Synthesis and characterization of a nano fluorescent starch

Objective

To synthesize a natural polymer fluorescent material (nano fluorescent starch) through covalent linkage with fluorescein via a ring-opening reaction, and to study its fluorescent properties in water.

Sample Preparation

First, 3-epoxypropoxy fluorescein (EF) was prepared via a nucleophilic substitution reaction between fluorescein and epichlorohydrin. Next, starch-bearing 3-epoxypropoxy fluorescein (ST-EF) was synthesized via a ring-opening reaction to attach fluorescein to native cassava starch chains. Then, the ST-EF was dissolved in deionized water to obtain a solution with a concentration of 1.6 mg / ml, the resulting sample was placed inside a 10 × 10 mm quartz cell for the fluorescence test.

Data acquisition

Fluorescence test of ST-EF sample was carried out via fluorescence spectrometer (F-7000, Japan). Fluorescence scans were obtained using a 5 nm slit width, a 460 nm excitation wavelength, and an emission scan ranging from 480 to 660 nm.

Representative figures & Results

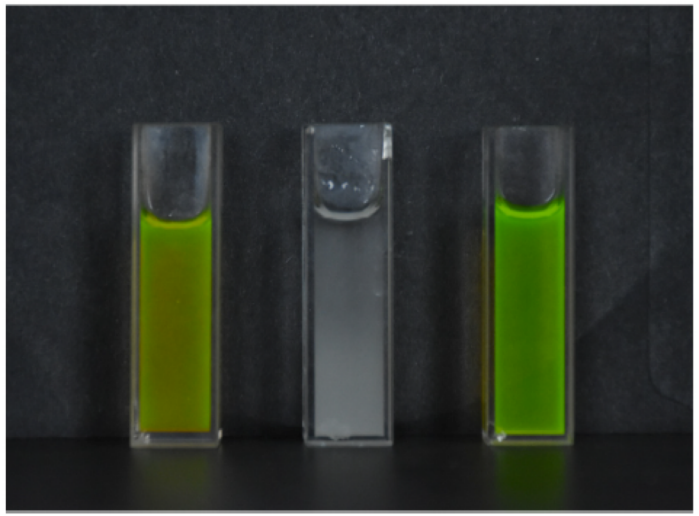

Fig. 8. Photos of fluorescein, cassava starch and ST-EF in aqueous solution from left to right under visible light.

In the figure 8 we can see that ST-EF emits bright green fluorescence like fluorescein under visible light. The photograph was taken 6 h after the solution was prepared, showing strong photoluminescence characteristics and fluorescence stability.

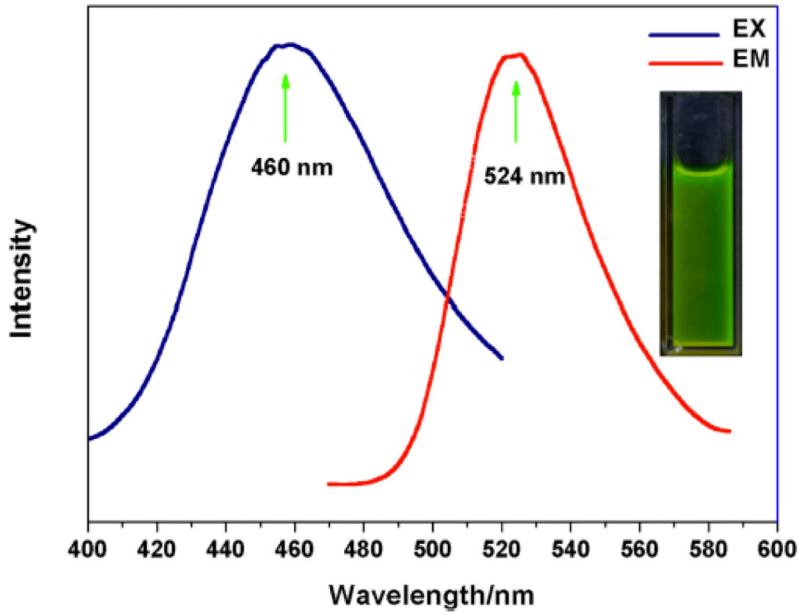

Fig. 9. Fluorescence spectra of ST-EF in aqueous solution.

The maximum fluorescence excitation peak is found at 460 nm, and the maximum emission wavelength is located at 524 nm, both are in the range of visible region.

Conclusion

ST-EF shows strong fluorescence as fluorescein, compared with small molecule fluorescence materials, this nano fluorescent starch has better processing performance and more stable fluorescence properties. In addition, it's easy to be compatible with organisms, non-toxic, harmless, coupled with good water solubility and dispersibility. Therefore, it can be used in the areas of fluorescence tracing technology, water-based fluorescent paint, cosmetic technique, chemical sensor and various biomedical applications including drug delivery, biosensing and bioimaging.