polish synchrotron
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International School and Symposium
on Synchrotron Radiation in Natural Science
Krakow, Poland, 22-25 August 2022

Investigation of copper-phenanthroline complexes with the use of X-ray absorption spectroscopy

Poster/Oral Presentation
Date of presentation
Time of presentation

W.I. Stańczyk[1]*, J. Czapla-Masztafiak[1], E. Pięta[1], A. Wach[1,2], W. Błachucki[1], W.M. Kwiatek[1]

[1]*Institute of Nuclear Physics Polish Academy of Sciences, PL-31342 Krakow, Poland*

[2]*Paul Scherrer Institut, CH-5232 Villigen PSI, Switzerland*

*e-mail: wiktoria.stanczyk@ifj.edu.pl

Searching for novel chemotherapeutics is still under consideration. Observed chemoresistance and side effects during anticancer treatment enhances development of new drugs and many various kinds of therapy, including immunotherapy or photodynamic therapy. Probably the most recognizable group of metal-based drugs in chemotherapy are these containing platinum, like cisplatin. Since platinum is not in the group of micronutrients and application of its complexes can sometimes generate some side-effects during the treatment, many scientists focus on application of elements naturally present in our bodies, such as zinc, nickel or copper [1]. To enable close interactions of these reactive elements with molecules within cells, like DNA or proteins, there is a need to design a drug of a proper chemical structure. Phenanthroline organic group seems to be a good scaffold for metals to get to the vicinity of biomolecules and to undertake interactions with them, therefore promoting the death of cancer cells [2].

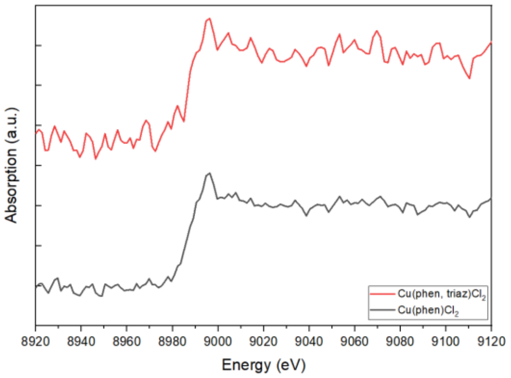

Figure 1. XAS spectra obtained in laboratory conditions, around Cu K-edge, for copper-phenanthroline complexes, including product of synthesis described in [4].

X-ray absorption spectroscopy studies on copper-phenanthroline complexes (Figure 1) were performed both in laboratory conditions at the Institute of Nuclear Physics PAN, Kraków, Poland [3] and in two synchrotron facilities: SLS, Villigen, Switzerland and SOLARIS, Kraków, Poland. Experiments provided XAS spectra of the studied complexes, that according to our knowledge, have never been obtained before. Examination was supported by Raman and ATR-FTIR spectroscopies. Complex data analysis provided information about the oxidation state of copper, the electronic structure of chosen compounds and it enables further investigation on these prospective cytotoxic complexes. In addition, significant differences between XAS spectra obtained from the experiments performed in laboratory and synchrotron conditions will be discussed.

Acknowledgements: This project was financed by NCN grant no. 2016/21/D/ST4/00378. The authors would like to acknowledge access to the SuperXAS beamline at Swiss Light Source, Villigen Switzerland, and the XAS beamline at Solaris, Kraków, Poland, with a special thanks to the beamlines' teams on-site for their help. The study was performed using equipment purchased in the frame of the project co-funded by the Małopolska Regional Operational Program Measure 5.1 Krakow Metropolitan Area as an important hub of the European Research Area for 2007–2013, project No. MRPO.05.01.00–12–013/15.

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