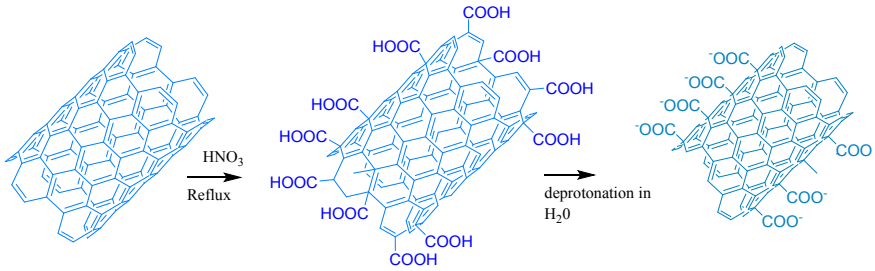
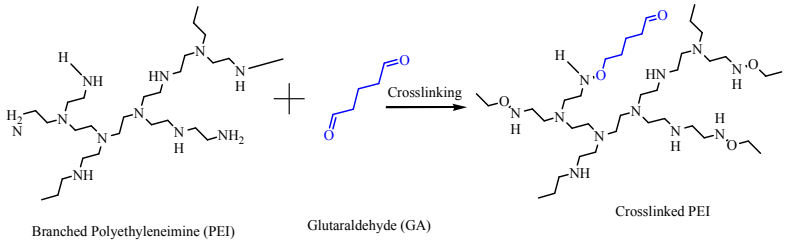
Electronic Supplementary Information (ESI)

(a) MWCNTs carboxylation.

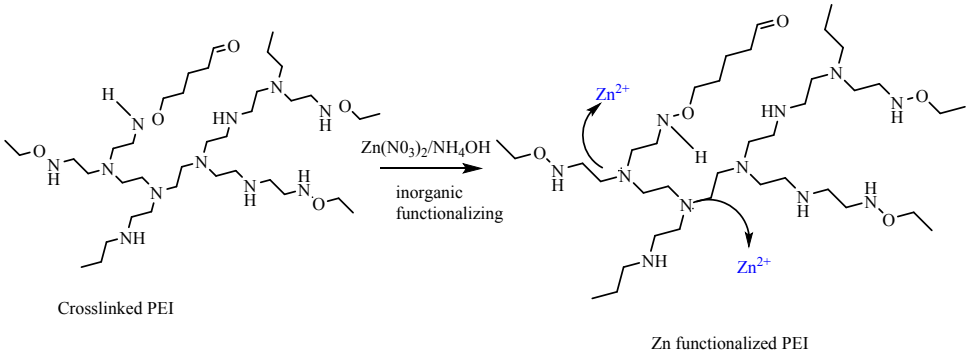


$$CNT\text{-}C\ (s) + 4\ HNO3\ (aq) \rightarrow CNT\text{-}COOH\ (s) + 4\ NO2\ (g) + 2\ H2O\ (l)$$

(b) Crosslinking of branched PEI using GA



(c) Zn^{2+} surface modification



Scheme 1. Reaction mechanism sketch for (a) MWCNTs carboxylation, (b) Crosslinking of branched PEI using GA and (c) Zn^{2+} surface modification.

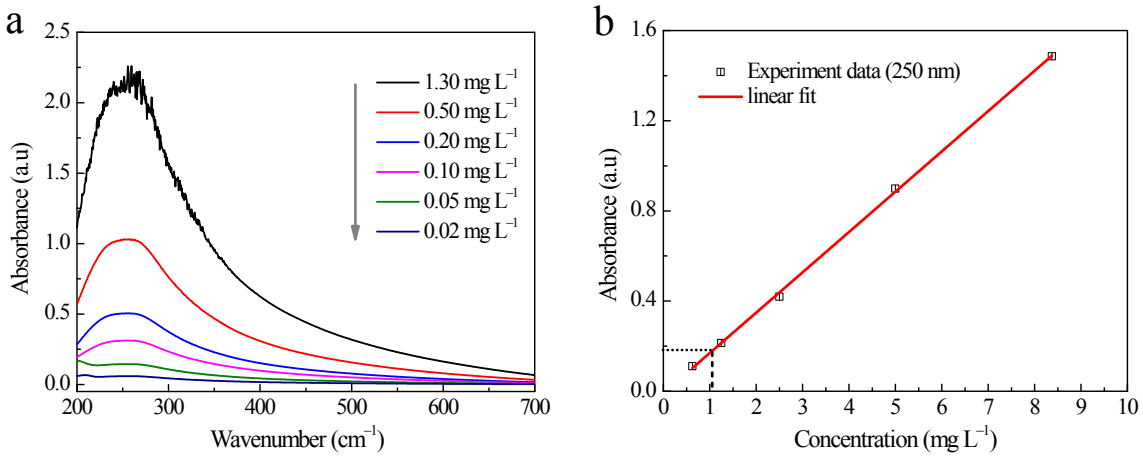


Fig. S1. a) UV-Vis absorption spectra of the different standards of the MWCNT solutions, b) calibration curve at a wavelength of 250 nm. The concentration of the diluted MWCNTs supernatant was found to be 1.04 mg/L.

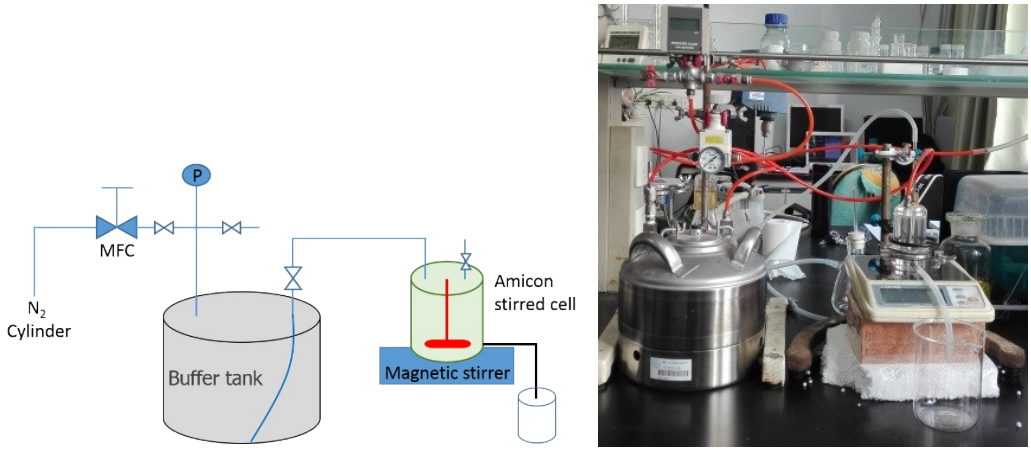


Fig. S2. The self-built experimental apparatus for the measurement of flux and rejection at well controlled pressure and stirring rate.

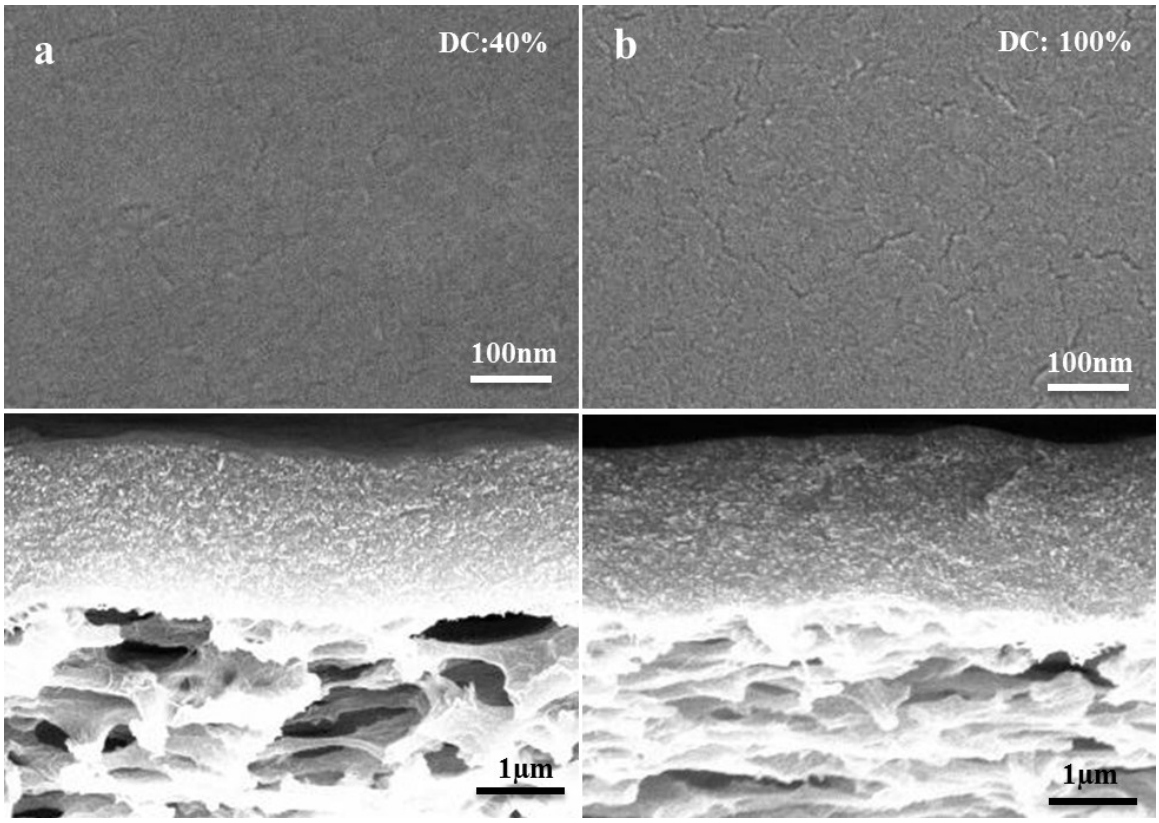


Fig. S3. Surface (top) and cross-section (bottom) SEM micrographs of the grafted MWCNT membranes using a) 40% DC and b) 100% DC PEI.

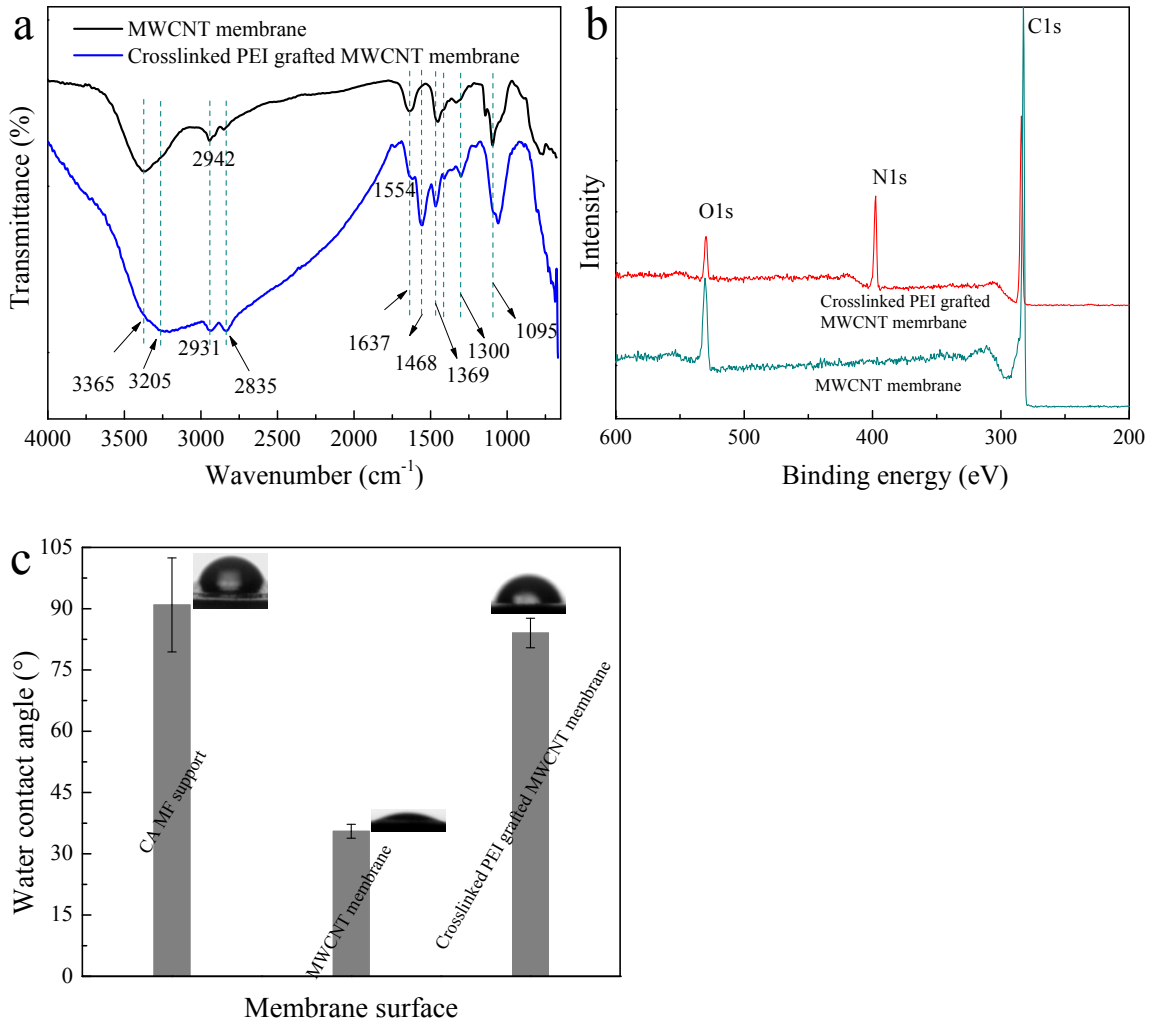


Fig. S4. a) FT-IR, b) XPS spectra and c) surface hydrophilicity of MWCNT membrane and PEI-grafted-MWCNT membrane.

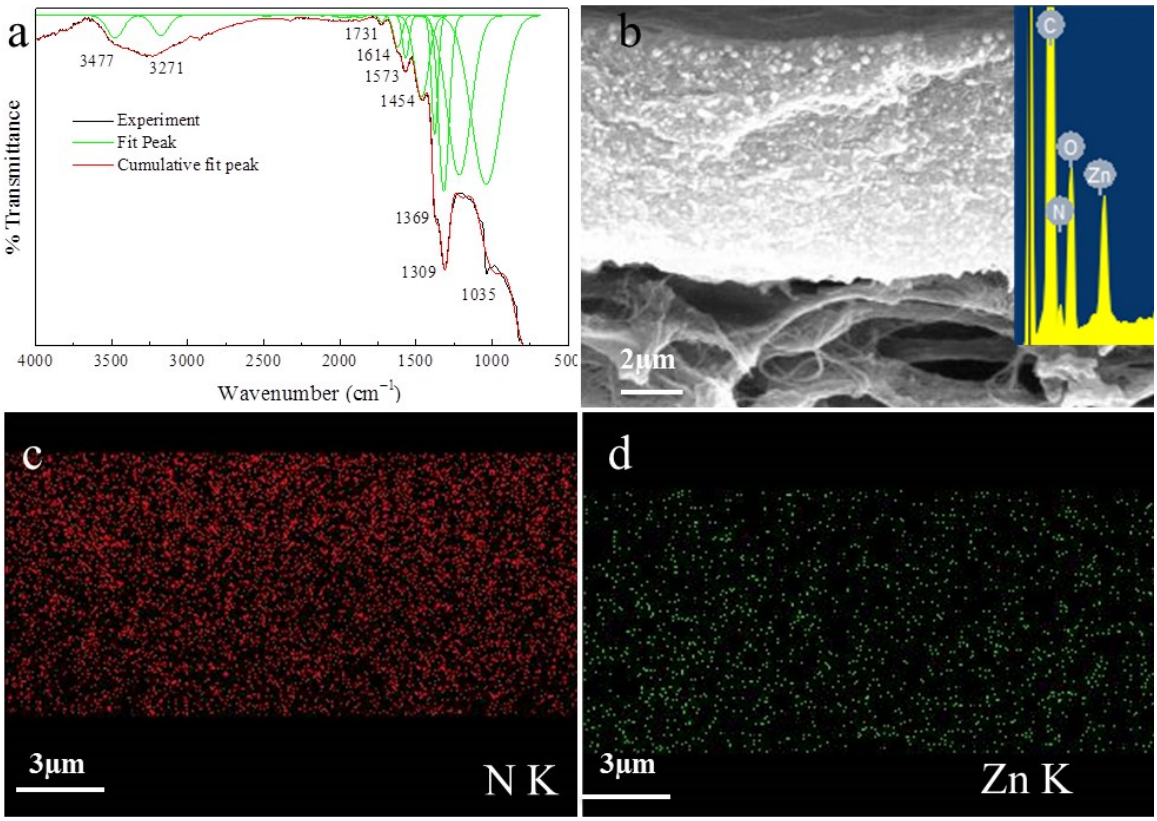


Fig. S5. a) FT-IR spectra and b-d) Cross-section SEM micrographs and elemental mapping images for N and Zn of metal functionalized membrane. Insert image in (b) is the cross section EDS spectra.

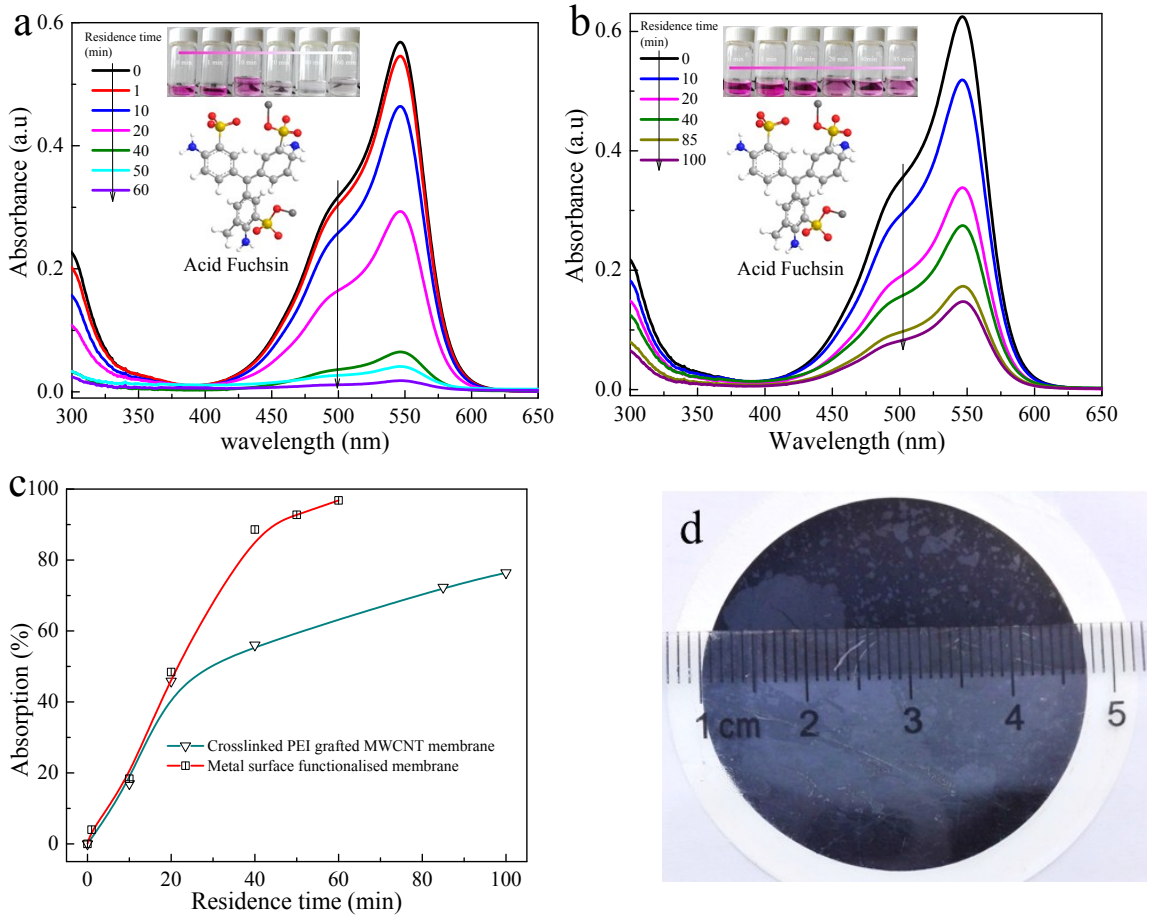


Fig. S6. UV-vis absorption spectra of Acid Fuchsin (0.02 mM, 60 mL) solution after absorption by a) metal surface functionalized and b) crosslinked PEI grafted MWCNT membrane, c) absorption performamce of the membranes, d) Representative digital photo of 47 mm membrane used for absorption experiment.

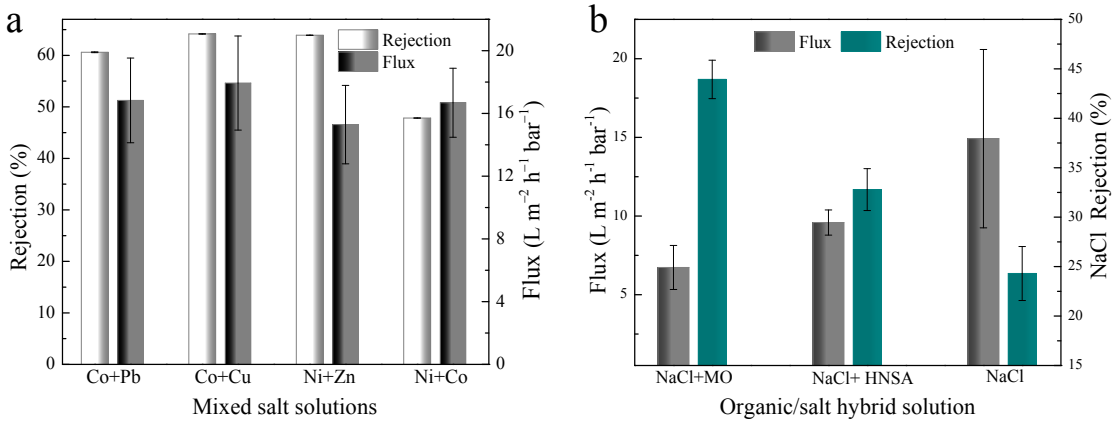


Fig. S7. a) Mixed salt retention performance b) Comparative retention of NaCl in organic-salt hybrid solutions by the metal surface functionalized membrane.

Table S1. Preparation of crosslinked PEI at 30°C.

DC (%)[a]	Preparation conditions (aqueous solutions used)[b]
10 (pH=8.47)	0.10 mL of 2.5 wt% GA solution in 4.0 mL of 10 mg mL^{-1} PEI solution, stirring for >24 h.
20 (pH=8.82)	0.10 mL of 5.0 wt% GA solution in 4.0 mL of 10 mg mL^{-1} PEI solution, stirring for >24 h.
40 (pH=8.72)	0.20 mL of 5.0 wt% GA solution in 4.0 mL of 10 mg mL^{-1} PEI solution, stirring for >24 h.
100 (pH=8.89)	0.50 mL of 5.0 wt% GA solution in 4.0 mL of 10 mg mL^{-1} PEI solution, stirring for >24 h.

a) $DC = \frac{\eta_1 \times 2}{\eta_2} = \frac{moles\ of\ GA \times 2}{moles\ of\ monomer\ of\ PEI\ (repeatunit\ of\ PEI)}$

b) PEI pH=10.38, GA pH =3.9.

Table S2. EDX analysis showing the surface elemental composition of PEI-grafted-MWCNT membranes.

	Weight (%)*			Atom (%)*			Weight			atom		
DC	C	N	O	C	N	O	O/C	N/C	O/N	O/C	N/C	O/N
MWCNT membrane	75.04	2.04	22.92	79.83	1.86	18.31	0.31	0.03	11.23	0.23	0.02	9.84
10%	65.59	23.51	10.74	69.88	21.48	8.59	0.16	0.36	0.46	0.12	0.31	0.40
20%	68.31	18.51	12.63	72.79	16.91	10.10	0.18	0.27	0.68	0.14	0.23	0.60
40%	71.57	15.59	12.80	75.69	14.14	10.16	0.18	0.22	0.82	0.13	0.19	0.72
100%	77.14	8.15	14.62	81.08	7.35	11.53	0.19	0.11	1.79	0.14	0.09	1.57

*The sum of the Weight (%) is not 100 due to the presence of traces of Cl and Pt from Pt coatings used during the SEM/EDX measurements.

Table S3. Properties and rejections of probe molecules separated by the membrane (0.1 M Zn^{2+} functionalized).

Probe molecule	MW (g mol^{-1})	Charge	Rejection (%)
6-Hydroxy-2-naphthalenesulfonic acid sodium salt (HNSA)	246.21	−	74.58±0.74
Methyl orange (MO)	327.33	−	98.94±0.19
Methylene nlue (MB)	320.	+	91.63±1.47
Acid fuchsin (ACF)	585.53	−	98.26±0.69
Congo red (CR)	696.67	−	99.89±0.07
Direct yellow 50 (DY)	956.82	−	99.73±0.15
α,β,γ,δ-tetrakis(1-methylpyridinium-4-yl)porphyrin p-toluenesulfonate (TMPyP)	1363.6	+	98.71±0.38