Supporting information

Nanofiltration membrane for bio-separation：process-oriented materials innovation

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Table S1 Bio-separation performances of various NF membranes prepared with innovate membrane materials

Membrane type	Permeance ($Lm^{-2}h^{-1}bar^{-1}$)	Separation performance	Application	Refs
NTR7450	5.3	Molasses decolorization rate: >90%	Bio-product decolorization	[1]
HNTs-SO_3H/PES	18.7	Reactive black rejection: > 90%; Na_2SO_4 rejection: <10%	Bio-product decolorization	[2]
TiO_2-HDMI modified PES membrane	15.3	Congo red rejection: 97.4%; Methyl blue rejection: 99.1%; Na_2SO_4 rejection: 6%	Bio-product decolorization	[3]
PEI-PI	37.4	Jansu green B rejection: 98.7%;	Bio-product decolorization	[4]
ZTFCMs	8.4	Erythromycin rejection: 96.5%; NaCl rejection: 14.4%	Biomolecules separation	[5]
PEI-g-SBMA/TMC	13.2	Orange GII rejection:90.6%; Na_2SO_4 rejection:50.4%; NaCl rejecton:7.1%	Bio-product decolorization	[6]
PA-PSFn	14.8	Norfloxacin rejection: >90%; NaCl rejection: <b20%	Biomolecules separation	[7]
N-hexane post-treated PA membrane	16.7	Clindamycin rejection: 95%; NaCl rejection: 19%	Bio-product desalination	[8]
Ethanol post-treated PA membrane	19.3	Clindamycin rejection: 92%; NaCl rejection: 12%	Bio-product desalination	[8]
HGMX	89.6	Rhodamine B rejection: >97%;, Methyl blue rejection: >97%	Bio-product decolorization	[9]

Abbreviations: Halloysite nanotubes (HNTs); 1, 6-hexamethylene diisocyanate (HDMI); polyimide-Extem (PI); zwitterionic polyamide thin film composite nanofiltration membranes (ZTFCMs); Sulfobetaine methacrylate (SBMA); Polysulfone (PSF); GO-based NF membrane intercalated with TiO_2 nanoparticles (HGMX).

Table S2 Fouling bahavior of various membranes and the corresponding anti-fouling mechanisms

Membrane type	Anti-fouling performance	Regulation mechanisms	Refs
PEG-4arm-NH_2/TMC	• Flux recovery ratio >90% after fouling with BSA	• PEG enhances the surface hydrophilicity	[10]
PEI-g-SBMA/TMC	• Number of *Escherichia coli* adhered on to surface is significantly lower than the control membrane	• Zwitterionic monomer provides a hydrophilic and electroneutral membrane surface	[6]
ZA-modified PA membrane	• Flux recovery ratio >99% after fouling with BSA	• Groups of ZA improve the hydrophilicity of membrane • The self-restrictive diffusion effect of PIP/ZA obtained from the reaction of PIP and ZA result in smooth membrane surface	[11]
P(AA-co-Ada)/PAH	• *Escherichia coli* and *Staphylococcus aureus* killing ratio >95%	• Quaternary ammonium salt groups on the surface inhibit the growth of bacteria	[12]
FPA/PES	• Total flux decline ratio is 9.9% and 4.9% after fouling with BSA and HA, respectively	• The covalently bonded perfluoro groups effectively lower the surface free energy of the membrane	[13]
PDADMAC-PSS	• The flux almost keeps constant after fouling with BSA for 24 h	• Biocatalytic activity removes adsorbed proteins from modified membrane surface.	[14]

Abbreviations: Polyethylene glycol (PEG); bovine serum albumin (BSA); zoledronic acid (ZA); piperazine (PIP); Poly(acrylic acid-co-1-adamantan-1-ylmethyl acrylate)/Poly(allylamine hydrochloride) (P(AA-co-Ada)/PAH); fluorinated polyamide (FPA); poly(diallyl dimethyl ammonium chloride) (PDADMAC); poly(acrylic acid) (PAA).

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