Spectral properties of CDOM depending on depth in artificially and naturally separated waterbodies

SokolovskayaYu.G. (1), Demidenko N.A. (2), Krasnova E.D. (3), Voronov D.A. (4), Savvichev A.S. (5), Fedichkin D.A. (1), Patsaeva S.V. (1)

(1)Faculty of Physics, Lomonosov Moscow State University, Moscow, Russia;
(2) Shirshov Institute of Oceanology, Russian Academy of Sciences, Moscow, Russia
(3)Biological Faculty, Lomonosov Moscow State University, Moscow, Russia;
(4)Kharkevich Institute for Information Transmission Problems, Russian Academy of Sciences, Moscow, Russia;
(5)Winogradsky Institute of Microbiology, Federal Research Center "Fundamentals of Biotechnology", Russian Academy of Sciences, Moscow, Russia

Introduction

It is known that natural water always contains a certain amount of colored dissolved organic matter (CDOM), which plays an essential role in natural biogeochemical processes. Of particular interest from the point of view of studying the composition and distribution of MOATS are meromictic water bodies which have stable vertical stratification of water layers. In this work, the optical characteristics of water from the Kanda Bay are studied. Kanda Bay is a unique hydrological object isolated from the White Sea more than a hundred years ago as a result of the construction of a railway dam. These anthropogenic transformations of the sea bay have led to changes in its hydrological and hydrochemical regimes. The aim of this work is to study the optical characteristics of CDOM in natural water from the Kanda Bay of the Kandalaksha Bay of the White Sea.

Studied objects and Method

Samples 1-6 were taken in a marine reservoir near the dam in the Kanda Bay. Samples 7-14 were taken in a meromictic reservoir in Kanda Bay with a depth of 14 meters (Fedoseevsky Ples). The depth of the water layer for each sample and the salinity of the water are shown in Table 1. Water samples were filtered through nylon filters with a pore diameter of 0.22 µm. Absorption spectra of natural water CDOM were recorded at room temperature relative to distilled water on a Solar PB2201 spectrophotometer in the wavelength range 200 to 700 nm with a scanning step of 1 nm.

Results

Absoprtion spectra for sea part of Kanda Bay (samples 1-6) is shown in Fig. 1. Absoprtion spectra for meromictic reservoir Fedoseevsky Ples (samples 7-14) is shown in Fig. 2. Dependence of the absorbance at the selected wavelength (250, 270, 280 nm) on the salinity of water is shown in Fig. 3 (SP – Sea part, FP-Fedoseevsky ples). It can be seen that for the sea part, the absorbance practically does not change from sample to sample. At the same time, a sharp increase in absorbance at salinities above 14 is visible in the meromictic Fedoseyevsky ples, which corresponds to layers of water with hydrogen sulfide H_2S content.

Water sample (water body)	Number of sample	Depth, m	Salinity, ‰
Sea part of Kanda Bay	1	1	14,56
	2	3	15,82
	3	5	16,55
	4	8	18,05
	5	11	18,32
	6	14	18,52
Fedoseevsky ples	7	1	3,3
	8	3	8,4
	9	5	11,0
	10	8	11,6
	11	11	14,7
	12	12	15,6
	13	13	16,1
	14	13,8	16,6

Table 1. Studied water samples

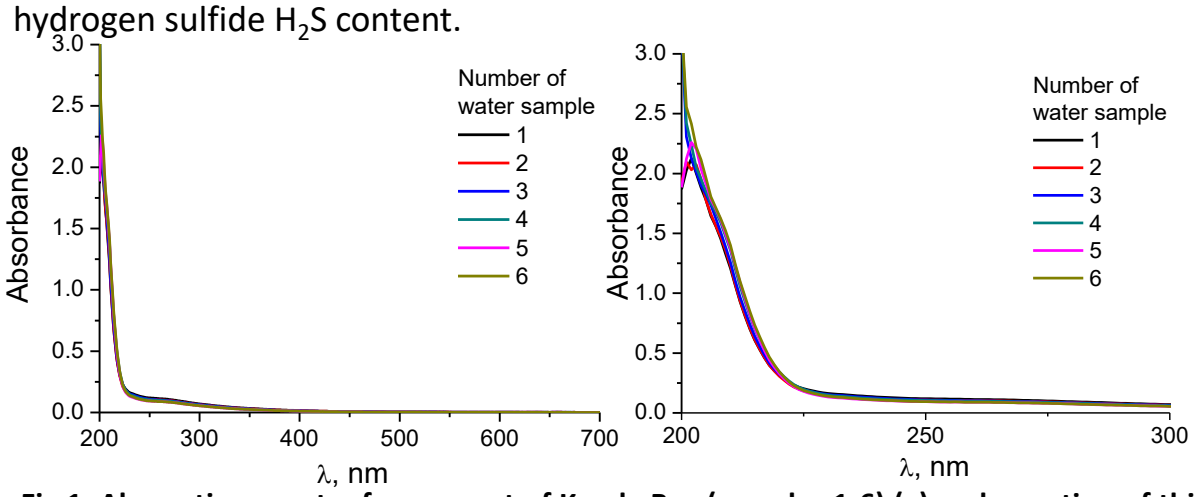

Fig 1. Absoprtion spectra for sea part of Kanda Bay (samples 1-6) (a) and a section of this spectrum on an enlarged scale (b)

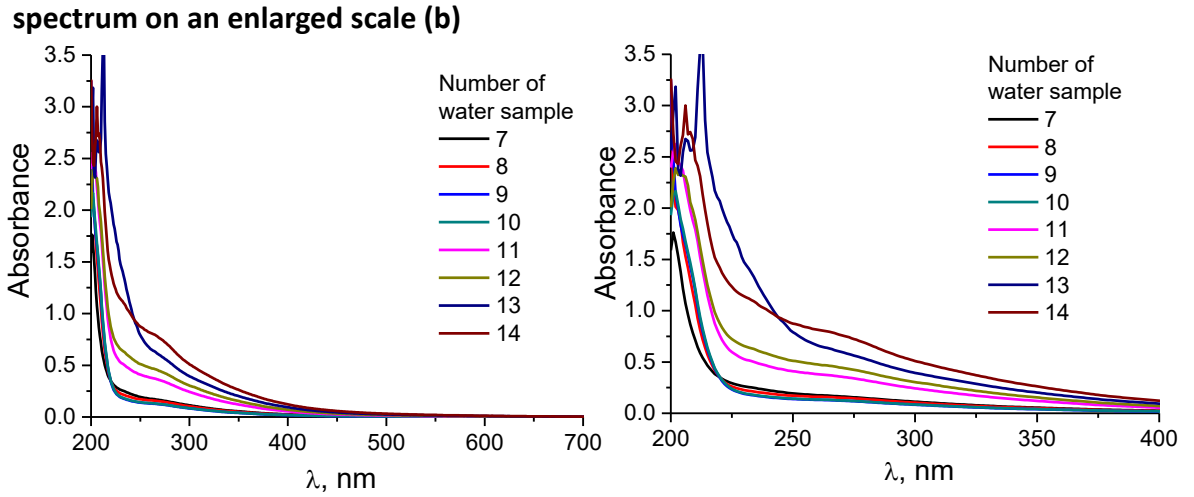

Fig 2. Absorption spectra for meromictic reservoir Fedoseevsky Ples (samples 7-14) (a) and a section of this spectrum on an enlarged scale (b)

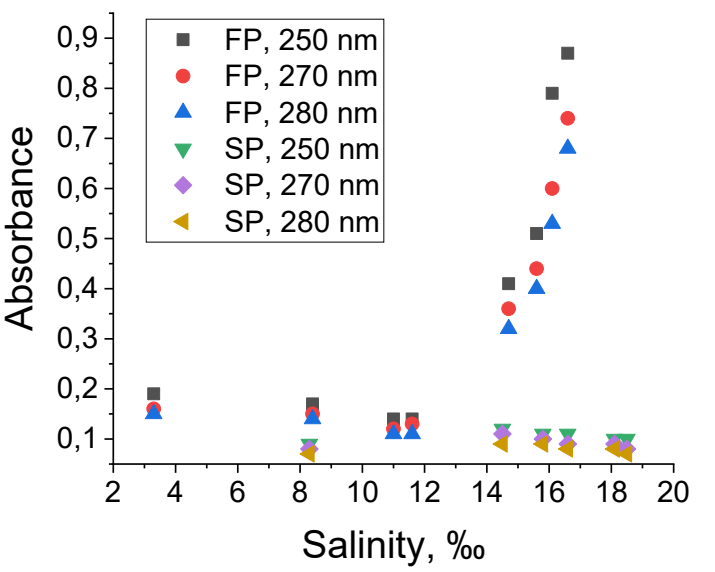

Fig. 3. Dependence of the absorbance at the selected wavelength (250, 270, 280 nm) on the salinity of water