



## Water treatment - hardness

### Do you have any of these problems?

- water will not lather with soap
- scum build up on sinks and basins
- hard deposits in hot water systems and kettles
- encrustations in irrigation equipment, domestic pipes and fittings

If you do, you may have water that is too hard!

### What is water hardness?

Hardness has been referred to historically, as the capacity of water to lather with soap. It is caused by the soap consuming properties of some ions in the water. These are mainly calcium and magnesium ions and they are derived primarily from bicarbonates and sulphates of calcium and magnesium.

Total hardness consists of temporary or carbonate hardness and permanent or non carbonate hardness. The former is removed by boiling, the latter is not. The scale formed inside kettles is the temporary hardness removed from the water by boiling.

The removal of hardness is referred to as water softening.

### Hardness limits

Water hardness is defined in terms of calcium carbonate (CaCO<sub>3</sub>) and is expressed as the total amount of this compound in milligrams per litre of water ie. mg/L.

The hardness limits generally adopted in Queensland are :-

soft but possibly corrosive	0 - 60 mg/L
acceptable	60 - 200 mg/L
increasing scale problems	200 - 500 mg/L
severe scaling	> 500 mg/L

Corrosion problems may result from soft water, but they are usually combined with other factors like pH, alkalinity and dissolved oxygen.

Whilst it is desirable to limit domestic water hardness to between 60 and 200 mg/L, some acceptable levels of hardness for farm use are:-

Dairy equipment	150 mg/L
Hot water systems	200 mg/L
General domestic use	200 mg/L
Dips and sprays	300 mg/L

Hot water systems are susceptible to encrustations, as carbonates readily precipitate out of solution at high temperatures; and hard deposits form on pipe walls causing blockages.

Hard water with salinity levels greater than 1000 mg/L and with chloride levels greater than 600 mg/L will require desalination before softening; and water containing iron should be treated to remove the iron before softening.

### What happens in a softener?

A water softener, sometimes referred to as a water conditioner, contains an ion exchange medium consisting normally of organic resins.

When hard water is passed through this medium, the calcium and magnesium ions are replaced by sodium ions. Treatment works best when the pH is between 7 and 8.

After all the sodium ions have been used, regeneration of this exchange medium is necessary. This is carried out by passing a brine solution through the resin to remove calcium and magnesium ions and replace them with sodium ions. The resins will last for a number of years if regular recharging is undertaken. If a build up of iron scale occurs then acid treatment may be necessary. Bacteria can also grow on the resins if

regular recharging is not undertaken. The safe disposal of the brine solution after regeneration is important.

With some water a rearrangement of ions could alter the taste, so that it is less palatable. However its suitability for domestic purposes should remain unchanged.

There are a number of commercial pressure water softeners on the market. They can be one-tank manual operations or two-tank systems that are automatic.

In large scale projects, where water is softened to less than 60 mg/L and then stored before use, corrosion of metal or concrete tanks and other equipment may occur. This is not normally a consideration with domestic water treatment, however seek immediate advice if you experience any corrosion problems.

## **What a water softener does not do**

The exchange process in a water softener does not alter the total amount of dissolved salts and so the salinity of the water will be unchanged by this process.

Softeners are not designed as filtration or chlorination units. Other treatment methods should be used to remove suspended or biological matter.

## **Other softening methods**

The lime-soda softening process is one alternative that can be used but due to complexities associated with settlement times and controlling pH levels, the process is not generally recommended for domestic water supplies.

Reverse osmosis (RO) units will remove the salts which cause water hardness, but osmosis units would not normally be used solely as water softeners due to their high purchase and operational costs. If water is both salty and hard, then RO units can be considered.

## **Water analysis**

A complete water analysis is necessary before undertaking any water treatment. The correct sampling methods and where you can have the water analysed are outlined in Water Facts Sheet 'Sampling Your Water Supply'.

## **Assistance**

Assistance with all aspects of your water supply, irrigation or drainage scheme is available from the Rural Water Advisory Services of the Department. Full details of the available services and charges can be obtained from your local Natural Resources office. ■