Steady-state and time-resolved measurements on bioluminescence emissions from the firefly-species Luciola substriata

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Abstract

In recent times, emission spectra and pulses from Indian species of firefly *Luciola praeusta* and *Asymmetricata circumdata* have been recorded and analysed both in control and in different ambient conditions like temperature and magnetic field. Interesting conclusions have been drawn from those observations. Here we record steady-state and time-resolved spectra from specimens of the third newly found species *Luciola substriata*. Spectra recorded for male specimens in a high resolution spectrometer show that the wavelength peak is at 559 nm. Pulses are not exactly triangular or Gaussian: those appear to be in between in shape. With increase in temperature, the pulse duration decreases exponentially, which implies that the speed of the enzyme catalysed reaction producing the light of the firefly increases exponentially - unlike for males of the species *L. praeusta* where the increase was found to be substantially linear in the range 20 – 40 ∘C [1]. At 33.5 ∘C, the pulse width becomes minimum and after that increases sharply for small increase in temperature. This implies that denaturation sets in at this temperature optimum. This optimum temperature was obtained at 41.5 ∘C for *L. praeusta* [2]. The peak position in the emission spectrum also shows a red shift of about 4 nm justifying this speculation. As the temperatures is lowered below 21 ∘C, the pulse-width increases noticeably with large variations similar to the ones observed in a strong static magnetic field. The broadening becomes abnormally large at and below temperature of 11.5 ∘C. Emission spectra in theses temperatures revealed a slight shift in the peak position towards blue.

References

U. Sharma, A. Goswami, M. Phukan, S.C. Rajbongshi, A. Gohain Barua, Photochem. Photobiol Sci 13 (2014) 1788-1792.

M.M. Rabha, U. Sharma, A. Goswami, A. Gohain Barua, Photochem. Photobiol. B: Biol. 170 (2017) 134-139.

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