

This article was downloaded by:

On: 27 January 2011

Access details: *Access Details: Free Access*

Publisher *Taylor & Francis*

Informa Ltd Registered in England and Wales Registered Number: 1072954 Registered office: Mortimer House, 37-41 Mortimer Street, London W1T 3JH, UK



Nucleosides, Nucleotides and Nucleic Acids

Publication details, including instructions for authors and subscription information:

<http://www.informaworld.com/smpp/title~content=t713597286>

Electroanalytical Study on Nicotinamide 7-Methylguanine Dinucleotide (Nm⁷GD), Analog of Coenzyme NAD and Related Compounds

Elzbieta Bojarsk^a; Edward Darzynkiewicz^a; Piotr Ostapczuk^b; Jean-Marie Sequaris^b; Barbara Czocharlsk^a

^a Department of Biophysics, Institute of Experimental Physics, University of Warsaw, Warszawa, POLAND ^b Institute of Applied Physical Chemistry, Nuclear Research Center (KFA), Julich, FRG

To cite this Article Bojarsk, Elzbieta , Darzynkiewicz, Edward , Ostapczuk, Piotr , Sequaris, Jean-Marie and Czocharlsk, Barbara(1990) 'Electroanalytical Study on Nicotinamide 7-Methylguanine Dinucleotide (Nm⁷GD), Analog of Coenzyme NAD and Related Compounds', *Nucleosides, Nucleotides and Nucleic Acids*, 9: 3, 437 — 438

To link to this Article: DOI: 10.1080/07328319008045163

URL: <http://dx.doi.org/10.1080/07328319008045163>

PLEASE SCROLL DOWN FOR ARTICLE

Full terms and conditions of use: <http://www.informaworld.com/terms-and-conditions-of-access.pdf>

This article may be used for research, teaching and private study purposes. Any substantial or systematic reproduction, re-distribution, re-selling, loan or sub-licensing, systematic supply or distribution in any form to anyone is expressly forbidden.

The publisher does not give any warranty express or implied or make any representation that the contents will be complete or accurate or up to date. The accuracy of any instructions, formulae and drug doses should be independently verified with primary sources. The publisher shall not be liable for any loss, actions, claims, proceedings, demand or costs or damages whatsoever or howsoever caused arising directly or indirectly in connection with or arising out of the use of this material.

ELECTROANALYTICAL STUDY ON NICOTINAMIDE 7-METHYLGUANINE DINUCLEOTIDE (Nm^7GD^+),
ANALOG OF COENZYME NAD^+ AND RELATED COMPOUNDS

Elzbieta Bojarska^a, Edward Darzynkiewicz^a, Piotr Ostapczuk^b, Jean-Marie Sequaris^b
and Barbara Czochralska^a

^aDepartment of Biophysics, Institute of Experimental Physics, University of
Warsaw, Zwirki and Wigury 93, 02-089 Warszawa, POLAND

^bInstitute of Applied Physical Chemistry, Nuclear Research Center (KFA), Julich,
P.O. Box 1913, D-5170 Julich, FRG

Abstract: Electrochemical methods (direct-current polarography, cyclic voltammetry and differential pulse polarography) were used for analysis of 7-methyl-guanine nucleosides and nucleotides.

Among the mutagenic and carcinogenic compounds, alkylating agents are a group of substances that disturb the biological function of cellular DNA and RNA. The major products of endogenous alkylation are methylated base adducts, including 7-methylguanine. It has been observed that a high level of 7-methyl-guanine in mitochondrial and nuclear DNA could contribute to ageing and cancer (1). Furthermore, 7-methyl GMP is a key component of the cap of various eukaryotic mRNA's (2).

We have studied polarographic behaviour of 7-methylguanine derivatives: 7-methylguanosine (m^7Guo), 7-methyl GMP (m^7GMP), methyl esters of 7-methyl GDP and 7-methyl GTP ($\text{m}^7\text{ester GDP}$ and $\text{m}^7\text{ester GTP}$), acyclo 7-methyl GMP ($\text{m}^7\text{acyclo GMP}$), nicotinamide 7-methylguanine dinucleotide (Nm^7GD^+) and nicotinamide guanine dinucleotide (NGD^+), analogs of coenzyme NAD^+ , in which the adenine moiety has been replaced by 7-methylguanine and guanine, respectively.

It is known that 7-methylguanosine readily undergoes electrochemical reduction, both in the free state (3) and when incorporated into DNA (4). Electrochemical reduction of 7-methylguanosine occurs in the imidazole ring (3).

Three polarographic techniques were used for analysis of 7-methylguanine derivatives: direct current polarography (d.c.), cyclic voltammetry (c.v.) and differential pulse polarography (d.p.p.).

It was found that 7-methylguanine nucleosides and nucleotides exhibit in aqueous solutions one d.c. polarographic wave (or one c.v. and d.p.p. peak) in the potential range -1.7 V to -1.8 V (pH 4.5 - 8.5). The data presented on Fig.1 indicate that there is no significant difference between polarographic behaviour

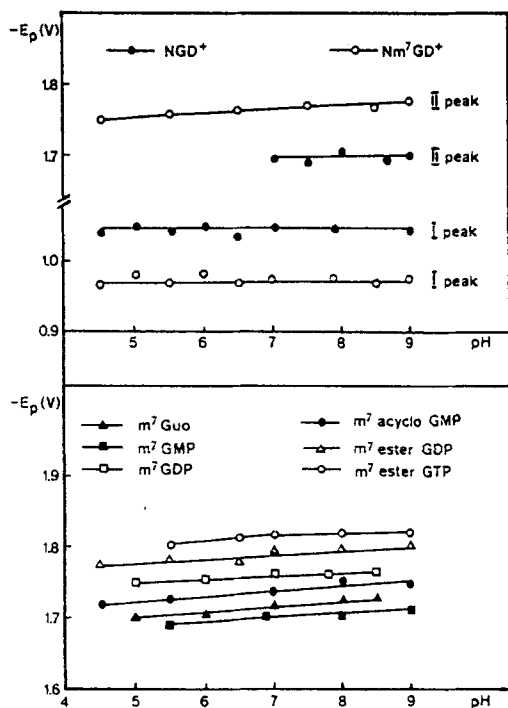


Fig. 1. pH dependence of d.p.p. potential peaks of 1×10^{-4} M 7-methylguanine derivatives (phosphate buffers).

of acyclo-7-methyl GMP and other compounds (cyclo derivatives). However, their adsorption properties are quite different. On the basis of an additional a.c. polarographic study it was shown that acyclo derivatives of 7-methylguanine adsorb weakly in comparison with cyclo derivatives.

Nm^7GD^+ and NGD^+ exhibit two polarographic waves (or two d.p.p. peaks) in the pH region 7-10 which can be ascribed to nicotinamide reduction. In slightly acidic medium (pH 4.5 - 6.0) the polarographic behaviour of both compounds differs. NGD^+ exhibits only one reduction wave (peak) due to the nicotinamide ring, whereas Nm^7GD^+ undergoes a two step reduction, the first identical with that for NGD^+ and the second due to reduction of 7-methylguanine moiety (Fig. 1).

The heights of the polarographic waves (peaks) are lineary dependent on the 7-methylguanine derivative concentrations in the range 2×10^{-4} M - 1×10^{-6} M (pH 5-7), which might be of use for analytical applications.

ACKNOWLEDGMENTS

This work was supported by the Ministry of Higher Education, project CPBP 01.06/10.01.

REFERENCES

1. J.W. Park and B.N. Ames, Proc. Natl. Acad. Sci. USA 85 (1988) 7467
2. R.S. Hall, "The Modified Nucleosides in Nucleic Acids", Columbia Univ. Press, New York, 1971
3. J.M. Sequaris and J.A. Reynaud, J. Electroanal. Chem. 63 (1975) 207
4. J.M. Sequaris, J.A. Reynaud and B. Malfoy, J. Electroanal. Chem. 77 (1977) 67