RECLAMATION Managing Water in the West

Improved Cellulose Acetate Membrane

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Abstract

The transport properties of cellulose acetate (CA) membranes have limitations due to polymer impurities that may act as sites for salt leakage. A patented polymer modification has produced CA membranes with lower salt passage (SP).

Background

CA membranes developed during the 1960s and were first type of membrane used in commercial RO. Today, water desalination membranes are predominantly polyamide (PA).

CA advantages to PA membranes

- Less expensive
- Less organic and biological fouling potential
- Much more resistant to chlorine

CA disadvantages to PA membranes

- CA polymer impurities cause more salt passage (SP)
- Lower productivity

Discussion

AFM imaging of commercial CA polymer displays "Rod-Like" polymer impurities as seen in Figure 1.

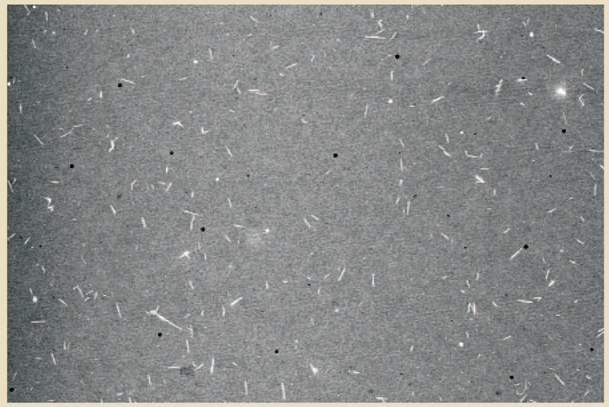

Figure 1. "Rod Like" CA polymer impurities of commercial polymer

Polymer modification removes these "Rod-Like" impurities as seen in Figure 2.

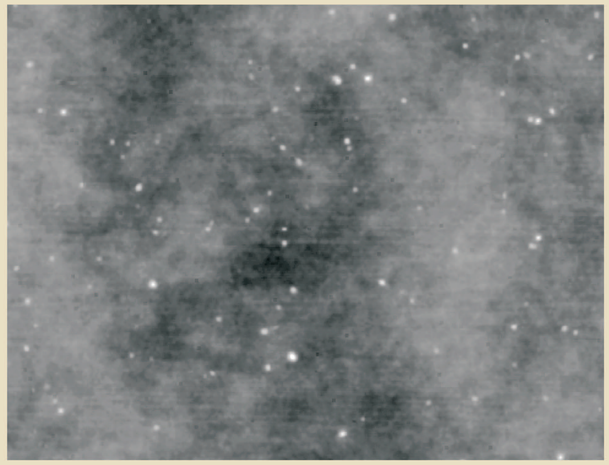

Figure 2. BOR modified CA polymer without "Rod-Like" impurities.

Bench Test

The hypothesis that CA polymer impurities cause lower transport properties is proven by swatch test results which indicate 50% decrease in salt passage and gain in membrane productivity. The results are displayed in Figures 3 and 4, respectively.

Pilot test

Completed scale up of polymer modification and tested 2.5 by 40 inch CA element against a commercial control membrane. The same casting formulation and materials were used for both membrane types with the exception of the CA polymer, which was modified and used for Reclamation membrane. Salt transport across the membrane decreases threefold while productivity remains about the same for Reclamation membrane when compared to the commercial control membrane. Figures 5 and 6 display salt passage and productivity, respectively for the pilot test.

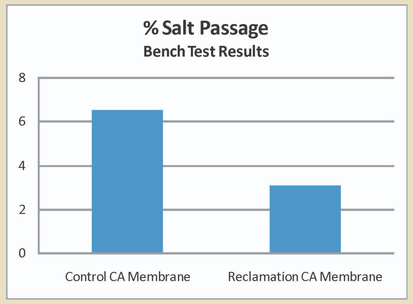

Figure 3. Bench test salt passage

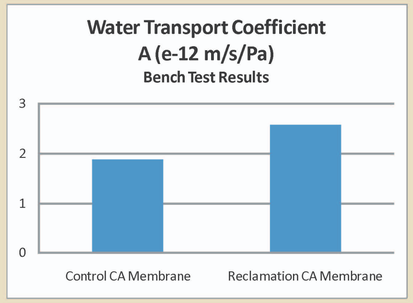

Figure 4. Bench test water productivity

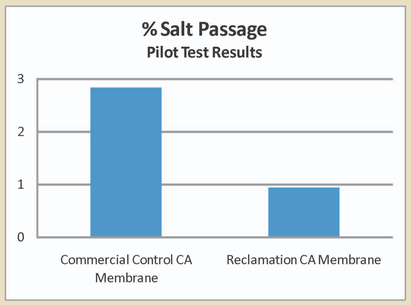

Figure 5. Pilot test Salt Passage

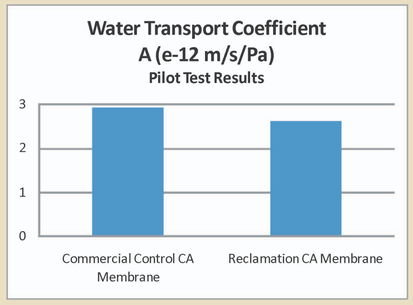

Figure 6. Pilot test water productivity

Conclusion

Reclamation CA polymer modification improves CA membrane transport properties. Threefold decrease in salt passage observed with reclamation produced CA membrane.