

Nanochemistry and biotechnology

Berberine Anticancer Activity through Nanocomplex with DNA and Metallic Nanoparticles

Anna Grebinyk¹, Valeriy Yashchuk², Tobias Hagemann¹, Nataliya Bashmakova², Dmytro Gryn², Antonina Naumenko², Nataliya Kutsevol², Thomas Dandekar³, Marcus Frohme¹

¹*Technical University of Applied Sciences Wildau, Hochschulring 1, 15745 Wildau, Germany, E-mail: grebinyk@th-wildau.de*

²*Taras Shevchenko National University of Kyiv, Volodymyrska 64, 01601 Kyiv, UA*

³*Biocenter, University of Würzburg, Am Hubland, 97074 Würzburg, Germany*

Alkaloids, synthesized in plants as secondary metabolites, could have multiple effects on cellular metabolism, therefore have been used in traditional medicine. The isoquinoline quaternary alkaloid berberine possesses a variety of pharmacological properties including anticancer activity [1]. The purpose of this study was to investigate *in vitro* the effects of berberine on the human T-cell line originated from the acute lymphoblastic leukemia – CCRF-CEM cells.

Berberine is characterized with yellow fluorescence (λ_{ex} 424nm, λ_{em} 558), which yield could be dramatically enhanced once it bounds with DNA [2]. CCRF-CEM cells double staining with 50 μ M berberine along with *Hoechst* 33342, accompanied with the fluorescent microscopy, revealed berberine nucleus localization. Obtained data pointed out on the berberine intercalation into double-stranded DNA upon *in vitro* conditions, what could be linked with its anticancer activity over telomerase inhibition [1]. The results showed that berberine inhibited CCRF-CEM cell growth in a time- and dose-dependent manner. A MTT assay showed that the IC₅₀ value after 24h was 69,80 \pm 2,81 μ M. The inhibition of CCRF-CEM cell growth by berberine was associated with the 5-fold increase of reactive oxygen species production in comparison with untreated cells. Obtained results support the possibility to use berberine as an alternative therapeutic agent for cancer treatment. Also the properties of DNA-berberine-metallic nanoparticles as potential drug for deep penetrative PDT were examined and analysed.

1. Ortiz L.M.G., Lombardi P., Tillhon M., Scovassi A.I. Berberine, an Epiphany Against Cancer // *Molecules*.-2014.-**9**.-P. 12349-12367.

2. Gumeniuk V.G., Bashmakova N.V., Kutovyy S.Yu., Yashchuk V.M., Zaika L.A. Binding parameters of alkaloids berberine and sanguinarine with DNA // *Ukr.J.Phys.*-2011.-**v.56**.-N2.-P. 524-533.