VEOLIA

Upstream Oil & Gas

Sulphate Removal and Water Injection

WATER TECHNOLOGIES

Sulphate Removal and Water Injection

Water is injected into the reservoir to enhance oil recovery (EOR) by maintaining the reservoir pressure and to sweep displaced oil towards the production wells.

Where oilfield reservoir formation water contains significant amounts of barium and/or strontium, injection of seawater can cause barium and strontium sulphate scale to be formed. These scales have the effect of reducing reservoir permeability and can also become deposited in production pipe internals.

Barium and strontium sulphate scales are notoriously difficult to remove since they cannot be easily dissolved. Squeeze inhibition treatments are often utilised to improve the well permeability but these are extremely difficult to control and cannot be applied to complex sub-sea networks or from floating production storage and off-loading vessels (FPSOs). Where pipeline scaling is experienced, this has to be removed by mechanical means.

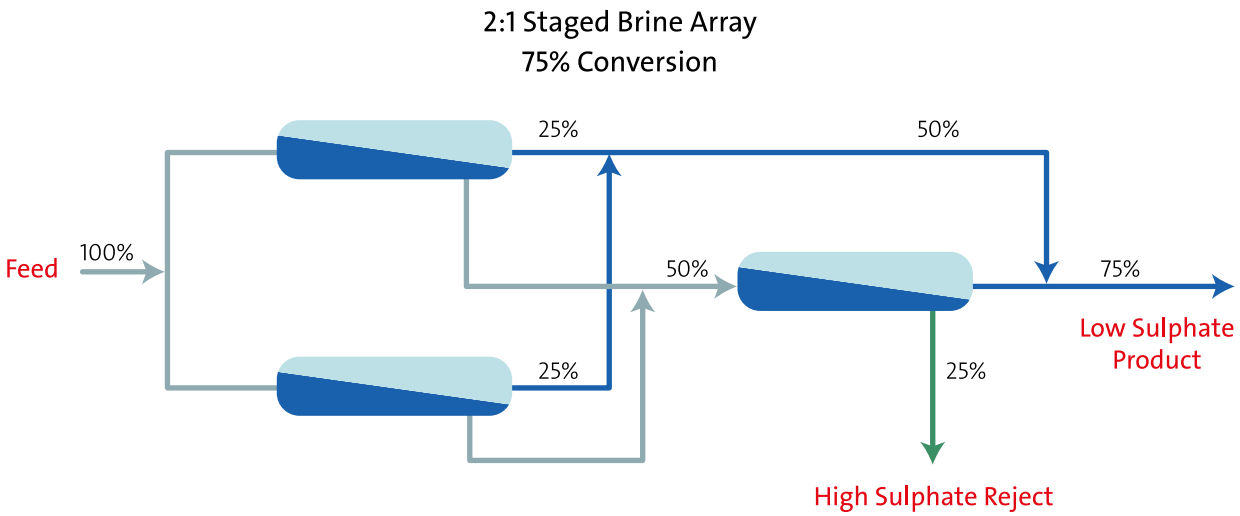
Our Solution

As an alternative to the removal of scale by mechanical means, the installation of a Sulphate Removal Plant (SRP), to extract the sulphates from the seawater prior to injection, is often seen as the most economical approach. The SRP uses nano-filtration membranes (FilmTec™ brand SR-90 MEMBRANE ELEMENTS) to remove the sulphates while leaving the other salts (sodium, chloride etc.) substantially unaffected, thus maintaining the stability and permeability of the formation clays. The Marathon Oil Company, using membranes supplied by Dow Chemical Company, invented the process.

How it works

The membranes are typically configured in an SRP with a “2-array, brine staged” arrangement. With this arrangement, the seawater feed is introduced to the first array of membranes which allows 50% of the feed to pass through the membrane material with the sulphate being rejected on the membrane surface. The 50% reject water (or brine) is then fed to the second array of membranes where again 50% passes through as low sulphate water. The two flows of low sulphate water are blended to give an overall recovery of 75% with the remaining 25% of increased sulphate reject being safely discharged overboard without endangering the environment.

Membrane arrangement



Benefits

- Reduces seawater sulphate (SO_4) concentration from around 2,500 ppm to less than 50 ppm (at temperatures of < 24ºC).
- Significantly reduces sulphate scale precipitation in production wells
- Reduces the quantity of scale inhibitor required downhole and in topsides equipment
- Eliminates economic and operational impacts resulting from scaling in reservoir
- Increases productivity index by limiting pipe constriction due to scaling
- Assists in maintaining reservoir permeability by limiting formation plugging caused by scaling
- Prevents well souring by controlling sulphate reducing bacteria (SRB) which in turn reduces equipment corrosion problems and the equipment required for scrubbing, removal, and handling of hydrogen sulphide
- Reduces safety hazards associated with hydrogen sulphide
- Has an additional safety benefit by reducing scale and thus the potential of naturally occurring radioactive material which can be attached to the scale
- Meets the stringent design and environmental criteria related to offshore platforms

Resourcing the world

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