Supplementary materials

Reductive total chlorine free photochemical bleaching of cellulosic fabrics

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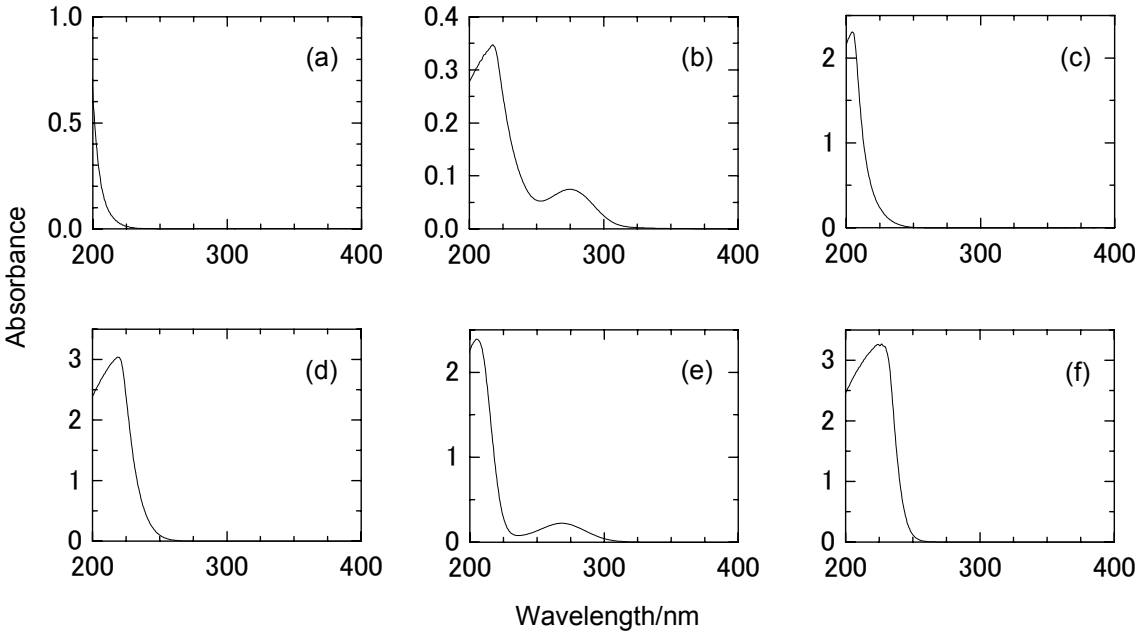

Fig. S1 UV absorption spectra of (a) $NaBH_4$, (b) $Na_2S_2O_4$, (c) $NaHSO_3$, (d) Na_2SO_3, (e) $H_2NC(=NH)SO_2H$, and (f) $HOCH_2SO_2Na$. Solvent: H_2O. Concentration: 2.5 mM. Optical path: 10 mm.

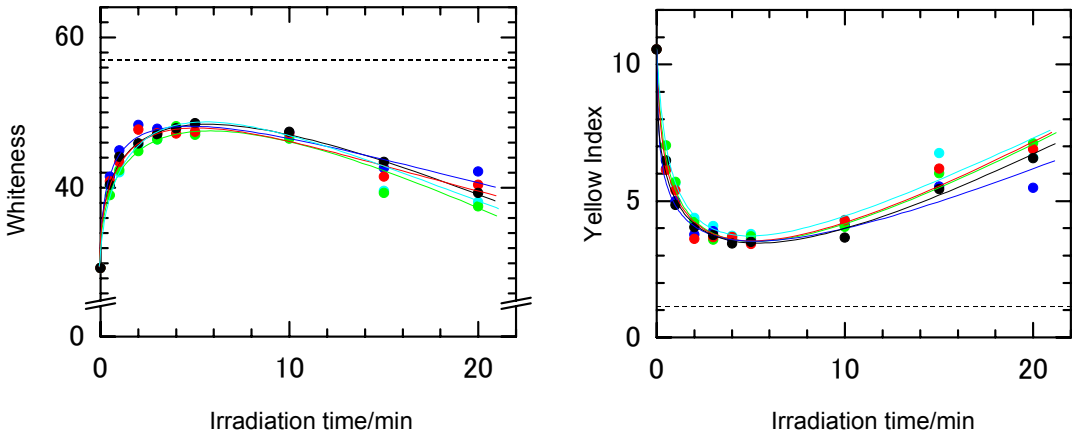

Fig. S2 Whiteness and yellow index of KrF excimer laser bleached cotton fabrics (**LF**) as a function of irradiation time. Reagents, ● : none (only EtOH); ● : $(MeO)_3SiH$; ● : $(EtO)_3SiH$; ● : *n*-Bu_3SiH; ● : *n*-$C_8H_{17}SiH_3$. Laser bleaching condition: 40 mJ cm^{-2} $pulse^{-1}$, 5 Hz, room temperature. Reagents: 6 wt% in EtOH. Number of cotton cloths: 1 sheet. Whiteness and yellow index of conventionally bleached fabric (**CF**) are shown in the figures as horizontal broken lines.

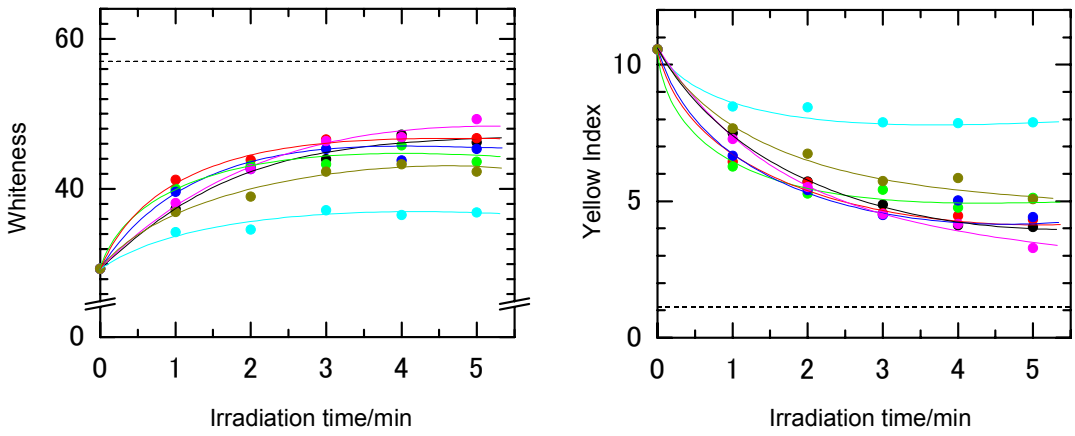

Fig. S3 Whiteness and yellow index of KrF excimer laser bleached cotton fabrics (**LF**) as a function of irradiation time. Reagents, ● : none (only EtOH); ● : $(HMe_2Si)_2O$; ● : $(HMe_2SiO)_4Si$; ● : $Me_3SiO(HMeSiO)_{20}SiMe_3$; ● : $(MeO)_3Si(CH_2)_3NH_2$; ● : SM8707 (Dow Corning); ● : SRX310 (Dow Corning). Laser bleaching condition: 40 mJ cm^{-2} $pulse^{-1}$, 5 Hz, room temperature. Reagents: 6 wt% in EtOH. Number of cotton cloths: 1 sheet. Whiteness and yellow index of conventionally bleached fabric (**CF**) are shown in the figures as horizontal broken lines.

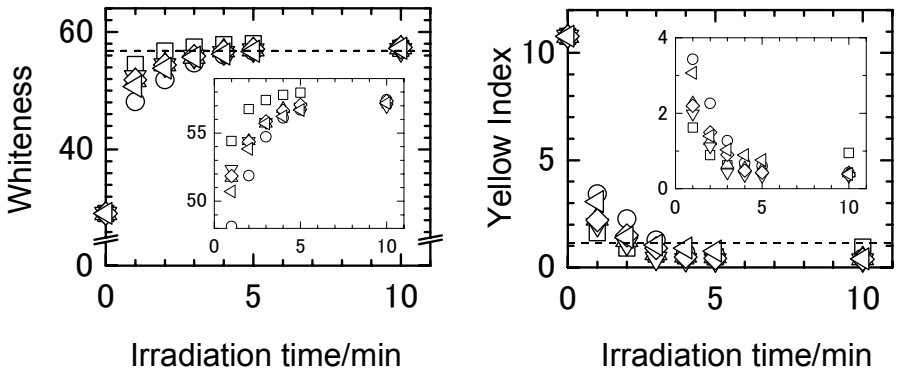

Fig. S4 Additive effect of amines on the whiteness and yellow index of excimer laser bleached cotton fabrics (**LF**) by $NaBH_4$ (aq) as a function of irradiation time. Amines, □ : none; ○ : NH_3; △ : *iso*-Pr_2NH; ▽: Et_3N; ◇ : Et_2NH; ◁ : $EtNH_2$. Laser bleaching condition: KrF laser, 40 mJ cm^{-2} $pulse^{-1}$, 5 Hz, 6 wt% $NaBH_4$ in various solvents (6 wt% amines in H_2O), room temperature. Number of cotton cloths: 1 sheet. Whiteness and yellow index of conventionally bleached fabric (**CF**) are shown in the figures as horizontal broken lines.

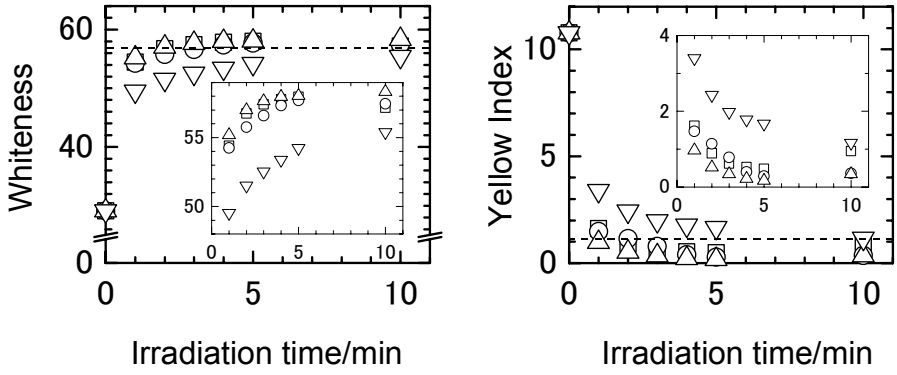

Fig. S5 Additive effect of ammonium salts on the whiteness and yellow index of excimer laser bleached cotton fabrics (**LF**) by $NaBH_4$ (aq) as a function of irradiation time. Ammonium salts, □ : none; ○ : $(NH_4)_2B_4O_7$; △ : $(NH_4)_2SO_4$; ▽: $(NH_3OH)_2SO_4$. Laser bleaching condition: KrF laser, 40 mJ cm^{-2} $pulse^{-1}$, 5 Hz, 6 wt% $NaBH_4$ in various solvents (6 wt% ammonium salt in H_2O), room temperature. Number of cotton cloths: 1 sheet. Whiteness and yellow index of conventionally bleached fabric (**CF**) are shown in the figures as horizontal broken lines.

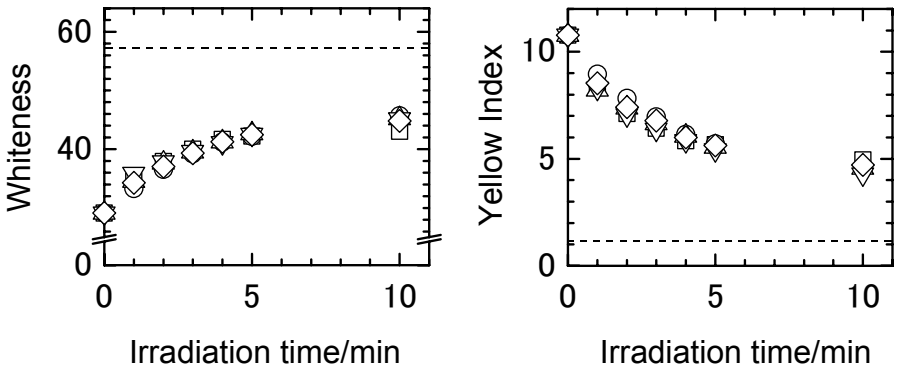

Fig. S6 Whiteness and yellow index of excimer laser bleached cotton fabrics (**LF**) in alcohol-H_2O mixtures as a function of irradiation time. Alcohols, □ : none; ○ : MeOH; △ : EtOH; ▽: *iso*-PrOH; ◇ : *tert*-BuOH. Laser bleaching condition: KrF laser, 40 mJ cm^{-2} $pulse^{-1}$, 5 Hz, 6 wt% alcohol in H_2O, room temperature. Number of cotton cloths: 1 sheet. Whiteness and yellow index of conventionally bleached fabric (**CF**) are shown in the figures as horizontal broken lines.

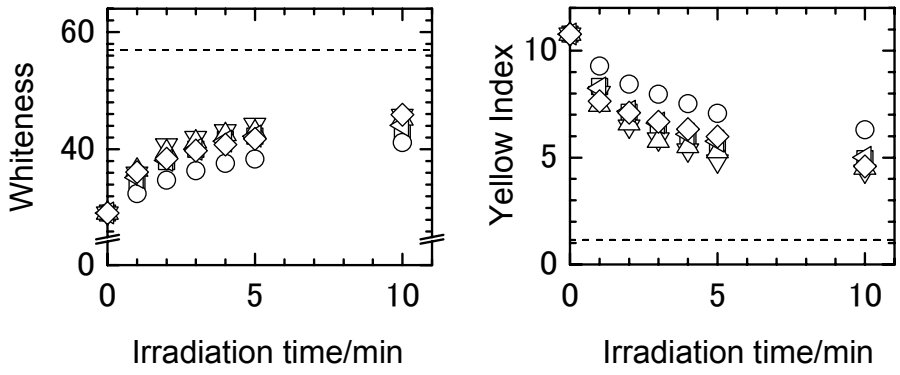

Fig. S7 Whiteness and yellow index of excimer laser bleached cotton fabrics (**LF**) in amine-H_2O mixtures as a function of irradiation time. Amines, □ : none; ○ : NH_3; △ : *iso*-Pr_2NH; ▽: Et_3N; ◇ : Et_2NH; ◁ : $EtNH_2$. Laser bleaching condition: KrF laser, 40 mJ cm^{-2} $pulse^{-1}$, 5 Hz, 6 wt% amine in H_2O, room temperature. Number of cotton cloths: 1 sheet. Whiteness and yellow index of conventionally bleached fabric (**CF**) are shown in the figures as horizontal broken lines.

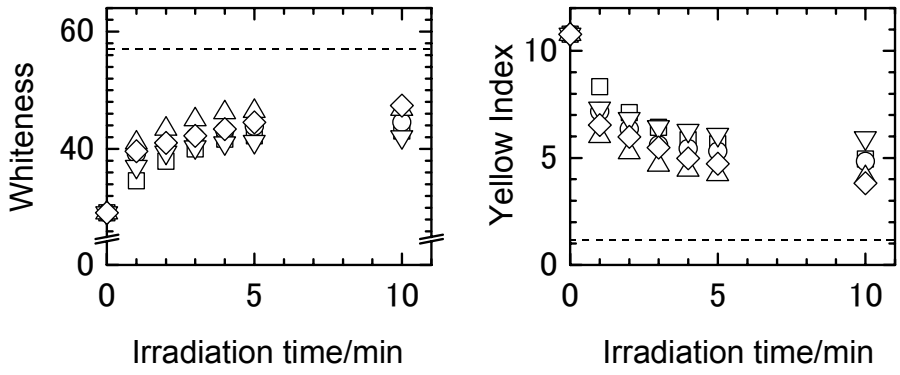

Fig. S8 Whiteness and yellow index of excimer laser bleached cotton fabrics (**LF**) in ammonium salt- or amide-H_2O mixtures as a function of irradiation time. Ammonium salts or amide, □ : none; ○ : $(NH_4)_2B_4O_7$; △ : $(NH_4)_2SO_4$; ▽ : $(NH_3OH)_2SO_4$.; ◇ : $HCONH_2$. Laser bleaching condition: KrF laser, 40 mJ cm^{-2} $pulse^{-1}$, 5 Hz, 6 wt% ammonium salt or amide in H_2O, room temperature. Number of cotton cloths: 1 sheet. Whiteness and yellow index of conventionally bleached fabric (**CF**) are shown in the figures as horizontal broken lines.

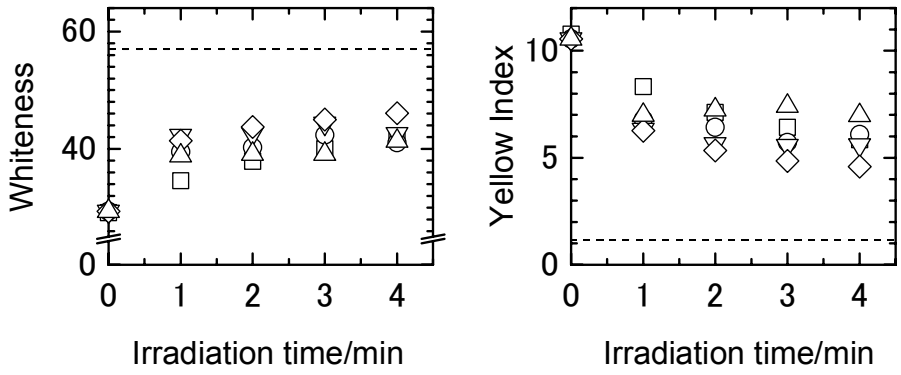

Fig. S9 Whiteness and yellow index of excimer laser bleached cotton fabrics (**LF**) in ammonium salt-H_2O mixtures as a function of irradiation time. Ammonium salts, □ : none; ○ : NH_4Cl; △ : $(NH_4)_2CO_3$; ▽ : CH_3COONH_4; ◇ : $HCOONH_4$. Laser bleaching condition: KrF laser, 40 mJ cm^{-2} $pulse^{-1}$, 5 Hz, 6 wt% ammonium salt in H_2O, room temperature. Number of cotton cloths: 1 sheet. Whiteness and yellow index of conventionally bleached fabric (**CF**) are shown in the figures as horizontal broken lines.

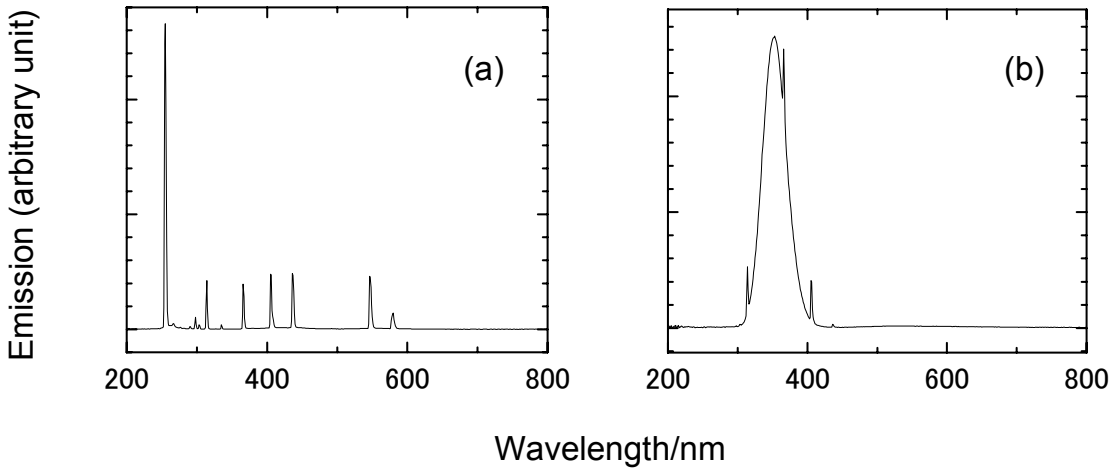

Fig. S10 Emission spectra of (a) a low-pressure mercury lamp and (b) a black-light fluorescent lamp.