

INTRODUCTION

Unfiltered colloids such as bacteria, organic molecules, and suspended solids, along with mineral scale precipitation and biofilm, constitute serious fouling problems for membrane separation systems, including reverse osmosis (RO) systems.

Membrane fouling causes loss of permeate production, high energy costs, and reduction of membrane life by frequent chemical cleaning.

The Zeta Rod™ has been proven successful as a pretreatment or preconditioning methodology to prevent membrane fouling.¹ And in most cases installation of a Zeta Rod system initiates a “cleaning in place” that restores much productive capacity in a relatively short time period.



Figure 1: The Zeta Rod™ protects a wide range of Reverse Osmosis units, including this system used for drinking water production in the Caribbean.

Zeta Rod components and configurations are available for installation on the full range of membrane separation systems.

A typical RO application uses one or more Zeta Rods in the feed line on the suction side of the high

1. Romo, Rodrigo F. V. and Pitts, M. Michael, “Reverse Osmosis Fouling Controlled by Electronic Modification of Particle and Surface Charge,” presented at the Annual Meeting of the American Institute of Chemical Engineers, New Orleans, LA, September 1998.

pressure pumps. In larger capacity systems, additional electrodes are placed between filter stages.

BENEFITS

Zeta Rod systems produce the following benefits on membrane separation systems:

- **Energy Savings.** The Zeta Rod significantly reduces membrane fouling, which allows the system to operate at lower feed pressures and with a lower pressure differential, using less power to produce the same amount of permeate.



Figure 2: A membrane “autopsy” clearly shows the difference between fouled (left) and unfouled (right) membranes.

- **Extended Membrane Operating Life.** Every chemical cleaning reduces the life of RO membranes. The cleaning process requires taking the RO system off-line, is labor intensive and requires handling hazardous acids and alkalis. By reducing cleaning frequency, the Zeta Rod helps extend membrane life, increases productivity, and reduces chemical and labor costs.
- **Reduction or Elimination of Chemical Dispersants.** The Zeta Rod helps prevent fouling in the absence of chemical dispersants by interfering with the attachment of particles to wetted surfaces.

Membrane Fouling Prevention in RO Systems with the Zeta Rod™

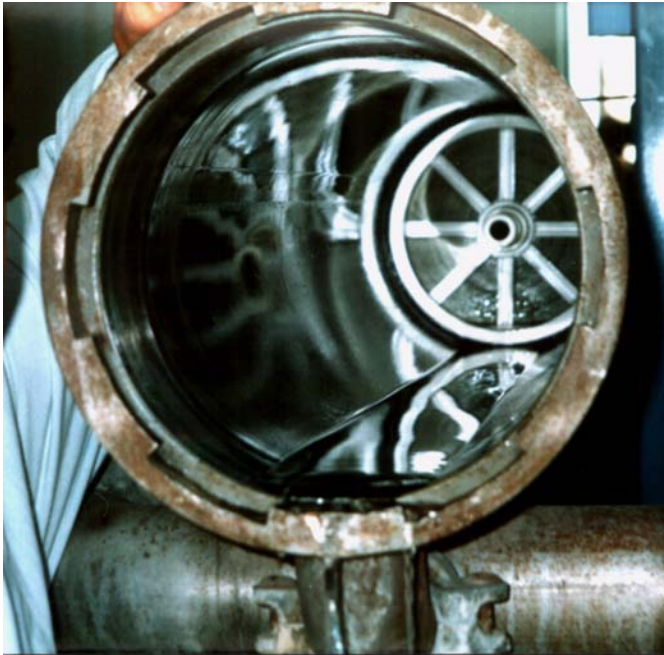


Figure 3: After three months of operation with the Zeta Rod, vessels show no signs of the biofouling that previously plagued this RO system used in pure water production in a beverage plant.

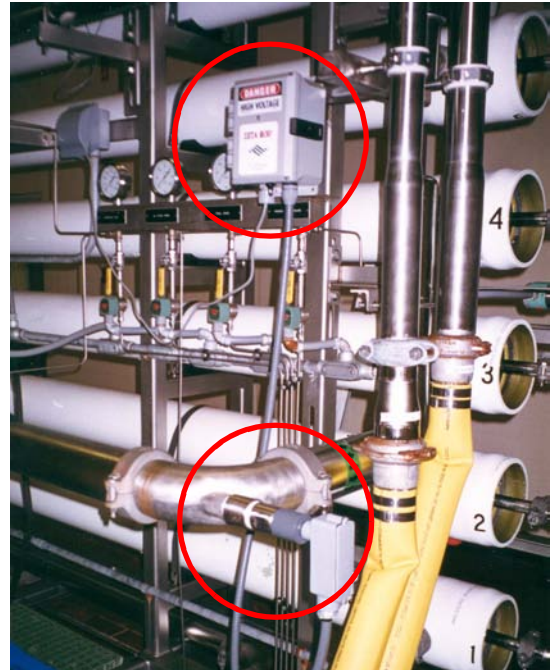


Figure 4: The Zeta Rod electrode (bottom circle) is installed in the feedwater line on the pressure side of the high-pressure pump. The power supply (top circle) can be mounted in any convenient location nearby.

System	Capacity (gpm)	Cleaning Cycle (weeks)		Permeate Rate (gpm)		Feed Pressure (psi)		Transmembrane Pressure Drop (psi)		Notes
		Before	After	Before	After	Before	After	Before	After	
Research Facility	5	2	32	4 - 1	4 - 3.5	no data	no data	no data	no data	High organic load in feed water
Soft Drink Plant	120	12	>52	90 - 80	100 - 90	300	270	90	80	5 year old TFC membranes
Micro-electronics	100	2	>24	90	99	308	266	266	220	Eliminated chemical dispersants
Corn refinery 1	160	3	no data	150	163	260	248	100	90	New membranes at installation
Corn refinery 2	160	3	no data	125	135	300	270	100	75	Old membranes at installation

Table 1: Results obtained with the Zeta Rod System on Reverse Osmosis units of various capacities and applications.



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