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CHEMICAL EFFECTS PRODUCED BY THE IONIZING RADIATION IN THE MERCURY BEATING HEART REACTION

S. Castillo-Rojas[1], G. Burillo[1], J. L. González-Chávez[2], L. Vicente[2]

[1]Instituto de Ciencias Nucleares, UNAM. Apartado Postal 70-543. Circuito Exterior C. U. México, D. F. 04510 México

[2]Facultad de Química, UNAM. Ciudad Universitaria, México, D. F. 04510 México

In a recent paper we have shown the existence of complex modes of oscillation in the study of the extinction dynamics of the mercury beating heart reaction[1]. It was proposed that one of the species responsible for the oscillatory movements of this reaction is the mercury(I), in anyone in their forms, either free or molecular.

The formation of Hg_2^{2+} from γ irradiation of ^{60}Co to the system Hg^0/H_2SO_4 (6M) allowed to elucidate the probable mechanism of reaction. The objective of this work is to study how the ionizing radiation affects the dynamics of extinction of this reaction, which is related with the existence of certain chemical species. The study was carried out in 2 ways: a) Method I: H_2SO_4 (6 M) was first irradiated and to the irradiated solution the Hg^0 was added and b) Method II: the system Hg^0/H_2SO_4 (6 M) was irradiated. The different irradiated systems were put into reaction with Fe^0 to investigate if there were differences between the two irradiated systems and how the complex modes of oscillation of the reaction were affected.

The quantity of Hg_2^{2+} produced by method I is bigger than in method II. This is explained because the majority species produced by radiolysis of H_2SO_4 are sulfate radical and H_2O_2 that act as oxidizer agents and their potential values allow to suppose that these substances react with Hg^0 to produce Hg_2^{2+}. On the other hand, by method II mercury clusters (Hg_4^{3+}) are formed as was reported by Sukhov and Ershov[2] in pulse radiolysis of aqueous Hg_2^{2+} solutions. We assume that the formation of these mercury clusters has to be observed with the decrease of the Hg_2^{2+} concentration when one makes the radiolysis by method II.

In general, the preliminary studies allow establishing that the ionizing radiation does not affect the extinction dynamics but it increases the half-life of this reaction.

References:

[1] J. Phys. Chem. A 2001, 105, 8038-8045.

[2] Bull. Russ. Acad. Sci. 1992, 41(1), 1-4.