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## Pilot-Scale Study of the Radiation-Induced Silica Removal from Underground Brackish Water in Saudi Arabia

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### Background of the study:

Brackish underground water desalination is the second main water supply, after seawater desalination, used in the Kingdom of Saudi Arabia. Most of the inland cities and villages rely entirely on this supply mode for their domestic industrial and agricultural purposes. High silica concentrations are found in these waters and can cause an excessive and recalcitrant deposit on the membrane fouling in the reverse osmosis (RO) units. This membrane fouling is a worldwide problematic issue in the cost-effective operations in water desalination plants.

### Methodology:

In this work, we investigated the effectiveness of the gamma radiation induced removal of silica in water sample from the Salbukh water treatment plant (near Riyadh, Saudi Arabia). A cobalt-60 source was used to gamma-irradiate the acidic pH solution containing silica mixed with metal iron powder and saturated with oxygen pure gas before irradiation. The radiolytically produced hydroxyl radicals  $\text{OH}\bullet$  oxidize the iron metal into ferric ions which co-precipitate with the silica resulting in the removal of this latter.

### Results:

The influence of several reaction parameters i.e iron powder dosage, radiation dose, initial pH and equilibrium pH effects were investigated. The removal increased with the irradiation dose and reached a plateau at 350-400 Gy. For a percentage removal as high as 75% obtained in this work, the optimal conditions of the main reaction parameters studied here, were the following:

- the optimum initial pH is 2-3,
- the removal increased with increasing pH up to the pka of the silicic acid.
- Fe0 dosage: 8 g/l.

### Conclusion:

This preliminary study showed that this environmentally friendly gamma radiation process is effective in silica removal from underground water. This process could be implemented in arid regions in Saudi Arabia, where population has a limited access to fresh water.

## Country/Organization invited to participate

Algeria

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