Photodissociation of orange i monoanion studied using an electrostatic storage ring

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M. Saito[*1], T. Tanabe[†], M. Lintuluoto[‡], E. B. Starikov[§], K. Noda[¶], T. Majima[*], S. Tomita[‖], and K. Takahashi[III]

[*]Kyoto University, Kyoto 615-8540, Japan
[†]High Energy Accelerator Research Organization (KEK), Tsukuba 305-0801, Japan
[‡]Kyoto Prefectural University, Kyoto 606-8522, Japan
[§]Chalmers University of Technology, 412 96 Gothenburg, Sweden
[¶]National Institute of Radiological Sciences, Chiba 263-8555, Japan
[‖]University of Tsukuba, Tsukuba 305-8573, Japan
[III]National Institute of Advanced Industrial Science and Technology, Tsukuba 305-8566, Japan

Synopsis Photodissociation of gas-phase orange I monoanions was studied by using an electrostatic storage ring. By comparing their wavelength spectra with those in the liquid phase and with theoretical predictions, it is deduced that the spectra originate from different tautomers of orange I monoanions.

Orange I is one of the most popular dyes and has been studied both experimentally and theoretically. There have been a number of studies on the photoabsorption of orange I molecules in the liquid phase, but not in the gas phase. Recently, we studied photodissociation of gas-phase fluorescein monoanions using an electrostatic storage ring and deduced that the photodissociation spectra originated from various tautomers of fluorescein monoanions [1]. Meanwhile, desodiated orange I monoanions ([orange I-Na]$^-$) can exist in two tautomeric forms: azo and hydrazone forms (Fig. 1). Here, we present the photodissociation of desodiated orange I monoanions in the gas phase studied using an electrostatic storage ring.

Figure 2 shows the experimental setup. The ions were produced in an electrospray ion source. The ions were then stored in an ion trap and accelerated to 20 keV. After mass-analyzed, the ions were injected into the storage ring. The stored ions were irradiated with an OPO laser pulse (410–660 nm) and neutral products were detected using an MCP detector. The storage time in the ring before the laser irradiation was variable up to the order of seconds.

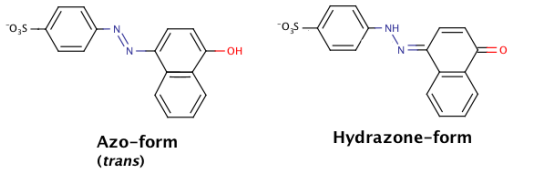

Fig. 1 Chemical structures of orange I monoanions.

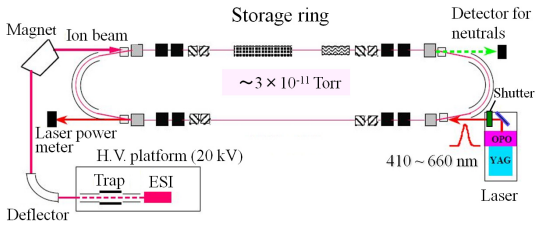

Fig. 2 Experimental setup.

Figure 3 shows the yield of neutral particles produced by the photodissociation as a function of time for different storage times in the ring. As shown in the figure, the time spectra varied depending on the storage time before the laser irradiation. By comparing the yield of neutral particles as a function of the wavelength with the absorption spectra in the solution phase and with theoretical predictions, we deduced that the wavelength spectra originated from two tautomeric forms of the orange I monoanions: azo and hydrazone forms. In addition, we observed that the wavelength spectra depended on the storage time before the laser irradiation.

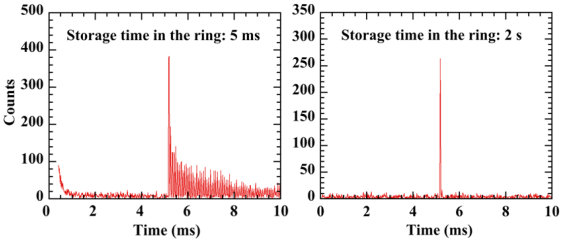

Fig. 3 Counts of neutral particles produced by the photodissociation of orange I monoanion as a function of time, for different storage times in the ring.

Reference

[1] T. Tanabe, M. Saito, K. Noda, E. B. Starikov, Eur. Phys. J. D **66**, 163 (2012)

[1] E-mail: saito@nucleng.kyoto-u.ac.jp