Two kinds of luminescence centers in low-temperature phosphorescence spectra of IPNV RNA

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INTRODUCTION

Viral infections are among the most important challenges for the modern world; thus the study of the properties of these nanosized biological objects is crucial for understanding the ways of fighting this challenge. Particularly, the electronic processes in viral nucleic acids and proteins determine the efficiency of the deactivation of viruses by electromagnetic irradiation. To understand these processes, spectral properties of viruses and their components (nucleic acids and proteins) should be studied. RNA viruses of fish are efficient models for the study of viral pathogenesis and its treatment. Important representative of this class of viruses is the infectious pancreatic necrosis virus (IPNV) which causes a highly contagious disease of salmonid fish.

RESULTS

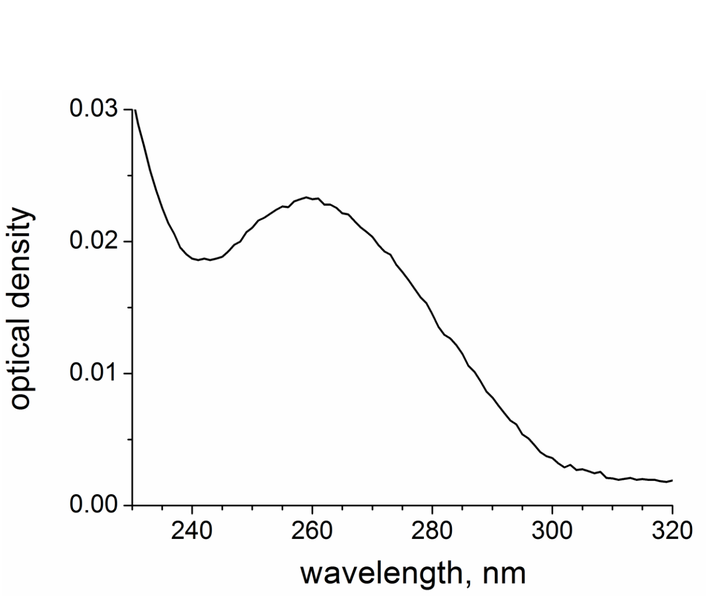

Fig. 1. Absorption spectrum of IPNV RNA in water.

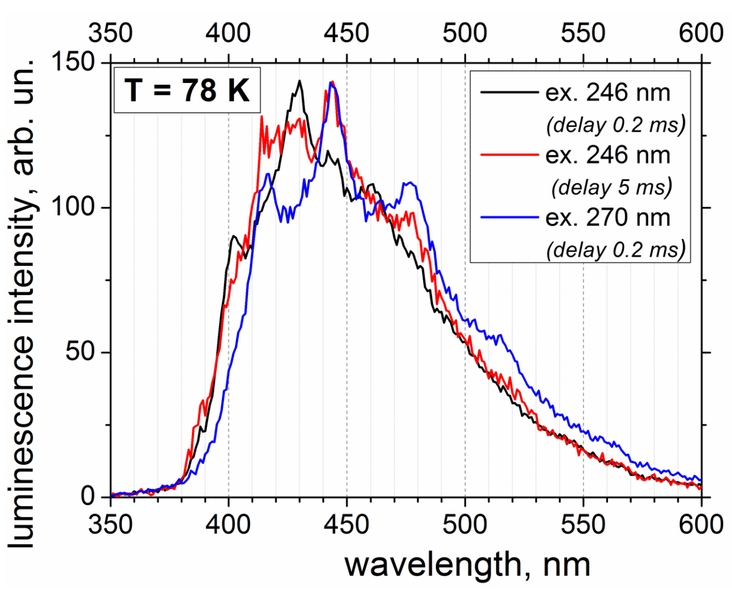

Fig. 2. Normalized phosphorescence spectra of IPNV RNA (78 K), excitation wavelengths 246 and 270 nm, delay after excitation pulse 0.2 ms and 5 ms.

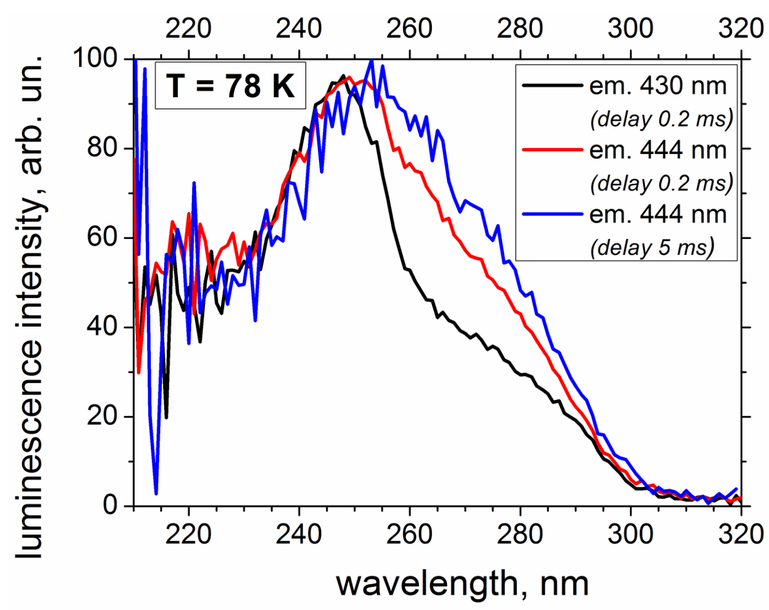

Fig. 3. Normalized phosphorescence excitation spectra of IPNV RNA (78 K), emission wavelength 430 and 444 nm, delay after excitation pulse 0.2 ms and 5 ms..

Earlier, spectral properties of IPNV virions, RNA and major capsid proteins were studied by us [1]. Here, we have studied the low-temperature luminescence properties of RNA molecules of IPNV in more details.

The phosphorescence spectra of RNA reveal the presence of two kinds of luminescence centers, each of them manifested as structured phosphorescence spectrum:

"center I" – maxima near 402, 430 and 460 nm; excitation maximum near 246 nm with shoulder near 280 nm; shorted emission decay time;

"center II" – maxima near 415, 444 and 477 nm; excitation maximum near 260 nm; longer emission decay time.

Basing on the positions of excitation and emission maxima, we suppose that "center I" corresponds to guanine bases of RNA, while "center II" corresponds to adenine ones. If our suggestion is true, this means that the excitation energy transfer between triplet states in viral RNA of IPNV is not efficient: while adenine has the lowest energy of triplet excited state compared to other nucleotide bases, guanine does not [1]; and thus excitations of guanine triplet state mainly do not reach adenine bases *via* energy transfer mechanism.

1. Kravchenko V. M., Rud Y. P., Buchatski L. P., Stepanenko Y. Y., Gryn D. V., Yashchuk V. M. Spectroscopic Studies of Infectious Pancreatic Necrosis Virus, Its Major Capsid Protein, and RNA // Ukr J Phys.-2019.-64, N 2.-P.120-125.

CONCLUSION:

Two luminescence centers were revealed in low-temperature phosphorescence spectra of IPNV RNA, possibly connected with emission of adenine and guanine bases. It is supposed that the excitation energy transfer between triplet states of nucleotide bases in viral RNA of IPNV is not efficient.

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