"Unusual diffusion processes associated with interfacial layers of water"

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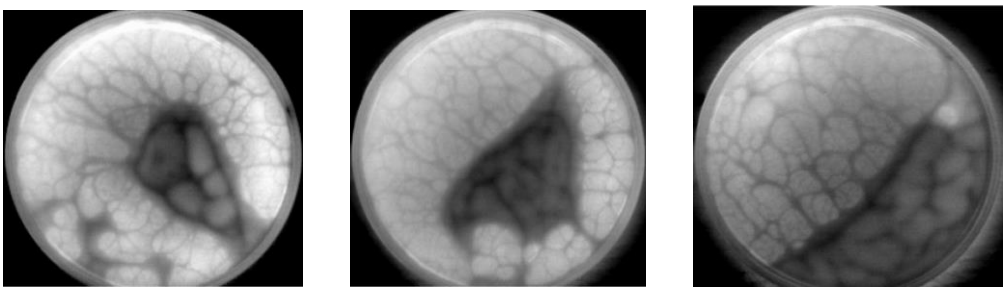
Open water surface in contact with the air is one of the most interesting cases of interfacial water. Largest part of the surface of our planet is covered by water in contact with the air. Many biological experiments are performed in physiological (water based) solutions with open surfaces. Previously we have demonstrated the formation of non-uniform structures in superficial layers of water and multi-component water solutions. Such structures are invisible in visual spectral range but they could be visualized using the method of real-time infrared imaging.

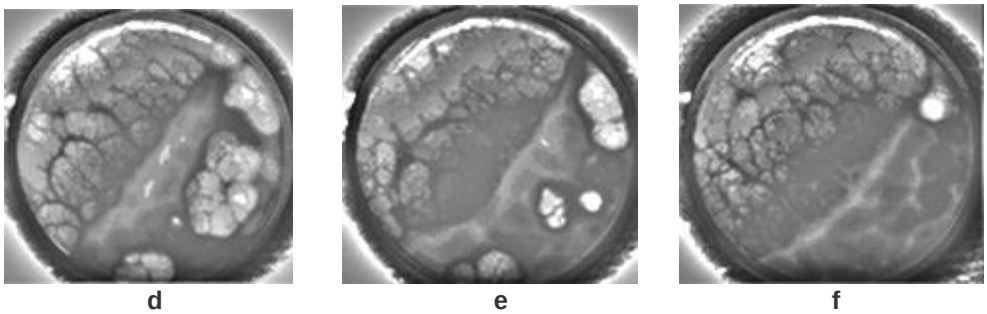
Mechanism of such structures formation is associated with convective and diffusion processes in thin superficial layer of water caused by thermal gradient, which appears due to evaporation and components mixing. Our future studies show that the time-dependent behavior of such structures could provide us with unique information concerning diffusion processes in very thin superficial interfacial layer of water. Open surface of the water allows us to directly observe diffusion processes in superficial layers using the technique of infrared imaging.

Experimental studies were performed using infrared (IR) camera with 3-5 micron spectral window of sensitivity and better than 15 mK temperature sensitivity at 200 frames per second acquisition rate. Such method makes it possible to visualize the difference between free and bounded water and to observe the dynamics of non-uniform structures in superficial layers of water and multi-component water solutions.

The separation of real multi-component water solutions in thin superficial layer has been observed. Examples of IR patterns in superficial layers of multi-component water solutions (10% ethanol and 5 % glycerin) are presented below.



a **b** **c**



d **e** **f**

The darker structure in the middle areas of pictures **a** and **b** and in lower right area of picture **c** is the area of pure water without solution components. Pictures **d, e** and **f** are representing the evolution of IR pattern leading to picture **c**.

The mechanism of self separation in the thin superficial area of true multi-component water solutions will be discussed.