EMEC21

21st European Meeting on Environmental Chemistry
November 30 – December 3, 2021, Novi Sad, Serbia

Association of Chemistry and the Environment

Serbian Chemical Society

Matica Srpska

www.emec21.rs

Scientific Committee
Jan Schwarzbauer, president

Organisational Committee
Branimir Jovančićević, president

Executive Committee
Vladimir Beškoski, president

BOOK OF ABSTRACTS

ASSOCIATION OF CHEMISTRY AND THE ENVIRONMENT

21st European Meeting on Environmental Chemistry

BOOK OF ABSTRACTS

EMEC 21

November 30 – December 3, 2021

Novi Sad, Serbia

Book of Abstracts

21st European Meeting on Environmental Chemistry

Publisher

Serbian Chemical Society

Karnegijeva 4/III, Belgrade, Republic of Serbia

For the publisher

Dušan Sladić

President of the Serbian Chemical Society

Editors

Ivana Ivančev-Tumbas

Vladimir P. Beškoski

Aleksandra Šajnović

Cover page photo

Branko Lučić

Design and prepress

Beoživković, Belgrade

Printed by

RIS Studio, Belgrade

Circulation

150

ISBN

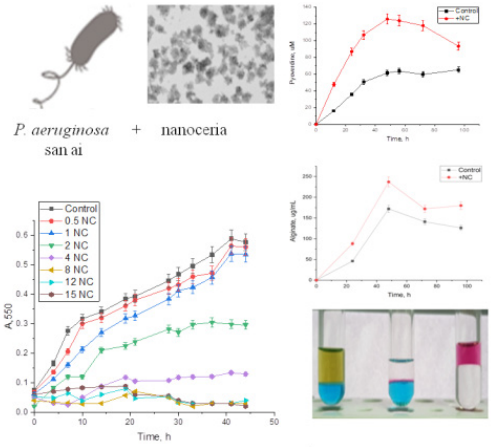
978-86-7132-078-8

Year

2021

Metabolic Responses of *Pseudomonas aeruginosa* san ai to Nanoceria

L. Izrael Živković[1], A. Medić[1], I. Karadžić[1], V.P. Beškoski[2]. (1) Department of Chemistry, Faculty of of Medicine, University of Belgrade, Visegradska 26, Belgrade, Serbia;(2) Department of Biochemistry, Faculty of Chemistry, University of Belgrade, Studentski trg 12-16, Belgrade, Serbia,* lidija.izrael-zivkovic@med.bg.ac.rs.*



Among numerous available nanomaterials, nanoceria (NC) has a particular importance based on its redox properties which are considered as a cause of antibacterial activity [1]. *Pseudomonas aeruginosa* is Gram-negative bacteria, well known for its ability to grow in diverse environments due to great potential for adaptation and its metabolic diversity. Its ability to overcome the challenges lies on bacterial cell-cell communication mechanism, known as quorum sensing (QS) system, which regulates expression of numerous genes [2].

To reveal effects of NC on metabolism of environmental isolate of polyextremophile *P. aeruginosa* san ai, production of exopolysaccharide, pigment – pyocyanin, siderophores – pyoverdine and pyochelin, as well accompanied changes related to QS, biofilm formation, and redox homeostasis were investigated.

The minimal inhibitory concentration of NC against *P. aeruginosa* san ai is 8 mg/mL, which classifies it in a group of highly resistant *Pseudomonas*.

P. aeruginosa san ai exhibited an important formation of biofilm, with OD590 readings of 0.21 for culture grown in LB and in range from 0.26 to 0.57 for culture from LB amended with increasing concentrations of NC (from 0.5 to 5 mg/mL). Accordingly, *P. aeruginosa* san ai can be classified as moderately adherent strain.

Changes in alginate formation with increasement of 37% in the presence of NC, which have been detected, imply its engagement in the cell protection. An improved biofilm formation and production of alginate in the culture exposed to nanoceria clearly indicates their role in the first line of defence, according to previous data [3].

The up-regulation of both siderophores pyoverdine and pyocheline, was detected in cultures amended with NC, suggesting strong effect of NC on the iron homeostasis. The siderophore biosynthesis and transport require tight regulation, particularly in case of exposure to the toxic threat of ROS generated. Free radical species can trigger Fenton reaction further compromising the maintenance of intracellular iron levels. An improved production of pyoverdine- highly iron-specific siderophore, obtained in this study clearly documents how promptly and efficiently the bacteria reacts to overcome exhaustion of iron.

Production of pyocyanin is almost 3 times higher in nanoceria amended culture than in control, clearly suggesting redox homeostasis disturbance caused by NC. Although NADH/NAD redox couple plays a major role in central metabolism of *P. aeruginosa*, another characteristic feature of *P. aeruginosa* is the ability to produce redox-active pyocyanin, which can react with NADH suggesting that electron transfer to pyocyanin may represent an adaptation that allows bacteria to modulate their intracellular redox state.

Acknowledgements

This study was supported by the Ministry of Education, Science and Technological Development, Republic of Serbia, Projects III43004 and 176006.

References

[1] N. Thakur, P. Manna, J. Das, *Journal of Nanobiotechnology* 17 (2019) 84.

[2] L. Zhou, Y.Zhang, Y. Ge, X. Zhu, J Pan, *Frontiers in Microbiology* 11 (2020) 589640.

[3] L. Izrael, M. Rikalović, G. Gojgić-Cvijović, S. Kazazić, M. Vrvić, I. Brčeski, V.Beškoski, B. Lončarević, K. Gopčevića and I. Karadžić, *RSC Advances* 8 (2018) 10549.