Electronic Supplementary Material (ESI) for RSC Advances.

Photoresponsive, Switchable, Pressure-Sensitive Adhesives: Influence of UV Intensity and Hydrocarbon Chain Length of Low Molecular Weight Azobenzene Compounds

Tae-Hyung Lee,[a] Gi-Yeon Han,[a] Mo-Beom Yi,[a] Jae-Ho Shin,[a] and Hyun-Joong Kim*[a,b]

[a]Laboratory of Adhesion and Bio-Composites,
Program in Environmental Materials Science
Department of Agriculture, Forestry and Bioresources
Seoul National University
1 Gwanak-ro, Gwanak-gu, Seoul 08826, Republic of Korea

[b]Research Institute of Agriculture and Life Sciences,
Seoul National University
1 Gwanak-ro, Gwanak-gu, Seoul 08826, Republic of Korea

* Corresponding Author

Prof. Hyun-Joong Kim

Laboratory of Adhesion & Bio-Composites

Program in Environmental Materials Science

Department of Agriculture, Forestry and Bioresources

Seoul National University, 1 Gwanak-ro, Gwanak-gu, Seoul 08826, Republic of Korea

Tel.: +82-2-880-4784; fax: +82-2-873-2318; E-mail: hjokim@snu.ac.kr (www.adhesion.kr)

- Synthetic route for the azobenzene-containing acrylic monomer and low molecular weight azobenzene compounds

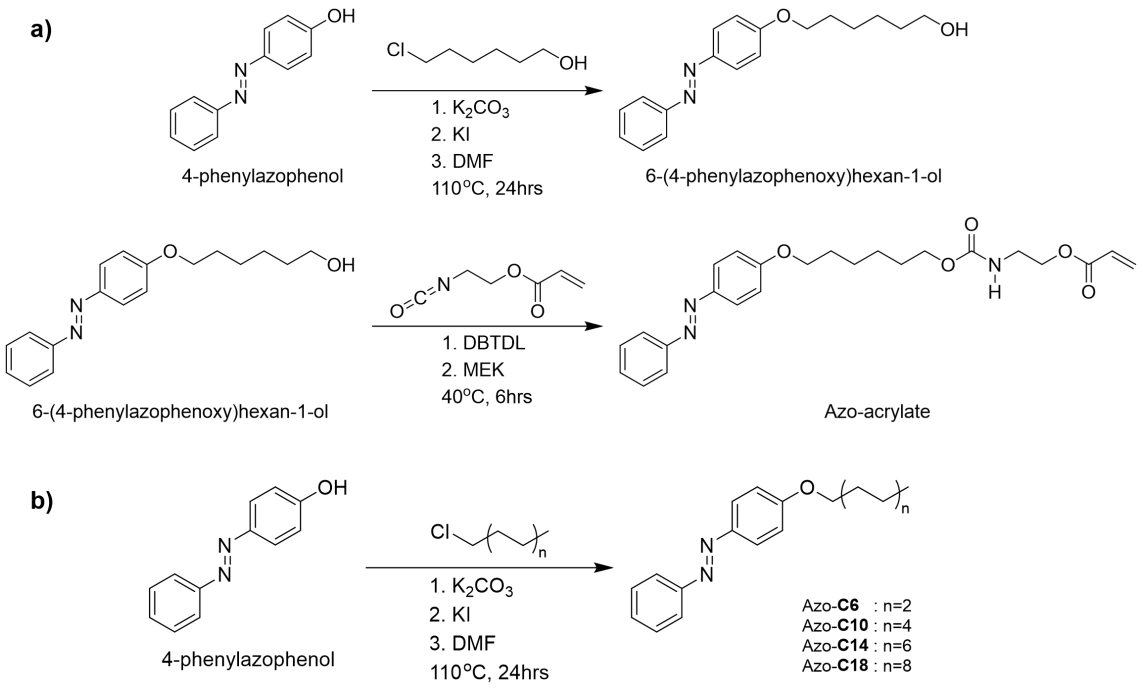

Figure S1. Synthetic route for a) the azobenzene-containing acrylic monomer (azo-acrylate) and b) the low molecular weight azobenzene compounds (azo-compounds).

- NMR spectra

6-(4-(phenyldiazenyl)phenoxy)hexan-1-ol

^{1}H NMR (400 MHz, DMSO-d6, δ): 7.83 (m, 4H, Ar H), 7.51 (m, 3H, Ar H), 7.08 (m, 2H, Ar H), 4.03 (m, 2H, OCH_2), 3.37 (m, 2H, $\underline{CH_2}OH$), 1.71 (m, 2H, $OCH_2\underline{CH_2}$), 1.38 (m, 6H, $OCH_2CH_2\underline{CH_2CH_2CH_2}$)

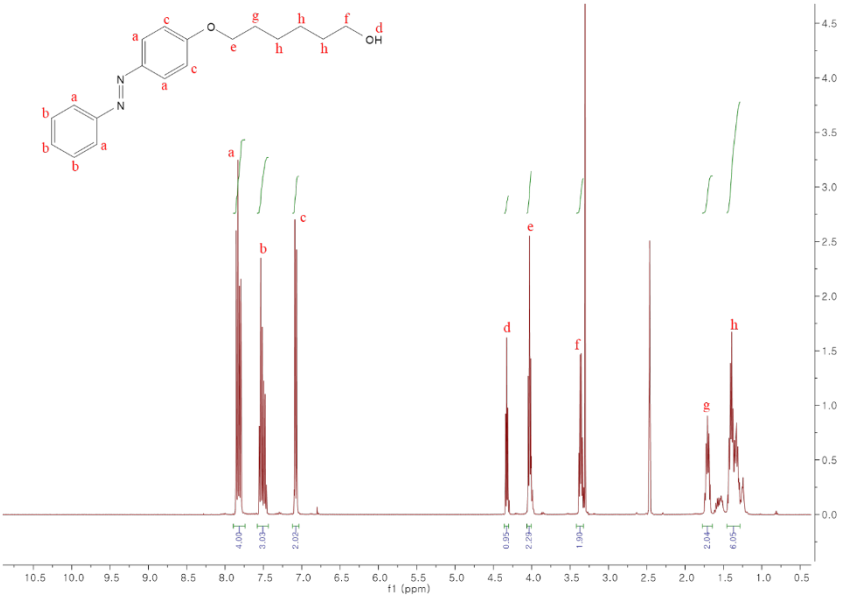

Figure S2. ^{1}H-NMR spectrum of 6-(4-(phenyldiazenyl)phenoxy)hexan-1-ol

2-((((6-(4-(phenyldiazenyl)phenoxy)hexyl)oxy)carbonyl)amino)ethyl acrylate (azo-acrylate)

^{1}H NMR (400 MHz, DMSO-d6, δ): 7.83 (m, 4H, Ar H), 7.51 (m, 3H, Ar H), 7.23 (m, 1H, NH), 7.08 (m, 2H, Ar H), 6.31 (m, 1H, C=CH), 6.12 (m, 1H, C=CH), 5.91 (m, 1H, C=CH), 4.04 (m, 4H, Ar-OCH_2, $NHCH_2\underline{CH_2}$), 3.90 (t, 2H, $\underline{CH_2}OOCNH$), 3.21 (m, 2H, $NH\underline{CH_2}$), 1.71 (m, 2H, Ar-$OCH_2\underline{CH_2}$), 1.45 (m, 6H, Ar-$OCH_2CH_2\underline{CH_2CH_2CH_2}$)

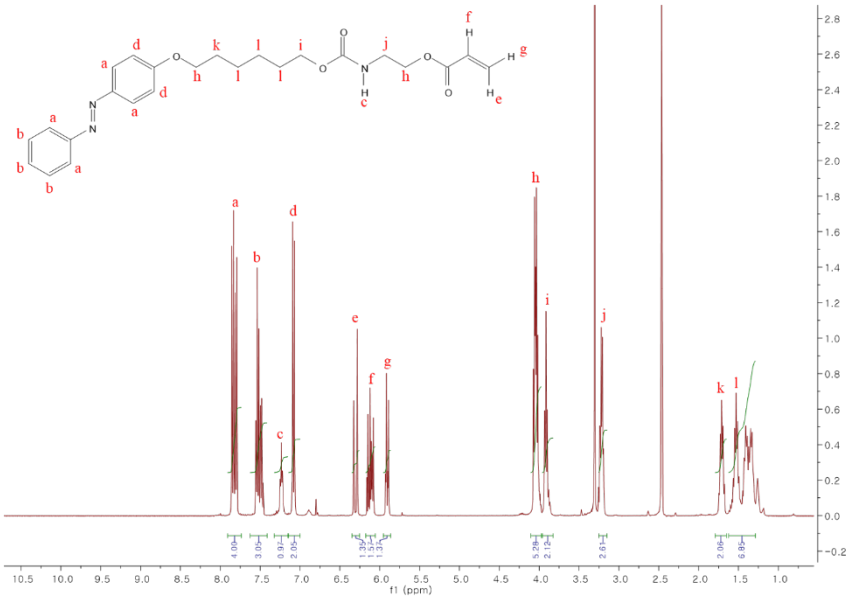

Figure S3. [1]H-NMR spectrum of azo-acrylate

1-(4-(hexyloxy)phenyl)-2-phenyldiazene (Azo-C6)

[1]H NMR (400 MHz, DMSO-d6, δ): 7.82 (m, 4H, Ar H), 7.52 (m, 3H, Ar H), 7.08 (m, 2H, Ar H), 4.02 (t, 2H, OCH_2), 1.70 (m, 2H, $OCH_2\underline{CH_2}$), 1.40 (m, 2H, $OCH_2CH_2\underline{CH_2}$), 1.26 (m, 4H, $OCH_2CH_2CH_2\underline{CH_2CH_2}$), 0.84 (m, 3H, $OCH_2CH_2CH_2CH_2CH_2\underline{CH_3}$)

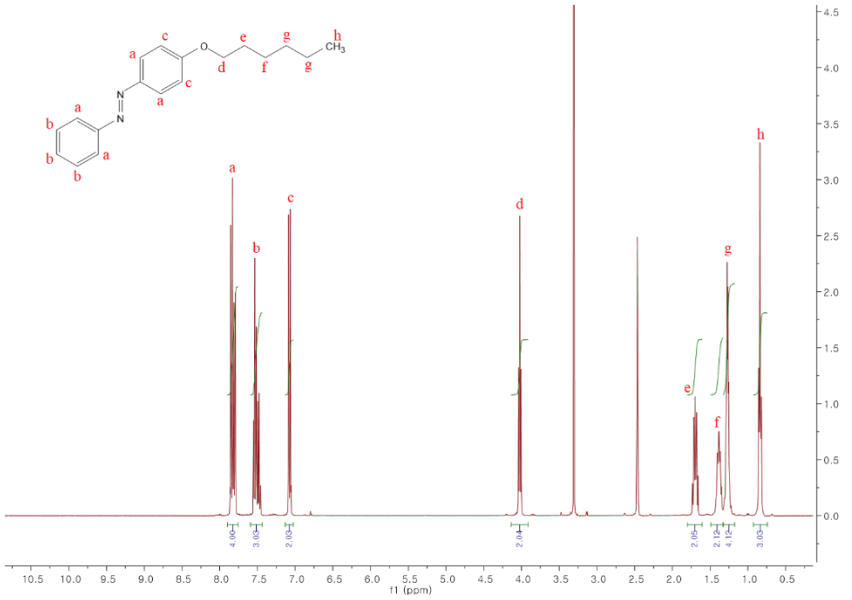

Figure S4. [1]H-NMR spectrum of Azo-C6

1-(4-(decyloxy)phenyl)-2-phenyldiazene (Azo-C10)

^{1}H NMR (400 MHz, DMSO-d6, δ): 7.89 (m, 4H, Ar H), 7.46 (m, 3H, Ar H), 7.00 (m, 2H, Ar H), 4.03 (t, 2H, OCH_2), 1.81 (m, 2H, OCH_2CH_2), 1.47 (m, 2H, $OCH_2CH_2CH_2$), 1.30 (m, 12H, $OCH_2CH_2CH_2(CH_2)_6$), 0.88 (m, 3H, $OCH_2CH_2CH_2(CH_2)_6CH_3$)

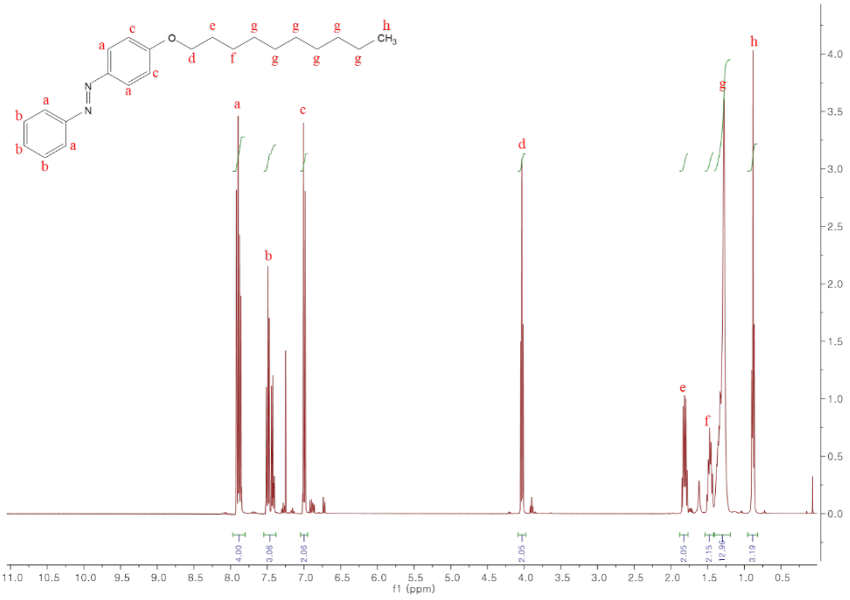

Figure S5. ^{1}H-NMR spectrum of Azo-C10

1-(4-(tetradecyloxy)phenyl)-2-phenyldiazene (Azo-C14)

^{1}H NMR (400 MHz, Chloroform-d, δ): 7.89 (m, 4H, Ar H), 7.46 (m, 3H, Ar H), 7.00 (m, 2H, Ar H), 4.03 (t, 2H, OCH_2), 1.81 (m, 2H, $OCH_2\underline{CH_2}$), 1.47 (m, 2H, $OCH_2CH_2\underline{CH_2}$), 1.30 (m, 20H, $OCH_2CH_2CH_2\underline{(CH_2)_{10}}$), 0.88 (m, 3H, $OCH_2CH_2CH_2(CH_2)_{10}\underline{CH_3}$)

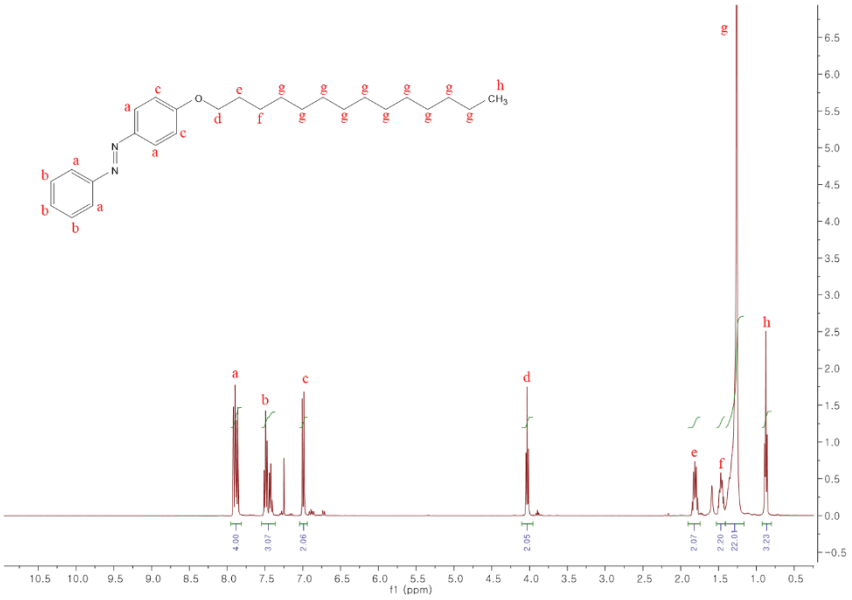

Figure S6. ^{1}H-NMR spectrum of Azo-C14

1-(4-(octadecyloxy)phenyl)-2-phenyldiazene (Azo-C18)

^{1}H NMR (400 MHz, Chloroform-d, δ): 7.89 (m, 4H, Ar H), 7.46 (m, 3H, Ar H), 7.00 (m, 2H, Ar H), 4.03 (t, 2H, OCH_2), 1.82 (m, 2H, $OCH_2\underline{CH_2}$), 1.47 (m, 2H, $OCH_2CH_2\underline{CH_2}$), 1.30 (m, 28H, $OCH_2CH_2CH_2\underline{(CH_2)_{14}}$), 0.88 (m, 3H, $OCH_2CH_2CH_2(CH_2)_{14}\underline{CH_3}$)

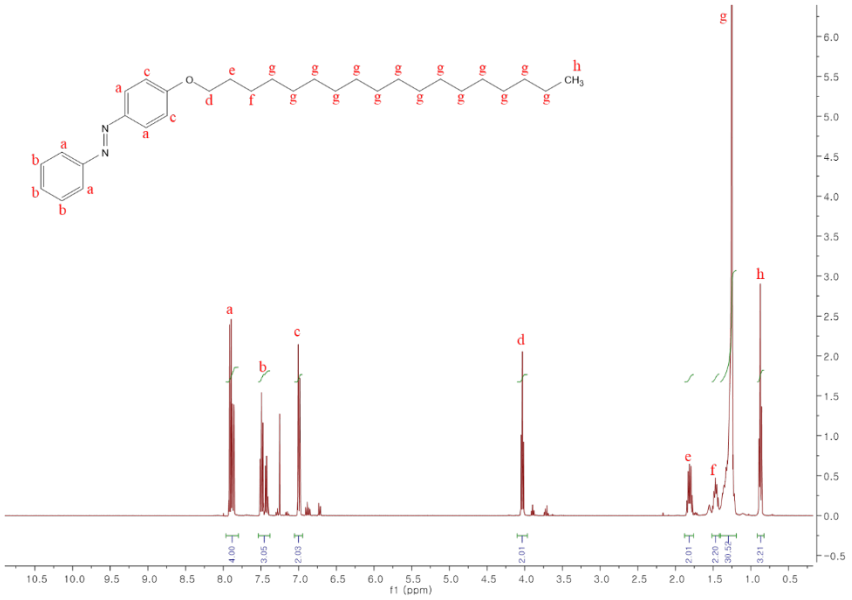

Figure S7. ^{1}H-NMR spectrum of Azo-C18

Azo-polymer (^{1}H NMR, 400 MHz, DMSO-d6)

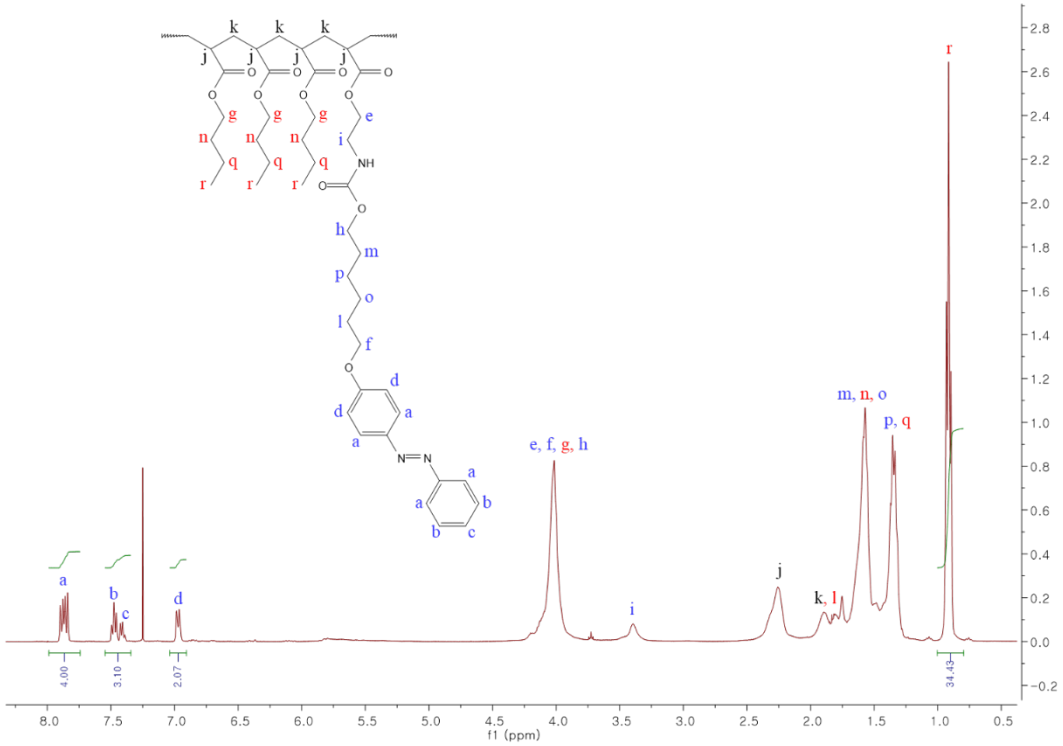

Figure S8. ^{1}H-NMR spectrum of azo-polymer

- Probe tack

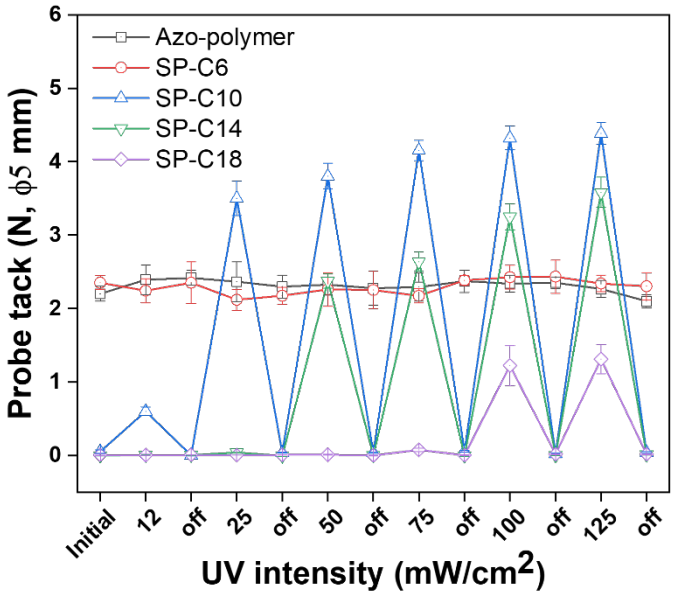

Figure S9. Probe tack forces of the switchable PSAs according to UV intensity, including switching off steps.

- Water contact angle

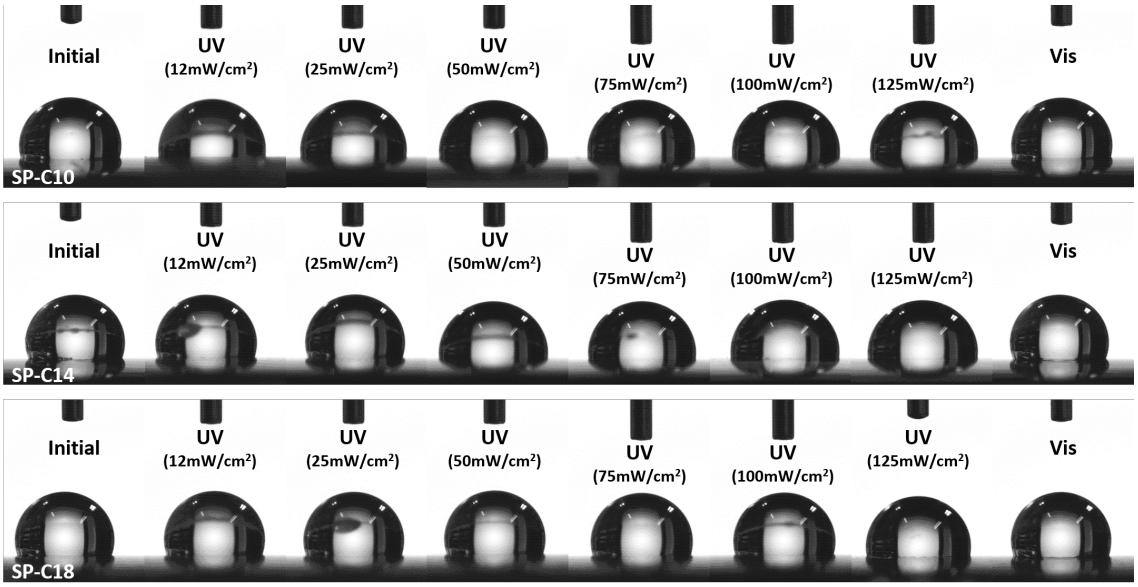

Figure S10. Images of the water droplet on the switchable PSAs according to UV intensity.