Luminescent fluoroapatite nano-biomaterial for labeling yeast cells as an innovative approach for identification, imaging and monitoring

Dušan Milojkov[1,*], Gvozden Jovanović[1] and Vukosava Živković-Radovanović[2]

[1]*Institute for Technology of Nuclear and Other Mineral Raw Materials, Belgrade, Serbia*
[2]*Faculty of Chemistry, University of Belgrade, Belgrade, Serbia*

Keywords: Bioimaging; nano-apatite; contrast agent; *Saccharomyces cerevisiae*; cascade luminescence; monitoring

Hem. Ind. **78(1S)** 67 (2024)

Available on-line at the Journal web address: http://www.ache.org.rs/HI/

INTRODUCTION: The ubiquity of pathogenic yeast species in the human body and the increasing number of immunocompromised people acquiring infections have drawn attention to fungal infections [1]. Improved diagnostic imaging techniques and tools to study infection are necessary due to the commensal nature of pathogens yeast and the severity of the diseases they cause. The ability to label non-pathogenic yeast cells, such as the budding yeast *Saccharomyces cerevisiae (S. cerevisiae)*, may facilitate the identification and monitoring of these microbes in different environments. The topic of interest in this research is the development of luminescent nano-biomaterials based on fluorapatite as a contrast agent for labeling and imaging *S. cerevisiae*.

EXPERIMENTAL (or Materials and Methods): The method used to manufacture fluorapatite nanopowder has been previously reported in research [2]. After being acquired locally, *S. cerevisiae* was suspended in saline. One milligram of the FAP sample was added to the yeast suspension. After mixing the resultant suspension, it was left to incubate at room temperature for one hour without being stirred. Following treatment, cells were taken out, preserved, and prepared in triplicate for microscopy. MIPAR software has been used to analyse the obtained images.

RESULTS AND DISCUSSION: Luminescent FAP nanoparticles were synthesized by precipitation and centrifugation at low temperature. The resulting single-phase nanomaterial exhibits cascade fluorescence in the violet and blue regions [2]. To investigate the performance of FAP nanoparticle fluorophores, cells of *S. cerevisiae* were labeled and observed with a Leica DMIL inverted fluorescence microscope. Nanofluoroapatite fluorophores were successfully labeled *S. cerevisiae* cells. MIPAR image analysis software extracted the luminescence of nano-biomaterials from yeast cells.

CONCLUSIONS: In this study, *S. cerevisiae* was used as a yeast model which, after labelling with a fluorapatite-based contrast agent, showed luminescent properties. The cascading nature of the agents' luminescence will allow us to monitor cellular uptake as well as monitoring cellular localization in future studies.

Acknowledgements: Ministry of Education, Science and Technological Development of the Republic of Serbia (451-03-68/2022-14/200023).

REFERENCES

[1] Akanksha Patel, Didar Asik, Joseph A. Spernyak, Paul J. Cullen, Janet R. Morrow, MRI and fluorescence studies of Saccharomyces cerevisiae loaded with a bimodal Fe(III) T1 contrast agent*, J. Inorg. Biochem.* 2019; 201: 110832. https://doi.org/10.1016/j.jinorgbio.2019.110832.

[2] Milojkov Dušan, Miroslav Sokić, Vukosava Živković-Radovanović, Vaso Manojlović, Dragosav Mutavdžić, Goran Janjić, Ksenija Radotić, Cascade luminescence and antibacterial behavior of fluorapatite nanopowder co-doped with Pr3+, NO3− and CO32− ions, *Opt. Quantum Electron.* 2023, 55: 84. https://doi.org/10.1007/s11082-022-04347-7.

*Corresponding author E-mail: d.milojkov@itnms.ac.rs