Structure and optical properties of agarose-based hydrogels

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Recent trends in hydrogel science have spurred extensive research on eco-friendly, biodegradable materials that are safe for health and the environment. Agarose is among the most widely used polysaccharides in molecular biology and biotechnological applications, as well as in the medical, cosmetic, and food industries, because it forms strong gels even at low concentrations. Agarose is transparent in the visible range, making it a potential material for optical fibers, e.g. [1]. The simple method of fiber production and the edibility of agar/agarose make it possible to obtain inexpensive, biocompatible devices suitable for in vivo imaging and light delivery. Importantly, agarose exhibits intrinsic photoluminescence (PL); thus, this property can be used to monitor the state of the gels.

The structure and morphology of the hydrogel were studied during the drying process in an electron microscope chamber. Observations have shown that the fabricated samples, with a thickness of ~4 mm, retain water for several hours. The gel structure changes very slowly over nearly 20 min during drying.

A broad band extending from 375 to 675 nm was observed in the PL spectra of a freshly prepared agarose gel under UV excitation. The profile of the emission spectrum changes slightly during storage under normal conditions due to water loss. This result indicates a complex origin of the emission, that can be caused by presence of multiple luminescence centers. Water coming out of the gel is accompanied by a change in the shape of the long-wavelength band luminescence band. Photoluminescence studies show that the water content of a gel can, in principle, be controlled by monitoring the change in the spectral characteristics of the gel's intrinsic luminescence.

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