PHYSICAL CHEMISTRY 2014

12th International Conference
on Fundamental and Applied Aspects of
Physical Chemistry

The Conference is dedicated to the
25. Anniversary of the Society of Physical Chemists of Serbia

---

September 22-26, 2014
Belgrade, Serbia

ISBN 978-86-82475-30-9

Title: PHYSICAL CHEMISTRY 2014 (Proceedings)
Editors: Ž. Čupić and S. Anić
Published by: Society of Physical Chemists of Serbia, Studenski trg 12-16, 11158, Belgrade, Serbia
Publisher: Society of Physical Chemists of Serbia
For Publisher: S. Anić, President of Society of Physical Chemists of Serbia
Printed by: "Jovan" Priting and Publishing Company; 200 Copies;
Number of pages: 6+ 441; **Format**: B5; Printing finished in September 2014.

Text an Layout: "Jovan"

200 - *Coppy priting*

PHYSICAL CHEMISTRY 2014

12th International Conference on
Fundamental and Applied Aspects of
Physical Chemistry

Organized by
The Society of Physical Chemists of
Serbia

in co-operation
with

Institute of Catalysis Bulgarian Academy of Sciences

Boreskov Institute of Catalysis of 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

Faculty of Pharmacy, University of Belgrade, Serbia

International Organizing Committee

Chairman: *S. Anić (Serbia)*
Vice-chairman: *M. Gabrovska (Bulgaria)*
V. A. Sadykov (Russia)

Members:
N. Cvjetičanin (Serbia), S. N. Blagojević (Serbia), M. Daković (Serbia), T. Grozdić (Serbia), D. Jovanović (Serbia), M. Kuzmanović (Serbia), D. Marković (Serbia), J. Marković-Dimitrić (Serbia), B. Milosavljević (USA), M. Mojović (Serbia), N. Ostrovski (Serbia), I. Pašti (Serbia), M. Petković (Serbia), A. Popović-Bjelić (Serbia), B. Simonović (Serbia), D. Stanisavljev (Serbia), B. Šljukić (Serbia), N. Vukelić (Serbia), V. Vukojević (Sweden)

International Scientific Committee

Chairman: *Ž. Čupić (Serbia)*
Vice-chairmans: *V. N. Parmon (Russia)*
S. Rakovsky (Bulgaria)

Members:
B. Adnađević (Serbia), S. Anić (Serbia), A. Antić-Jovanović (Serbia), G. Bačić (Serbia), A. Kelarakis (Greece), R. Cervellati (Italy), V. Dondur (Serbia), Ivan Gutman (Serbia), S. D. Furrow (USA), K. Hedrih (Serbia), M. Jeremić (Serbia), A. V. Knyazev (Russia), Lj. Kolar-Anić (Serbia), V. Kuntić (Serbia), Z. Marković (Serbia), S. Mentus (Serbia), Š. Miljanić (Serbia), M. Perić (Serbia), M. Plavšić (Serbia), D. M. F. Santos (Portugal), G. Schmitz (Belgium), I. Schreiber (Czech), P. Sevčik (Slovakia), B. C. Simionescu (Romania), N. Stepanov (Russia), D. Todorović (Serbia), M. Trtica (Serbia), V. Vasić (Serbia), D. Veselinović (Serbia)

Local Executive Committee

Chairman: *S. Blagojević*
Vice-chairmans: *A. Ivanović-Šašić*

Members:
P. Banković, N. Bošnjaković, J. Dostanić, A. Đerić, A. Ignjatović, A. Jović, N. Jović-Jovičić, D. Lončarević, J. Krstić, J. Maksimović, V. Marković, M. Milenković, S. Maćešić, V. Marković, B. Nedić, N. Potkonjak, D. Ranković, M. Stević, M. Žunić, M. Ristić,

THE EFFECTS OF DIAZINON AND ITS DEGRADATION PRODUCTS ON OXIDATIVE STRESS PARAMETERS IN RAT BRAIN SYNAPTOSOMES

M. Čolović[1], V. Vasić[1], N. Avramović[2], D. Djurić[3] and D. Krstić[2]

[1] *Department of Physical Chemistry, Vinča Institute of Nuclear Sciences, University of Belgrade, Serbia*
[2]*Institute of Medical Chemistry, School of Medicine, University of Belgrade, Serbia*
[3]*Institute of Medical Physiology "Richard Burian", School of Medicine, University of Belgrade, Serbia*

ABSTRACT
In *vitro* evaluation of oxidative stress responses to various concentrations of diazinon and its degradation products, diazoxon and 2-isopropyl-6-methyl-4-pyrimidinol (IMP) was investigated by determining antioxidant enzymes activity (catalase (CAT), superoxide dismutase (SOD) and glutathione peroxidase (GPx)) and lipid peroxidation level in rat brain synaptosomes. Diazinon showed negligible prooxidative properties causing increase in antioxidant enzymes activity and lipid peroxidation level up to 10%. Increasing concentrations of diazinon oxidation product, diazoxon activated CAT (up to 20%), SOD (up to 50%), GPx (up to 25%), and significantly increased the content of lipid peroxidation indicator (up to 50%). The investigated hydrolysis product of diazinon, IMP did not remarkably influence the activity of CAT, GPx and lipid peroxidation level (up to 10%), while it induced SOD stimulation up to 30%.

INTRODUCTION
Oxidative stress has been reported as one of the adverse effects in poisoning by organophosphorus pesticides (OPs) in both humans and animals [1, 2]. Investigations have shown that pesticides can damage the balance between prooxidants and antioxidants, resulting in both the increased production of reactive oxygen species (ROS) and attenuation of the antioxidant barrier of the organism [3, 4]. The key enzymes for the detoxification of ROS in all organisms are superoxide dismutase (SOD; EC 1.15.1.1), catalase (CAT; EC 1.11.1.6) and glutathione peroxidase (GPx; EC 1.11.1.9).
The aim of this study was to investigate *in vitro* effect of various doses of organophosphorous insecticide diazinon and its degradation products

(diazoxon and IMP) by determining antioxidant enzymes activity (CAT, SOD, GPx) and lipid peroxidation level in rat brain synaptosomes.

EXPERIMENTAL

Synaptosomes were isolated from the brain of *Wistar albino* rats and incubated at 37^{o}C for 1 hour in the presence of desired concentrations of diazinon, diazoxon and IMP (within the range 1×10^{-7}-1×10^{-4}mol/L). Antioxidant enzymes activities and malondialdehyde (MDA) content as a lipid peroxidation indicator were determined using standard methods [5].

RESULTS AND DISCUSSION

The influence of exposure for 1 hour toward increasing concentrations of diazinon, diazoxon and IMP on the activity of CAT, SOD and GPx is presented in Figure 1 (a-c). Obtained results show that the activity of synaptosomal CAT (Figure 1a) was not affected by diazinon as well as by its hydrolysis product IMP, at all investigated concentrations. Unlike these two compounds, diazoxon significantly increased synapsomal CAT in a dose-dependent way. The presence of maximal investigated diazoxon concentration (1×10^{-4} mol/l) increased CAT activity up to 23% in comparison with the control.

Specific SOD activity in the absence (control) and presence of various concentrations of diazinon and its degradation products, diazoxon and IMP is presented in Figure 1b. The obtained results show that diazinon does not result in significant changes in the enzyme activity. Actually, the highest investigated concentration (1×10^{-4} mol/l) increases SOD activity approximately 10%. The products of diazinon hydrolysis and oxidation, IMP and diazoxon cause concentration-dependent activation of the antioxidant enzyme. At the highest investigated concentration (0.1 mM), diazoxon stimulates SOD activity about 50% related to control, while IMP causes 30% alteration (Figure 1b).

Similar to the results obtained for CAT, diazoxon induces the increase in GPx activity, while diazinon and IMP do not result in statistically significant change of the enzyme activity (Figure 1c). Increasing diazoxon concentrations induce the gradual activation of GPx up to 25%, obtained at the maximal investigated concentration (0.1 mM).

The effect of diazinon, diazoxon and IMP on the level of MDA is shown in Figure 2. In the case of IMP and diazinon, MDA content was changed up to about 10% compared to untreated synaptosomes, at the highest concentration (0.1 mM). On the contrary, the MDA level is gradually increased with increasing concentrations of diazoxon, reaching the highest increase of about 50% at a concentration of 0.1 mM (Figure 2).

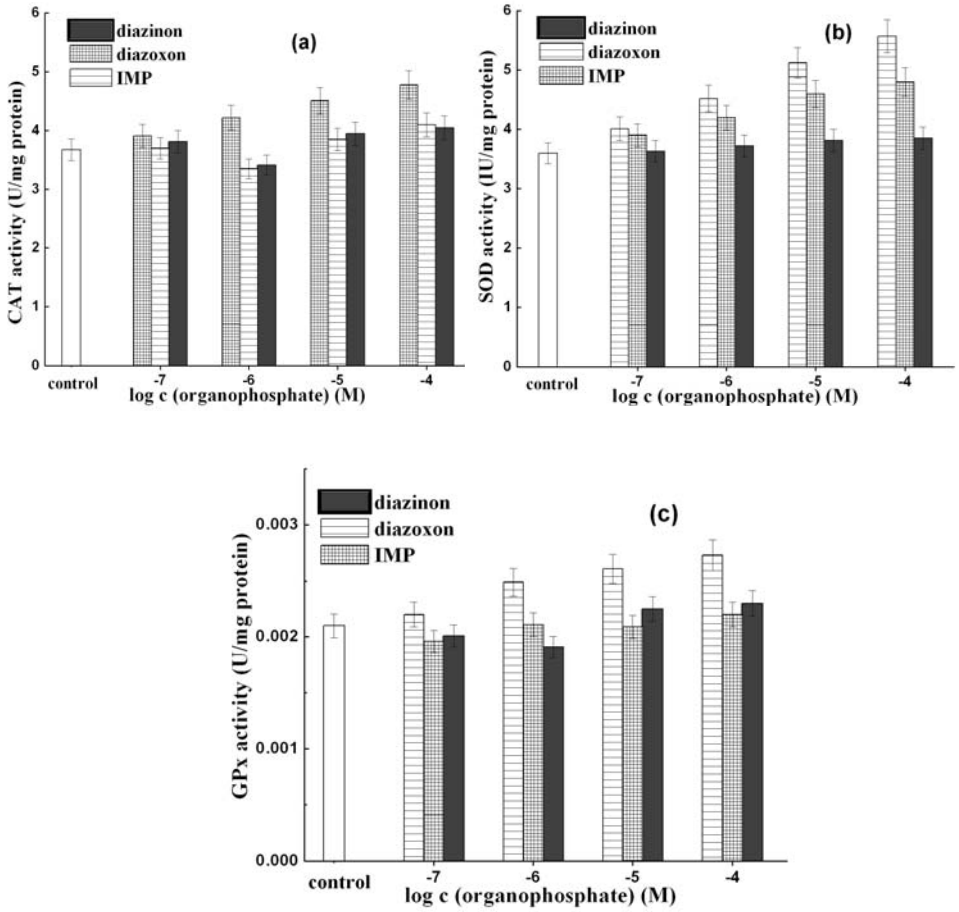

Figure 1. CAT (a), SOD (b) and GPx (c) activities in rat brain synaptosomes in the absence (control) and presence of different diazinon, diazoxon and IMP concentrations.

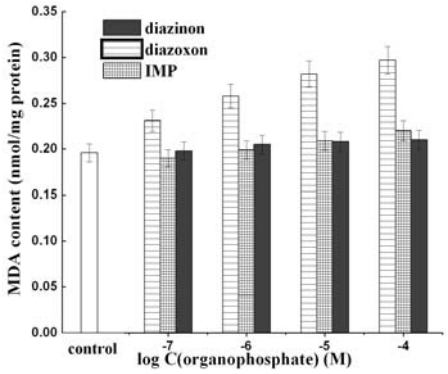

Figure 2. MDA contents in rat brain synaptosomes in the absence (control) and presence of different diazinon, diazoxon and IMP concentrations.

CONCLUSION

The present study demonstrated that diazinon and its decomposition products differ in the induced changes of antioxidant enzymes activity as well as lipid peroxidation. Actually, synaptosomal CAT and GPx activities and MDA level were not significantly affected by diazinon and its hydrolysis product IMP at all investigated concentrations, while the highest investigated IMP concentration stimulated SOD activity about 30%. However, diazoxon, in comparison with its parent compound (diazinon), possesses much stronger prooxidative potential causing the significant activation of antioxidative enzymes as well as the increase in lipid peroxidation, as oxidative stress responses. It suggests that nonspecific toxic effects of diazinon appear as a consequence of its transformation that occurs in the environment and metabolic pathways.

ACKNOWLEDGEMENT

This work was financially supported by the Ministry of Education, Science and Technological Development of the Republic of Serbia (project 172023).

REFERENCES

[1] Altuntas, N. Delibas, Biomed. Res., 2002, 13, 43–47.
[2] M. Akhgari, M. Abdollahi, A. Kebryaeezadeh, R. Hosseini, O. Sabzevari, Hum. Exp. Toxicol., 2003, 22, 205–211.
[3] B. Karademir Catalgol, S. Ozden, B. Alpertunga, Toxicol. in Vitro, 2007, 21, 1538–1544.
[4] A. Mohammad, R. Arkam, S. Shahin, N. Shekoufeh, R. Ali, Med. Sci. Monit., 2004, 10, 141–147.
[5] E.O. Oruc¸ D. Usta, Environ.Toxicol. Phar., 2007, 23, 48–55