxidation by O^2 .- radicals, ZnO+RGO and Zn+RGO+Cu show prooxidant effects, as the prooxidant activity is kept for ZnO+RGO even at physiological pH 7.4.

2. *Vladkova T.G., Staneva A., Avramova I., Ivanova I.A., Gospodinova D.*, **Fucoidan-Containing, Low-Adhesive Siloxane Coatings for Medical Applications: Inhibition of Bacterial Growth and Biofilm Development**, Materials , vol:16, issue:3651, 2023, pages:1-13, doi:https:// doi.org/10.3390/ma16103651, Ref, IR , SCOPUS, SJR (0.563 - 2022), SCOPUS **Quartile: Q2 (2023)**

The deposition of low-adhesive siloxane coatings is a current trend for the non-toxic control of bacterial growth and biofilm formation. Total elimination of biofilm formation has not been reported so far. The aim of this investigation was to study the ability of a non-toxic, natural, biologically active substance, such as fucoidan, to inhibit bacterial growth on similar medical coatings. The fucoidan amount was varied, and its impact on the bioadhesion-influencing surface characteristics, as well as on bacterial cell growth, was investigated. The inclusion of up to 3–4 wt.% brown algae-derived fucoidan in the coatings increases their inhibitory effect, more significantly on the Gram-positive bacterium S. aureus than on the Gram-negative bacterium Escherichia coli. The biological activity of the studied siloxane coatings was ascribed to the formation of a low-adhesive, biologically active surface top layer consisting of siloxane oil and dispersed water-soluble fucoidan particles. This is the

first report on the antibacterial activity of fucoidan-containing medical siloxane coatings. The experimental results give reason to expect that relevantly selected, natural biologically active substances can be efficient in the non-toxic control of bacterial growth on medical devices and, as a result, medical device-associated infections.

3. *Vladkova T.G., Martinov B.L., Staneva A.D., Ivanova I.A., Gospodinova D., Albu-Kaya M.*, **PREPARATION AND ANTIMICROBIAL ACTIVITY OF FUCOIDAN CONTAINING COLLAGEN/(ZnTiO3/SiO2) COMPOSITES**, Journal of Chemical Technology and Metallurgy,, vol:58, issue:4, 2023, pages:654-663, Ref, IR , SCOPUS, SJR (2 - 2023), SCOPUS **Quartile: Q3 (2023)**

The aim of this investigation was to develop collagen based composite biomaterial with improved antimicrobial activity using a combination of antimicrobial agents consisting of zinc titanateembedded in a silane matrix, ($ZnTiO_3$/ SiO_2) and fucoidan at varied concentrations. The morphology of the investigated porous collagen/($ZnTiO_3$ /SiO_2)/ fucoidan composites was observed by SEM and their antimicrobial activity was evaluated against four Gram-negative bacteria (*Escherichia coli, Pseudomonas aeruginosa, Pseudomonas putida, Salmonela holeresius*), two Grampositive bacteria (*Staphylococcus epidermidis, Bacillus cereus*) and two fungi (*Candida Lusitania, Saccharomyces cerevisiae*) by disk diffusion test. Broad-spectrum antimicrobial activity of the studied porous collagen/($ZnTiO_3$ /SiO_2)/fucoidan composites was demonstrated, specific toward the different test microbial strains and dependent on the fucoidan concentration. The specific activity toward different microbial cultures was ascribed to the features of the microbial cells (size, shape, cell wall and membrane) and differences in the composition of the secreted exopolymeric substances. It was found that both, the formed interconnected open porous structure of the mixed collagen/fucoidan matrix with fine dispersed submicron $ZnTiO_3$ /SiO_2 particles along the marix fibrils and the own antibacterial activity of the fucoidan, contribute to the increased wide spectrum antibacterial activity compared to that of similar collagen composites do not containing fucoidan.

4. *Vladkova T.G., Monov D.M., Akuzov D.T., Ivanova I. A., Gospodinova D.*, **Comparative Study of the Marinobacter hydrocarbonoclasticus Biofilm Formation on Antioxidants Containing Siloxane Composite Coatings**, Materials (Basel) 4530., vol:15, issue:13, 2022, pages:4530-0, doi:doi: 10.3390/ma15134530, Ref, Web of Science, Web of Science Quartile: Q2 (2022), SCOPUS **Quartile: Q2 (2022)**

No systematic study of antioxidant containing coatings and their anti-biofilm action has been reported so far. The utilization of antioxidants in protective coatings to inhibit marine biofilm formation is a current challenge. The aim of this preliminary study was to prepare, characterize and compare the efficiency of low adhesive siloxane composite coatings equally loaded with different antioxidants against mono-species biofilms formation. Most often participating in the marine biofilms formation, *Marinobacter hydrocarbonoclasticus* was the test bacterium. Both the biofilm covered surface area (BCSA) and corrected total cell fluorescence (CTCF) (by fluorescent microscopy) were selected as the parameters for quantification of the biofilm after 1 h and 4 h incubation. Differing extents of altered surface characteristics (physical-chemical; physical-mechanical) and the specific affection of *M.hydrocarbonoclasticus* biofilm formation in both reduction and stimulation, were found in the studied antioxidant containing coatings, depending on the chemical nature of the used antioxidant. It was concluded that not all antioxidants reduce mono-species biofilm formation; antioxidant chemical reactivity stipulates the formation of an altered vulcanization network of the siloxane composites and thus microbial adhesion which influences the surface characteristics of the

vulcanized coatings; and low surface energy combined with a low indentation elastic modulus are probably pre-requisites of low microbial adhesion.

5. ***Ivanova I.,*** *E. Pavlova, A. Kostadinova, R. Toshkovska, L. Yocheva, Kh El-Sayed, M. Hassan, H. El-Zorkany, H. Elshoky*, **Investigation of Biological and Prooxidant Activity of Zinc Oxide Nanoclusters and Nanoparticles**, Acta Chimica Slovenica , vol:69, issue:3, 2022, pages:1-12, ISSN (print):13180207, ISSN (online):15803155, doi:https://doi.org/10.17344/acsi.2021.7337, Ref, Web of Science, **IF (1.735 - 2021), SCOPUS, SJR (0.29 - 2021), SCOPUS Quartile: Q3** (2022), https://acsi-journal.eu/index.php/ACSi/article/view/7337

Zinc oxide (ZnO) nanomaterials offer some promising antibacterial effects. In this study, a new form of ZnO is synthesized, named ZnO nanocluster bars (NCs). Herein, ZnO NCs, ZnO nanoparticles (NPs), ZnO coated with silica (ZnO-SiO_A, ZnO-SiO_B), and SiO_2 NPs were prepared, characterized, and their antimicrobial and prooxidant activity were tested. The prooxidant activity of all nanomaterials was studied according to free-radical oxidation reactions (pH 7.4 and pH 8.5) in chemiluminescent model systems. Each form of new synthesized ZnO nanomaterials exhibited a unique behavior that varied from mild to strong prooxidant properties in the Fenton`s system. ZnO NPs and ZnO NCs showed strong antibacterial effects, ZnO-SiO_A NPs did not show any antibacterial activity representing biocompatibility. All tested NMs also underwent oxidation by H_2O_2. ZnO NCs and ZnO NPs exhibited strong oxidation at pH 8.5 in the $O_2^{-\cdot}$ generating system. While, SiO_2, ZnO-SiO_A andZnO-SiO_B possessed pronounced 60-80% antioxidant effects, SiO_2 NPs acted as a definitive prooxidant which was not observed in other tests. ZnO NCs are strong oxidized, assuming that ZnO NCs provide a slower release of ZnO, which leads to having a stronger effect on bacterial strains. Thus, ZnO NCs are an important antibacterial agent that could be an emergent replacement of traditional antibiotics.

6. *Pavlova E.,* ***Ivanova I.A.,*** *Staneva, A., Kostadinova, A, Kichukova DG., Yocheva L.*, **Prooxidant, antioxidant and biological activity of nanocomposites of reduced graphene oxide, silver, copper and their combinations**, Chemical Papers, Springer, issue:76, 2022, pages:6789-6800, doi:https://doi.org/10.1007/s11696-022-02360-4, Ref, **IF (2146 - 2021**), **Quartile: Q2 (2022), PhD**

The study aimed to evaluate the prooxidant, antioxidant and biological activities of newly synthesized nanocomposites of reduced graphene oxide (RGO) and its combinations with silver and copper by luminescent and microbiological assays. The antimicrobial activity was tested in a liquid medium during 24 h against Escherichia coli and Staphylococcus aureus. The Gram-positive bacteria were more resistant than the Gram-negative. Strongest antibacterial effect was demonstrated by the graphene nanocomposite decorated with silver and copper. The cubic silver nanoclusters size 30 nm showed better bacteriostatic effect than the spherical nanoparticles on reduced graphene sheets with 43 nm diameter. The eukaryotic cell cytotoxicity effect was evaluated with two cell lines—MDCK kidney epithelium noncancerous cells and A549 lung cancerous epithelium cells, tested in cell culture medium for 24 h. Our results showed that RGO Ag:Cu had stronger cytotoxic effect on eukaryotic cells. We have discovered that the cancerous A549 cells show stronger sensitivity to the nanomaterials than the noncancerous MDCK-cells. The pro- and antioxidant activity of all nanomaterials was studied according to the free-radical oxidation reactions (pH 7.4 and pH 8.5) in the following chemiluminescent model systems: (1) chemical, with Fenton`s reagent (H_2O_2-$FeSO_4$), for the generation of hydroxyl radicals (.OH), (2) chemical, with oxidant hydrogen peroxide (H_2O_2), (3) chemical (NAD.H-PhMS), for the generation of superoxide radicals (O^2.–). All tested nanomaterials presented definitive antioxidant activity in both tested media at neutral and alkaline pH. The only exception was RGO Ag nanoparticles,

sized 30 nm, that exhibited less than 10% prooxidant activity in the Fenton`s system, at pH 8.5. Those results support the idea to use such nanomaterials in body implants.

7. *Gospodonova D., Vladkova T.G., Ivanova I.A.,* **Fabrication and Characterization of Antimicrobial Magnetron Cosputtered TiO2/Ag/Cu** Composite Coatings, Coatings 11 (4):473-487, 2021, ISSN (online):02578972, doi: www.mdpi.com/journal/coatings, Ref, IF (4.158 - 2021), Web of Science Quartile: Q1 (2021)

The aim of this study was to prepare TiO_2/Ag/Cu magnetron co-sputtered coatings with controlled characteristics and to correlate them with the antimicrobial activity of the coated glass samples. The elemental composition and distribution, surface morphology, wettability, surface energy and its component were estimated as the surface characteristics influencing the bioadhesion. Well expressed, specific, Ag/Cu concentration-dependent antimicrobial activity in vitro was demonstrated toward Gram-negative and Gram-positive standard test bacterial strains both by diffusion assay and by Most Probable Number of surviving cells. Direct contact and eluted silver/coper nanoparticles killing were experimentally demonstrated as a mode of the antimicrobial action of the studied TiO_2/Ag/Cu thin composite coatings. It is expected that they would ensure a broad spectrum bactericidal activity during the indwelling of the coated medical devices and for at least 12 h after that, with the supposition that the benefits will be over a longer time.

8. *Ivanova I., Stoyanova D., Nenova E., Staneva A., Kostadinova A.,* **Antimicrobial and cytotoxic properties of metal and graphene nanomaterials (review**)., Journal of Chemical Technology and Metallurgy , vol:55, issue:2, 2020, pages:239-250, ISSN (online):13147471, 13147978, Ref, Web of Science, IF (55 -), Web of Science Quartile: Q3 (2020), SCOPUS, SJR (259 -), SCOPUS **Quartile: Q3 (2020),** PhD

The nanotechnology is the fastest developing branch of science in the border of physics, chemistry, biology and electronics. The ecological effect of nanomaterials on various organisms is still not enough understood. This review of the literature presents the mechanisms of action of nanomaterials: eluted metal ions, size and form of nanoparticles, reactive oxygen species and non-ionic interactions. The results obtained by different authors on the effects of graphene, metal nanoparticles, their oxides and nanocomposites on different types of organisms - prokaryotes and eukaryotes are described. Antimicrobial and cytotoxic properties of the new materials are discussed in respect to their medical and environmental significance.

9. *Yankova R, Kostadinova A ., Toshkovska RD., Ivanova Iliana A.*, **CHARACTERISATION AND in vitro CYTOTOXICITY OF SILVER(I) BENZIMIDAZOLE COMPLEX**, Oxidation Communications, vol:43,, issue: No 4, 2020, pages:647-660, ISSN (print):02094541, Ref, IF, IF (0.361 - 2019), Web of Science Quartile: Q3 (2020), MSc

Chemical structure and biological activity of silver(I) complex of benzimidazole were investigated. The complex was synthesised using EtOH solution of the silver nitrate and benzimidazole and precipitation product was purified and vacuum dried. FTIR spectroscopy and Powder X-ray diffraction was used to confirm the phase purity of the synthesised material. The intramolecular chemical bonds nature was described. The antibacterial effect of the complex was evaluated against Gram-negative E. coli ATCC25922 and Gram-positive Staphylococcus aureus ATCC 25923 and compared with AgNO 3 and previous synthesised Pt(II) 3-amino-1,2,4-triazole complex. The Gram-positive S. aureus have shown higher sensitivity than E. coli, famous with their efflux cells pumps used for protection of metal ions and antibiotics. The silver complex did not inhibit the fungus Candida lusitaniae 74-4 grown in Sabouraud dextrose medium. Cytotoxic activity of the complex was examined against two types of cell lines: cancer (A549) and noncancerous eukaryotic cell (MDCK). All of the tested silver(I) complex

concentrations were toxic for cancer cell line and without effect on normal cells till 5 μg/ml. In concentration from 10 to 50 μg/ml silver(I) complex kills almost 70% of cancerous cells, but also normal epithelial cells are influenced at 50%. It can be concluded that silver(I) benzimidazole complex effects on the different way with cancer and noncancerous cells. In the same time, the synthesised silver benzimidazole compound has well demonstrated antibacterial effect in concentration of 10 μg/ml. In contrast, platinum(II) 3-amino-1,2,4-triazole complex has no toxic effect on both bacteria and the fungus tested. This specific effect of silver(I) benzimidazole complex could be used in medical application like substance that specifically kills epithelial cancer cells (skin melanoma, lung and kidney cancer, etc.).

10. *Staneva, A., Albu-Kaya M., Martinov, B., Ivanova I., Vladkova T.*, **Preparation and antimicrobial activity of collagen/(RGO/ZnO/TiO_2/SiO_2) composites**, Journal of Chemical Technology and Metallurgy, , vol:55, issue:5, 2020, pages:1078-1086, ISSN (online):13147471, 13147978, Ref, SCOPUS, SJR (253 - 2020), SCOPUS Quartile: Q3 (2020), International, PhD

A serial investigation is initiated aiming to explore the biological activity of some newly synthetized chemical compounds for the development of novel antimicrobial collagen based biomaterials. Collagen/$ZnTiO_3$, Collagen/RGO, Collagen/(Ag/RGO), Collagen/(Ag/RGO/SiO_2) and Collagen/($ZnTiO_3$/SiO_2) composites have been so far studied and all of them demonstrate a specific antimicrobial activity against Gram-negative and Gram-positive bacteria and in some cases against fungi. The aim of this investigation is to develop new antimicrobial collagen biomaterials using RGO, ZnO, and TiO_2 embedded in TEOS as another antimicrobial agent, combining the biological activity of RGO, ZnO and TiO_2 with the dispersing effect of SiO_2. The new Collagen/(RGO/ZnO/TiO_2/SiO_2) composites demonstrate an antimicrobial activity dependent on the agent loading level. It is specific in respect to Gram-negative, Gram-positive bacteria and fungi. An optimal balance between the antimicrobial activity and the cytotoxicity is achieved by varying the concentration of the antimicrobial agent, RGO/ZnO/TiO_2/ SiO_2, in Collagen/(RGO/ZnO/TiO_2/SiO_2) composites. It is suggested that the mechanism of the antimicrobial action includes the simultaneous proceeding of (i) metal ions chelation; (ii) free oxygen radicals formation due to the interactions between the microbial cells and the antimicrobial agent; (iii) mechanical demolition of the cell walls and membranes by RGO crystal nanoparticles. The broad spectrum antibacterial and anti-fungal activity combined with the low cytotoxicity at an optimal Collagen/Antimicrobial agent ratio makes the studied Collagen/(RGO/ZnO/TiO_2/SiO_2) composites a promising antimicrobial material increasing the medical biomaterials assortment.

11. *Pavlova, E.L., Toshkovska, R.D., Doncheva, T.E., Ivanova, I.*, **Prooxidant and antimicrobic effects of iron and titanium oxide nanoparticles and thalicarpine**. Archives of Microbiology, vol:202, 2020, pages:1873-1880, ISSN (online):03028933, 1432072X, Ref, IF (1.8842 - 2019), Web of Science Quartile: Q3 (2020)

The aim is to evaluate the prooxidant and antimicrobial effects of Fe_3O_4 and TiO_2 nanoparticles and thalicarpine by luminescent and standard microbiological assays. Their effect on the kinetics of free-radical oxidation reactions (at pH 7.4 and pH 8.5) is studied in the following model systems, using activated chemiluminescence: chemical, with Fenton's reagent (H_2O_2–FeSO4)—for the generation of hydroxyl radicals (.OH); chemical, with oxidant hydrogen peroxide (H_2O_2); chemical (NAD.H-PhMS), for the generation of superoxide radicals (O_2.−). Fe_3O_4 nanoparticles exhibit highly pronounced antioxidant properties; TiO_2 nanoparticles exhibit mild to moderate prooxidant properties at neutral and alkaline conditions. Those properties are tested by the chemiluminescent method for the first time. Thalicarpine and its combination with TiO_2 nanoparticles exhibit pronounced antioxidant activities at pH 8.5 which are lost and transformed into well-presented prooxidant effects at pH 7.4.

That is a result-supported proof on the observed typical properties of thalicarpine and TiO_2, namely antibacterial, organic-preserving and anti-pathogenic activities. The antimicrobial effect is tested on Gram-positive and Gram-negative bacteria: two strains of *Escherichia coli, Bacillus cereus 1095 and Staphylococcus aureus*. All bacteria are destroyed after the application of TiO_2, but not Fe_3O_4nanoparticles, showing their antibacterial effect. Thalicarpine, in combination with TiO_2, showed even synergetic antibacterial effect.

12. *Kostadinova, A., Keranov, I., Vladkova, T., Ivanova, I., Yankova, R.*, **Characterization and biological response of electrospun amphiphilic poly (Dimethylsiloxane-b-acrylic acid) fibrous scaffolds**, Oxidation Communications, vol:43, issue:2, 2019, pages:234-247, ISSN (online):02094541, Ref, IR , SCOPUS, SJR (0.361 - 2019), SCOPUS Quartile: Q3 (2019)

The obtaining of poly (dimethylsiloxane-block-acrylic acid)(PDMS-b-PAA) fibres scaffold driven by electrospinning, one of the most versatile and powerful physical-chemical methods is described. The process was controlled by varying of voltage, flow rate, collector-to-tip distance and polymer solution concentration. The new fibres mats were characterised by numerous methods as follows: Scanning electron microscopy (SEM), Differential scanning calorimetry (DSC), and Water contact angle (WCA). The influence of the fibre scaffold morphology on in vitro biocompatibility was investigated by culturing cells on the scaffolds, immunofluorescence and MTT assay. The results indicated that the keratinocytes could attach and proliferate on the unique scaffolds, which confirmed that the PDMS-b-PAA amphiphilic mat had good biocompatibility, and it could be a promising biomaterial for tissue engineering applications.

13. *Stoyanova D., Nesheva A., Veleva R., Borisova M., Angelov O., Ivanova I., Kostadinova A.*, **Thin films of TiO2: Cu:Ag cell cytotoxicity and antibacterial activity** , International Journal of Bioinformatics and Biological systems, vol:1, issue:2, 2018, pages:25-29, ISSN (print):02197200, 17576334, ISSN (online):02197200, 17576334, doi:open access, Ref, IF (- 2018), Web of Science Quartile: Q3 (2018), PhD, MSc

Self-cleaning surfaces are of increasing interest in various studies around the world. Static metal oxide layers are attractive for application to the walls of neonatal incubators, in sterile rooms, on dressings, and antimicrobial layers on catheters and implants. The aim of this study is to investigate the antibacterial and cytotoxicity effect of TiO_2 : Ag: Cu thin films. The thin films of TiO_2 : Ag: Cu are deposited on glass substrates without heating during the deposition by RF magnetron cosputtering of TiO_2 target and pieces of Ag (60 mm^2) and Cu (100mm^2). The studied films, thickness about 60 nm, were deposited in argon atmosphere. Films tested by diffusion assay showed antibacterial effect to *E. coli, Salmonella entherica, Staphylococcus epidermidis* and *Bacillus cereus*. The growth curve reveal the full destroying of *S. epidermidis* and *Bacillus cereus* cells. Crystal violet staining and phase-contrast microscopy observation were used to determine changes in the morphology and cytotoxicity of the epithelial cell line (A549). Our investigations show that these thin films of TiO_2 :Ag:Cu decrease the cell viability of the tested cultured lines and has good antibacterial effect against Gram - positive and Gram-negative bacteria. This material can be used for the medical application such as catheters, clean surfaces etc.

14. Stoyanova D, Ivanova I, Angelov O, Vladkova T. Antibacterial Effect of Thin Films TiO_2:SiO_2:Ag Against E.Coli and P. Putida. NANOCON 2017. Conference proceedings. 9th International conference on Nanomaterials- Research and Application, 2018, 2017 October, pp. 443-448. SCOPUS: (2018) SJR_{2017} (0,101) 10 points

The antibacterial effect of thin films TiO_2:SiO_2:Ag on two Gram-negative bacteria Escherichia coli and Pseudomonas putida was investigated. The thin films were deposited on glass substrates without heating by r.f. magnetron co-sputtering of TiO_2 target with small plates of quartz and Ag on its surface in the zone with maximum erosion. The total area of quartz plates was 750 mm2 and the area of Ag plates was 40 mm2 and 100 mm2. High resistant industrial strain E.coli (ATCC 10536)

and sensitive P. Putida (ATCC 12633) with an ability to form biofilm were chosen for the test. Three experimental techniques were used to estimate the antibacterial activity: classical Koch's method, optical density measurements, and dehydrogenase activity inhibition. The bacteria were cultivated on the studied thin films in a liquid nutrient medium for 24 h without agitation. Complete deactivation of the bacterial growth was observed between the 1st and the 4th hours from the beginning of the experiment. The destruction of the bacterial cells was registered by scanning electron microscope. The developed thin films have a potential for application as antibacterial coating for different medical devices and surfaces.

15. *Ivanova I.A., Toshkovska R., Benkova D., Yordanova V., Nesheva A., Hazarosova R., Staneva G., Kostadinova A.*, **Stress Response of Gram-Positive and Gram-negative Bacteria Induced by Metal and Non-Metal Nanoparticles. In Search of Smart Antimicrobial Agents**, Recent Contributions to Bioinformatics and Biomedical Sciences and Engineering, Editors: S. Sotirov, T. Pencheva, J. Kacprzyk, K. Atanassov, E. Sotirova, S. Ribagin, 2023, Ref, Web of Science, SCOPUS Quartile: Q4 (2023), PhD

The increasing resistance of pathogens to a number of antibiotics has been the subject of many research reports from the European Antibiotic Resistance Surveillance Network (Ears-Net) and The World Health Organization (The WHO). The aim of this work was to study the effects of nanomaterial dispersions as Selenium (Se), Gold (Au), Iron oxide (Fe_2O_3), Silicon dioxide (SiO_2) and Graphene oxide (GO) on bacteria like *Staphylococcus aureus, Staphylococcus epidermidis, Bacillus cereus* and two strains of *Escherichia coli*. Two classical methods were used to investigate the antibacterial effect of the nanoparticles (NPs): Spot and Well diffusion tests in agar medium. The tested nanoparticles were active against Gram-positive bacteria in concentrations between 3.0 and 1.5 mg/mL but they were not active against Gram-negative bacteria such as *E. coli*. Among tested nanomaterials, SeNPs express the strongest antimicrobial effect. Gold nanoparticles with Polyvinylpyrolidone (Au-PVP NPs) were more active against bacteria than pure AuNPs. Lower concentrations (1.0 mg/mL and 0.5 mg/mL) of Se, GO and the two types of Gold nanoparticles did not show activity against all test microorganisms. Fe_2O_3 NPs as well as SiO_2 NPs had no effect on any test bacteria in the mentioned concentrations. In conclusion, the most cytotoxic for tested bacteria were SeNPs, followed by Au-PVP and AuNPs. GONPs also showed a certain cytotoxic effect, especially on *B. cereus* 1095.

16. Iliana A. Ivanova, Dragomira S. Daskalova, Lilia P. Yordanova, Elitsa L. Pavlova Copper And Nano-Copper Applications In The Prevention Of Infections. Processes, 2024, accepted IF 3.352; SJR2022 0.529 Q2, 20 точки

The focus of this review article is to present a retrospective analysis of the copper applications focusing on ions and nanoparticles as broad-spectrum antimicrobials. Copper nanoparticles are presented as an alternative to rising antibiotic resistance. The basic mechanisms of bacterial, fungal, and viral inactivation, which explain their potential are presented. The green biosynthesis of copper nanoparticles using biomaterials is also presented and considered a very promising trend for future biotechnology and medical applications.

09.04.2024 Signature: Iliana Ivanova Digitally signed by Iliana Ivanova Date: 2024.04.09 13:34:50 +03'00'

/Assoc.Professor Iiana Ivanova/

Sofia