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Title:

The effect of Mxene nanoflakes size to nanofiltration process via Mxene membrane

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Abstract: (Your abstract must use **Normal style** and must fit in this box. Your abstract should be no longer than 300 words. The box will 'expand' over 2 pages as you add text/diagrams into it.)

To design high-performance membranes overcoming the limitations of conventional polymeric membranes, 2D laminated membranes have been developed due to their atomic thickness and low transport resistance. Among them, MXene is recently attracting much attention for its unique physico-chemical properties. In this work, we tried to control the flake size of MXene-based nanofiltration membranes with an aim to improve the permeance while keeping their salt rejection property.

First, a Mxene (Ti_3C_2) solution was prepared by etching of MAX (Ti_3AlC_2). Then, MXene flakes were classified based on their sizes with an aid from the centrifugation at a specific rotate speed. Then, two types of membranes namely L-MXene (large flake) and S-Mxene (small flake) were fabricated by the vacuum filtration method. In filtration tests, it was found that both membranes could reject the organic dyes having molecular weight of 452 Da greater than 90%. However, the S-MXene membrane exhibited a far higher water permeance (~ 34 L m^{-2} h^{-1} bar^{-1}) than that of L-MXene membrane (~ 2.5 L m^{-2} h^{-1} bar^{-1}) while keeping the similar rejection rate. It is ascribed to a less tortuous pathway of S-MXene laminate as compared to L-MXene laminate. Meanwhile, since the rejection property of 2D laminate membranes is governed by the interlayer spacing of MXene layers, the small MXene flakes did not give any negative impact on the rejection performance. Apart from this, the S-MXene membrane also displayed a promising potential in organic solvent nanofiltration (OSN) due to their excellent stability. For example, the S-MXene membrane exhibited the IPA permeance of 10 L m^{-2} h^{-1} bar^{-1} along with the organic dye rejection (orange G ~ M_W: 452 Da) of 92.7%. The membranes were also able to be operated in other organic solvents.

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