$$\Delta P_{\text{entry}} = -\frac{2\gamma_{\text{L}} \cos\theta}{r_{\text{p,max}}} \tag{8.34}$$

In eqn (8.34), γ_{L} is the surface tension of the liquid, θ is the contact angle, and $r_{\text{p,max}}$ is the radius of the largest pores of the membrane. Literature provides several examples of breakthrough pressure; for most commercially available microporous polymeric membranes, ΔP_{entry} varies between 100 and 400 kPa.[60] For a membrane having a contact angle of 130°, the penetration pressure of water through an ideally cylindrical pore with diameter of 1 μm is 185 kPa.[61]

Breakthrough pressure can be drastically reduced in the presence of organic molecules or surfactants, even at trace level; therefore, in membrane crystallization operations, the impact of fouling is not evaluated in terms of pressure drop or transmembrane flux decrease, but with respect to occurrence of wettability. Experimental practice demonstrated that, if the membrane is wetted by the liquid phase, unwetted conditions cannot be simply restored by decreasing the hydrostatic pressure.

As discussed in Section 8.7, as long as the solvent molecules of the crystallizing solution evaporate at the feed side and diffuse across the membrane, retained solutes accumulate at the membrane surface. The resulting concentration polarization phenomenon described by eqn (8.22), although not determining a significant decrease in transmembrane flux (contrary to what happens in Reverse Osmosis, where osmotic phenomena play a critical role), influences the supersaturation profile and, ultimately, the nucleation rate. As a consequence, crystallization occurring at the membrane surface requires accurate kinetic control in order to avoid excessive nucleation and consequent pore encrustation.

Abbreviations

ACM	acetaminophen
APIs	active pharmaceutical ingredients
CBZ	carbamazepine
CNT	classical nucleation theory
CSD	crystal size distribution
DBP	dibutyl phthalate
DEP	diethyl phthalate
DHP	dihexyl phthalate
DMAc	*N*,*N*-dimethyl acetamide
DMF	*N*,*N*-dimethyl formamide
DMP	dimethyl phthalate
DMSO	dimethyl sulfoxide
DPC	diphenyl carbonate
DPK	diphenyl ketone
DGM	dusty gas model
EAA	ethyl acetoacetate