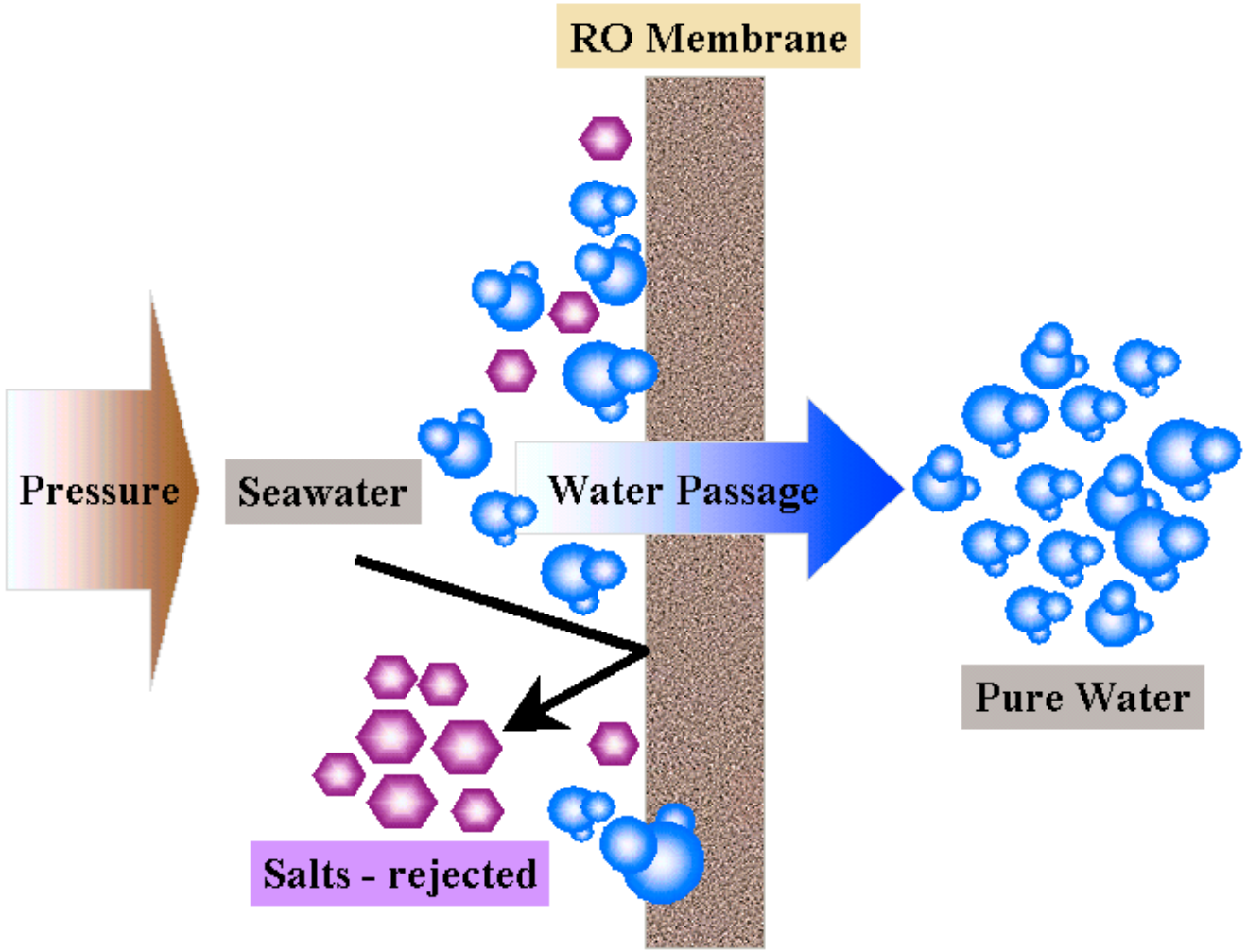
Omya Advanced Remineralization Process

Jarrod Massam – Director of Market Development & Innovation

THINKING OF TOMORROW

omya.com

Properties of Desalination Permeate



- 85 – 99 % of dissolved ions rejected
- Low pH (pH 4-6.5)
- Lacking in Alkalinity – minimal buffer capacity
- Low in mineral content (Ca^{2+} and Mg^{2+})
- Acidic and aggressive

This document contains proprietary information which shall not be used and disclosed without Omya explicit written authorization

Need for Remineralization

- Corrosion of water infrastructure:
  - $500 billion over 25 years (AWWA 2012)
- Release of toxic ions
  - Heavy metals (Cu^{2+}, Pb^{2+}, Cd^{2+}, Cr^{2+})
  - ‘Red water’ incidents (Fe^{3+})
  - Flint, Michigan – Lead poisoning
- Health
  - Consumption leads to elimination of important ions
  - Dental
  - Reduction in intake of essential minerals (Ca^{2+}, Mg^{2+})

This document contains proprietary information which shall not be used and disclosed without Omya explicit written authorization

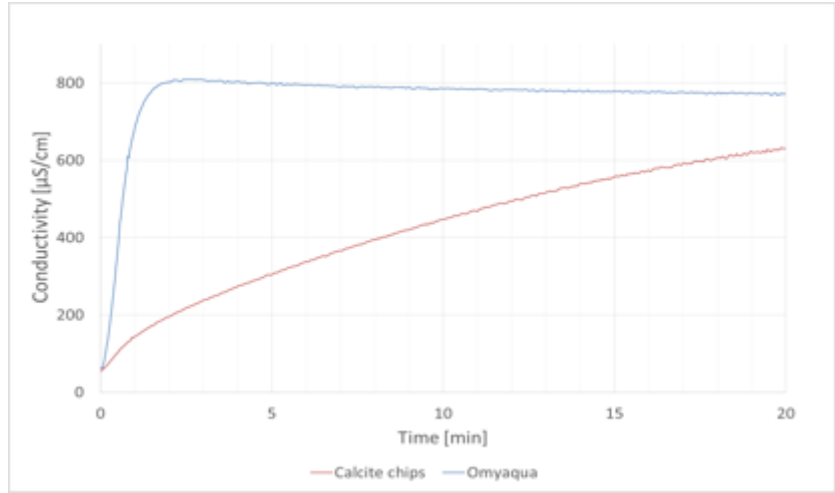
Drawbacks of Current Processes

Direct Chemical Dosing	Lime Dosing	Calcite Contactors
Calcium Chloride ($CaCl_2$) Sodium Bicarbonate ($NaHCO_3$)	Lime ($Ca(OH_2)$) Carbon Dioxide (CO_2)	Calcium carbonate chips ($CaCO_3$) Carbon Dioxide (CO_2)
High operating cost Unwanted counter ions Focused on LSI Difficult to maintain stability	High cost Waste by-product No Carbonate Difficult to maintain stability	Slow reaction kinetics Poor CO_2 efficiency Large plant footprint

mya explicit written authorization

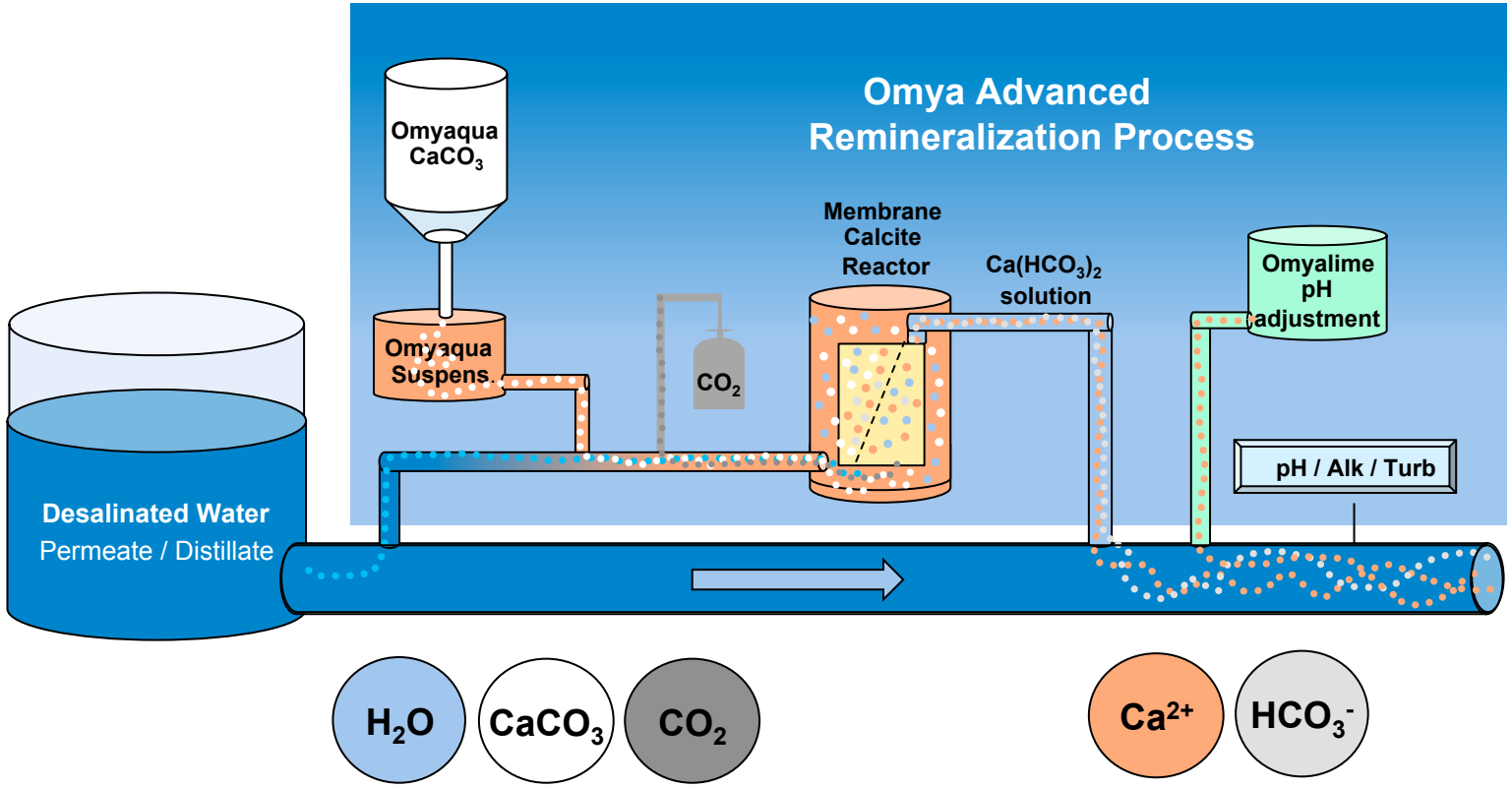
Remineralization Process Development

- World leader in industrial minerals
- Providing (re)mineralization products and solutions for over 40 years
- Supply granular calcium carbonate and dolomite products in Middle East, North America.
- Process development driven by product and engineering expertise
- Solution = **Omya Advanced Remineralization Process**



This document contains proprietary information which shall not be used and disclosed without Omya explicit written authorization

Innovative New Remineralization Process

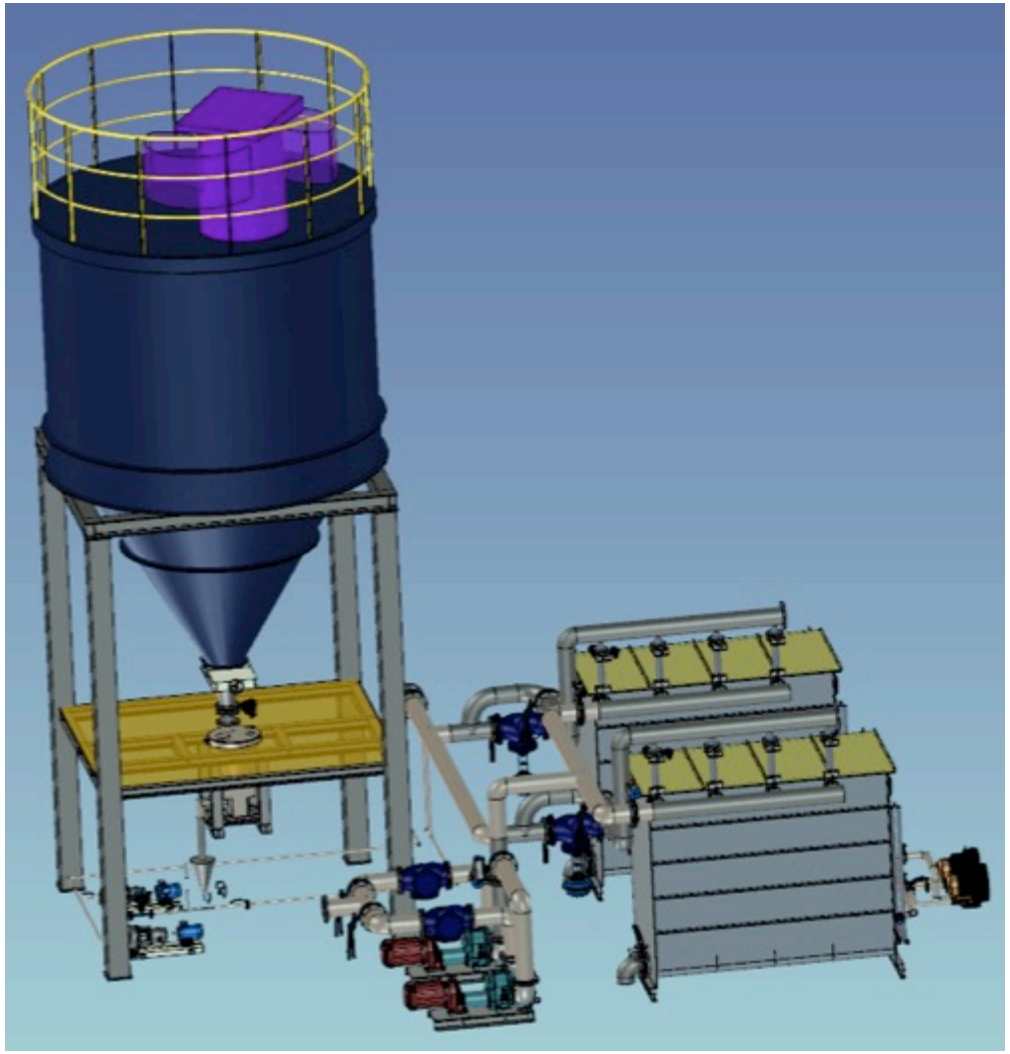


$$CaCO_3 + CO_2 + H_2O \rightarrow Ca^{2+} + 2\ HCO_3^-$$

This document contains proprietary information which shall not be used and disclosed without Omya explicit written authorization

Advantages of OARP

- Reduced plant footprint
- Reduced CAPEX
- Reduced OPEX
- Modular design
- High CO_2 efficiency
- Turbidity free water



This document contains proprietary information which shall not be used and disclosed without Omya explicit written authorization