Molecular Filtration, Inc.
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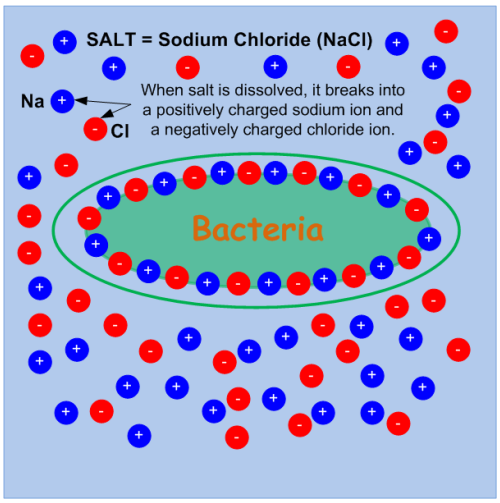
THE SCIENCE OF SMALL PARTICLES & LARGE MOLECULES®

Re-cycle Water
Oil & Gas Industry
High Salinity – Solution to Bio-fouling
Enhance Oil Recovery

Re-cycle high salinity water for the oil & gas

Enhance oil recovery of oil and gas well using high salinity re-cycle water to prevent biofouling



Presented by:

Felipe Lembcke – Chemical Engineer, President and CEO of Molecular Filtration, Inc.

This document presents the explanations of why recycle water with high salinity from the oil & gas makes sense for re-injection. By Molecular Filtration, Inc. and its scientists Dr. Eduardo Gomez-Maqueo and Felipe Lembcke

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THE SOLUTION
IS IN THE PROBLEM

INTRODUCTION

How and why exactly sodium chloride does affect microorganisms? or bacteria?

All organisms with a semi permeable membrane are subject to osmotic pressure, or the effect of water moving in and out of the cell. Bacteria have a cell membrane and a cell wall. Bacteria must live in an aqueous (watery) environment. Most often this is a hypotonic environment, in other words, the concentration of water outside the cell is greater than the concentration of water inside the cell. This causes the net movement of more water into the cell than outside. If the bacterium did not have a cell wall, this could cause the cell to burst. (In fact, many antibiotics work by causing an ineffective cell wall to be made, which allows the bacterial cell to burst under water pressure). So why does salt work as a preservative? Because when the outside environment around a cell is salty, then the concentration of water in the solution is less than inside the cell and water tends to leave the cell. This causes the cell to dehydrate, which eventually kills the cell. By subjecting bacteria to a salty environment, it keeps them from growing.

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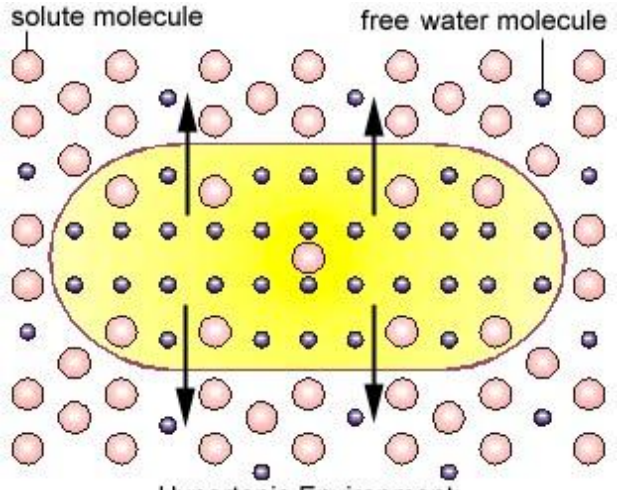
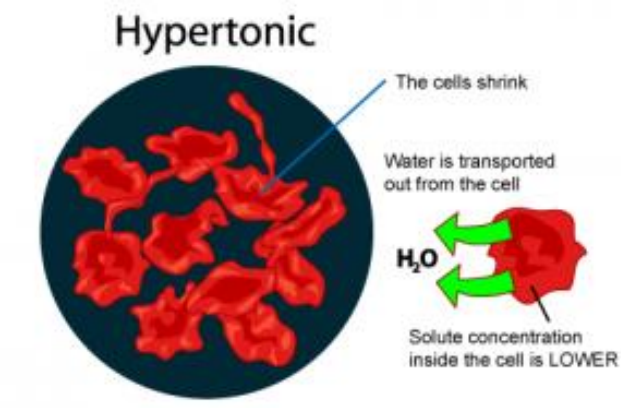
The main effect of salt as a preservative is that it withdraws water from micro-organisms if the external salt concentration is high enough. The microbes would shrivel and die; spores would not be killed but would not be able to germinate.

THE PRINCIPLE OF HYPERTONICITY

Hypertonic refers to greater than normal concentration. In biology, a hypertonic solution is one with a higher concentration of solutes outside the cell than inside the cell (bacteria). When a cell (bacteria) is immersed into a hypertonic solution, the tendency is for water to flow out of the cell (bacteria) in order to balance the concentration of the solutes.



Hypertonic Environment:
The solute concentration is greater outside the cell; the free water concentration is greater inside. Free water flows out of the cell.



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BE GREEN

REDUCE BIOCIDES

RE-CYCLE

PRODUCED WATER

The answer is on the problem. Most of the time, we overlook the ability of nature to take care of problems by itself.

We try to outsmart nature when we attempt to disrupt the natural balance and efficiency in which she works.

Most of the water we inject in the oil fields takes a considerable amount of biocides, this being the single factor that we use to prevent the bacteria growth in the oil well.

Naturally, we can inject the treated produced water with high salinity and it will do a better job in controlling bacteria growth by killing bacteria and micro-organisms by the principle of hypertonicity.

Osmotic Pressure. If a microbial cell is in a solution in which the concentration of solutes is higher than that found in the cell, cellular water passes through the cytoplasmic membrane in the direction of the high solute concentration. Due to the loss of water, the cytoplasmic membrane collapses away from the cell wall, which is called plasmolysis.

With its unique capabilities to reject bacteria

Molecular Filtration, Inc. organophobic ceramic membranes contribute to the environment by reducing the use of biocides.