Supporting information

Fig. S1. (a) XRD patterns of the CsPb(I\textsubscript{x}Br\textsubscript{1-x})\textsubscript{3} films prepared by adding various solvent additives into CsBr/MeOH solutions. (b) Current density–voltage (J–V) curves of the CsPb(I\textsubscript{x}Br\textsubscript{1-x})\textsubscript{3} solar cells prepared by incorporation of DMF, DMSO and no additives to the CsBr/MeOH solutions.
Fig. S2. Photographs of the CsPb(I_{x}Br_{1-x})_{3} films prepared by different amounts of DMSO in CsBr/MeOH solutions, (a) before annealing and (b) after annealing.
Fig. S3. (a) The energy level diagram and (b) the cross-sectional SEM image of the fabricated device with a structure FTO/bl-TiO₂/mp-TiO₂/CsPb(IₓBr₁₋ₓ)₃/spiro-OMeTAD/Au. The UPS spectra of the CsPb(IₓBr₁₋ₓ)₃ film.
Fig. S4. (a) Photographs and (b) XRD patterns of the initial PbI$_2$/PbBr$_2$ films, after MeOH solutions wash and after MeOH/DMSO (2 vt%) solutions wash, (c-e) the top-down SEM images of PbI$_2$/PbBr$_2$ after different treatment, (c) initial, (d) after MeOH solutions wash, (d) after MeOH/DMSO (2 vt%) solutions wash.
Fig. S5. Statistical results of J–V characteristics of perovskite solar cells prepared with 0, 2, 4 and 8% volume of DMSO in two-step multicycle spin-coating process. (a) $J_{sc}$ (mA·cm$^{-2}$), (b) $V_{oc}$ (mV), (c) FF, (d) PCE(%).
Fig. S6. IPCE and integrate $J_{sc}$ of the CsPb(I$_x$Br$_{1-x}$)$_3$ devices prepared by different amounts of DMSO in CsBr/MeOH solutions.
Fig. S7. The normalized PCE of the CsPb(I$_x$Br$_{1-x}$)$_3$ devices as a function of the storage time. All the devices were measured in the ambient air and without encapsulation.
Fig. S8. XRD patterns evolution of the CsPb(I_xBr_{1-x})_3 perovskite films heated on a 80°C hotplate in air with a controlled humidity environment with <20% RH.