PHYSICAL CHEMISTRY 2010

10th International Conference on
Fundamental and Applied Aspects of
Physical Chemistry

Proceedings

The Conference is dedicated to the
100th Anniversary of the academician Pavle Savić birthday
and
20th Anniversary of the Society of Physical Chemists of Serbia

---

21-24 September 2010
B E L G R A D E

ISBN 978-86-82475-17-0
Title: Physical Chemistry 2010. (Proceedings)
Editors: S. Anić and Ž. Čupić
Published by: Society of Physical Chemists of Serbia, Studentski trg 12-16 P.O.Box 47, 11158 Beograd, 218, Srbija
Publisher: Society of Physical Chemists of Serbia
For Publisher: S. Anić, President of Society of Physical Chemists of Serbia
Printed by: "Jovan" Printing and Publishing Company; 200 Copies; Number of pages 16 + 388, **Format:** B5; Printing finished in September 2010.

Text and Layout: "Jovan"

200 - *Copy printing*

CONTENTS

The Society of Physical Chemists of Serbia

in co-operation with

Institute of Catalysis, Bulgarian Academy of Sciences

Boreskov Institute of Catalysis, Siberian Branch of the Russian Academy of Sciences

Faculty of Physical Chemistry, University of Belgrade, Serbia

Institute of Chemistry Technology and Metallurgy, University of Belgrade, Serbia

Vinča Institute, University of Belgrade, Serbia

Institute of General and Physical Chemistry, Serbia

International Organizing Committee

Chairman: S. Anić (Serbia)
Vice-chairman: N. Stepanov (Russia)
B. Adnađević (Serbia)

Members:
M. Gabrovska (Bulgaria), N. Cvijetićanin (Serbia), T. Grozdić (Serbia), D. Jovanović (Serbia), M. Lalić (BiH), D. Marković (Serbia), B. Milosavljević (USA), N. Miljević (Serbia), M. Mojović (Serbia), N. Ostrovski (Serbia), C. Pona (Italy), B. Simonović (Serbia), D. Stanisavljev (Serbia), A. G. Stepanov (Russia), V. Vasić (Serbia), N. Vukelić (Serbia), V. Vukojević (Sweden)

International Scientific Committee

Chairman: Ž. Čupić (Serbia)
Vice-chairmans: V. N. Parmon (Russia)
M. Franko (Slovenia)
V. Vasić (Serbia)

Members:
A. Antić-Jovanović (Serbia), G. Bačic (Serbia), R. Cervellati (Italy), R. Compton (United Kingdom), V. Gaspar (Hungary), M. Jeremić (Serbia), A. L. Kawczyñski (Poland), Lj. Kolar-Anić (Serbia), S. Kuchanov (Russia), R. Leblanc (USA), S. Mentus (Serbia), S. Milonjić (Serbia), Lj. Morozova-Roche (Sweden), D. Moscone (Italy), J. Nedeljković (Serbia), Z. Noszticzius (Hungary), M. Perić (Serbia), V. Petruševski (Macedonia), M. Plavšić (Serbia), G. Smulevich (Italy), G. Schmitz (Belgium), I. Schreiber (Czech), P. Ševčik (Slovakia), N. Stepanov (Russia), M. Trtica (Serbia), D. Veselinović (Serbia)

Local Executive Committee

Chairman: B. Adnadjević
Vice-chairmans: S. Blagojević
A. Ivanović

Members:
A. Abu Rabi-Stanković, P. Banković, N. Begović, S. N. Blagojević, N. Cvjetičanin, M. Daković, A. Đerić, A. Ignjatović, Lj. Ignjatović, A. Jović, J. Krstić, S. Kuprešak, D. Lončarević, J. Maksimović, V. Marković, M. Milenković, M. Milojević, Z. Mojović, B. Nedić, I. Pašti, N. Pejić, A. Popović-Bjelić, M. Petković, N. Potkonjak, D. Ranković, R. Ranković, M. Stević, I. Stojković, B. Šljukić, M. Vujković

Honorary Committee

Nikola Hajdin,	President of Serbian Academy of Sciences and Arts
Branko Kovačević,	Rector of University of Belgrade
Paula Putanov,	Member of Serbian Academy of Sciences and Arts
Momčilo Ristić,	Member of Serbian Academy of Sciences and Arts
Ankica Antić Jovanović,	Honorary President of Society of Physical Chemists of Serbia
Ivan Draganić,	Honorary Member of Society of Physical Chemists of Serbia
Roger M. Leblanc	(Canada) Honorary Member of Society of Physical Chemists of Serbia
Preben Graae Sørensen	(Denmark) Honorary Member of Society of Physical Chemists of Serbia
Guy Schmitz (Belgium)	Honorary Member of Society of Physical Chemists of Serbia
Miroslav Kopečni,	Honorary Member of Society of Physical Chemists of Serbia
Vladimir Petruševski	(Macedonia), Honorary Member of Society of Physical Chemists of Serbia
Biljana Minčev Šukarova	(Macedonia), Honorary Member of Society of Physical Chemists of Serbia
Ljiljana Kolar-Anić,	Honorary Member of Society of Physical Chemists of Serbia
Milorad Jeremić,	Honorary Member of Society of Physical Chemists of Serbia
Čedomir Radenović,	Honorary Member of Society of Physical Chemists of Serbia

SPONSORS

Ministry of Science and Technological Development

University of Belgrade, Belgrade

The Faculty of Physical Chemistry, University of Belgrade

Institute of Chemistry Technology and Metallurgy, University of Belgrade

Vinča Institute, University of Belgrade

Institute of General and Physical Chemistry, Belgrade

NovoLab, Belgrade

MOL, Belgrade

Gradski zavod za zaštitu zdravlja, Belgrade

On the occasion of the hundredth anniversary of the birth of Academician Pavle Savić and twentieth anniversary of founding Society of Physical Chemists of Serbia, instead of the usual introduction, here is given translation of the text ***20 years of Society of Physical Chemists of Serbia 1989 – 2009****, published in a special Issue of Chemical Industry Vol. 63 (5a).*

Editors

THE APPLICATION OF PHYSICOCHEMICAL METHODS FOR THE ANALYSIS OF RADIATION PROCESSED FOOD PRODUCTS

Z. Rogić[1], I. Spasojević[2], A. Ignjatović[1] and M. Mojović[1]

[1]*Faculty of Physical Chemistry, University of Belgrade, Studentski Trg 12–16, 11158 Belgrade, Serbia*
[2]*Institute for Multidisciplinary Research, Kneza Višeslava 1, 11000 Belgrade, Serbia*
milos@ffh.bg.ac.rs

Abstract
The aim of this study was to investigate the occurrence and stability of free radicals in freeze-dried samples of cow milk, pineapple and banana after irradiation (10 kGy dose), using the ESR spectroscopy, as well as to assess possible changes in their protein structure by means of electrophoresis.

Introduction
The application of irradiation in order to preserve food quality has been neglected for a long time in comparison to other methods, mainly due to prejudices. However, the attitude of consumers towards food irradiation is now becoming more positive due to spreading of information and knowledge of this process as well as to the availability of a number of analytical methods to detect aftermath of radiation treatment [1]. ESR spectroscopy due to its ability to reveal the presence of minute amounts of free radicals generated by irradiation plays a leading role in such studies [2]. The procedure for food samples used in these experiments is based on the fact that non-irradiated samples give poor signals, while in irradiated samples the significant increase of amplitude of EPR signal is noticed. Although the nutrient proprieties of irradiated food are no longer in question, there is a need for irradiation control in the international food trade in order to enhance consumer confidence in the regulation [3].

Experimental
Samples of cow milk, pineapple and banana were cryogenically dried, pulverized and then freeze-dried. The ESR spectra of irradiated and non-irradiated samples (control) of the same mass were obtained using X-band EPR spectrometer, and standard SDS-PAGE electrophoreses was used for detection of radiation induced protein degradation products.

Results and Discussion
The difference in the EPR peak heights of free radicals of the control and irradiated samples is obvious (Fig.1). Radiation induced signal decay with time (banana sample week II shows aberration most likely due different orientation of the sample in the EPR cavity), but clearly indicate that radiation treatment can be detected long after its application.

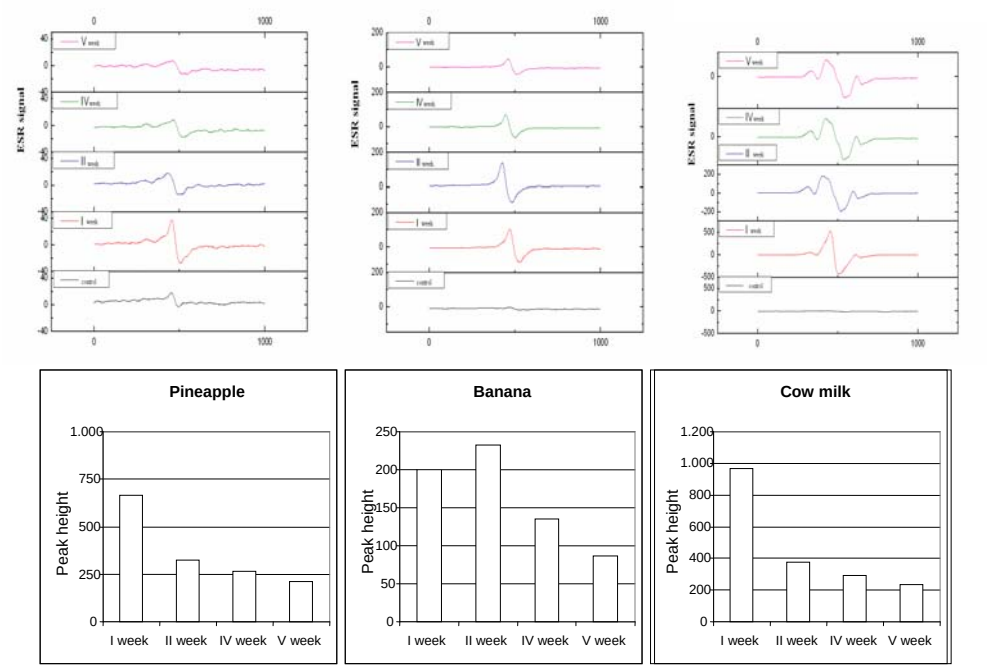

Fig.1. Typical ESR spectra and calculated absolute EPR peak heights of different food samples

In the second part of the experiment samples were subjected to SDS electrophoresis in order to detect any changes in the concentration of proteins.

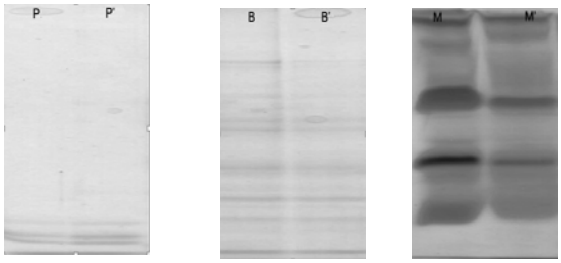

Fig.2. SDS-PAGE gels of: P - pineapple, P '- irradiated pineapple, B - banana, B' - irradiated banana, M - milk, M '- irradiated milk.

Pineapple (Fig.2.P, P') sample shows very small number of low molecular weight proteins, but also no change in the concentration of proteins. Banana (Fig.2.B, B') shows different molecular weight proteins, as well as the loss of some higher molecular mass proteins during radiation. Milk sample (Fig.2.M, M') is extremely sensitive to radiation. Gel presents proteins in a wide range of molecular weight, as well as many proteins of similar molecular weight. Reduction of the intensity and of the number of strips on gel of irradiated milk sample is present. Tested samples of banana and cow milk showed the destruction of proteins, while a change in the sample of pineapple is negligible. Changes in the number and width of protein fragments in gel are a clear proof that during the radiation degradation of existing protein molecules into smaller molecular fragments occurred.

Conclusion

Based on the results obtained by ESR spectroscopy and electrophoresis, we demonstrated that the tested samples suffered a series of changes after the application of 10 kGy ionizing radiation which is commonly used for food preservation.

Electrophoresis shows that radiation treatment undoubtedly breaks peptide links affecting the decomposition of certain proteins, reducing their concentration, and decays polypeptide chains of high molecular weight proteins into smaller fragments.

EPR spectra showed that ionizing radiation enhances cellulose and sugar radical EPR signal in tested samples of cow milk, banana and pineapple. By investigating EPR signal attenuation in time it can be reliably determined whether any of these groceries had been treated by radiation even after longer periods of time after the radiation. Furthermore, we concluded that sample of cow milk powder could potentially be used as radiation dosimeter since free radicals generated under the influence of ionizing radiation showed a weak recombination in time.

Acknowledgments

The authors acknowledge their gratitude to the Ministry of Science of Republic of Serbia for the financial support (Project #143016).

References

[1] M. P. Esteves, M. E. Andrade, J. Empis, Radiation Physics and Chemistry, 1999, **55**, 737-742.

[2] O. G. Duliu, R. Georgescu, S. I. Ali, Radiation Physics and Chemistry, 2007, **76,** 1031-1036.

[3] J. Raffi, N. D. Yordanov, S. Chabane, L. Douifi, V. Gancheva, S. Ivanova, Spectrochimica Acta Part A, 2000, **56**, 409-416.