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Integrated CSG Water characterisation, management, and treatment options at QUT

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Introduction

Coal Seam Gas (CSG) recovery requires the extraction of associated groundwaters (CSG Water) which may contain considerable quantities of dissolved salts. At QUT, an integrated approach is being taken to assess the genesis, characterisation, health & environmental implications of CSG Water, as well as treatment and management options. This approach aims to assist in maximising the resource potential of CSG whilst minimising the total footprint.

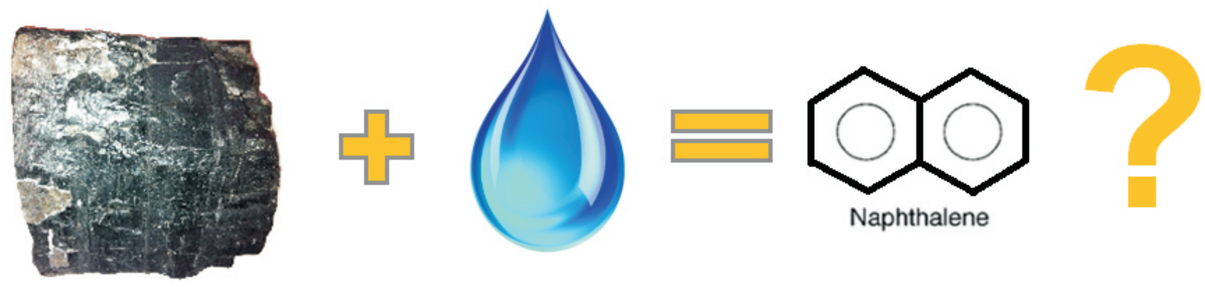

Figure 3. Adaptation of toxicity leaching tests to assess the dissolved organic content of CSG Waters

CSG Water characterisation

CSG waters have a specific geochemical signature which is a product of their formation. Typically, CSG Waters have high bicarbonate, high sodium, low calcium, low magnesium, and very low sulphate concentrations. Additionally, chloride concentrations may also be high. This particular signature (Figure 1) is useful for exploration purposes and also highlights the potential challenges that arise as a consequence of disposal. Minor constituents of concern in CSG Water may include boron, fluoride, and organic compounds (depending on the basin). QUT is taking an integrated approach in understanding the controls on CSG Water chemistry. Understanding the mechanisms that control the absence or occurrence of dissolved inorganic and organic constituents will support exploration and environmental management.

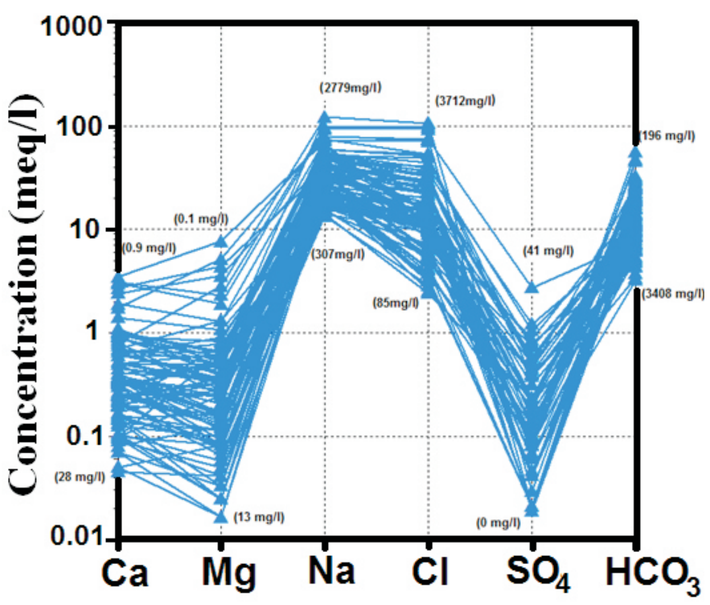

Figure 1. Schoeller diagram for selected CSG Water samples from the Surat Basin Walloon Coal Measures (Source: DERM database).

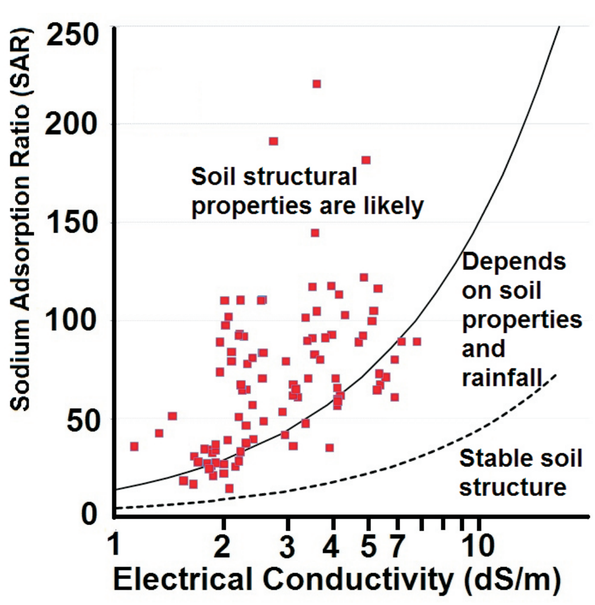

Figure 2. Assessment of soil infiltration problems due to water sodicity as per ANZECC guidelines (2000).

$$SAR = \frac{[Na]}{\sqrt{\frac{[Ca]+[Mg]}{2}}}$$

Health and environmental considerations

When disposed on land or used for irrigation, water with a high dissolved solids content (salts) may reduce water availability to crops. In addition, the high sodium, low calcium and low magnesium concentrations increase the potential to disperse soils and significantly reduce the water infiltration rate. Figure 2 shows the soil dispersion potential of selected CSG Water samples from bores in the Walloon Coal Measures. In addition, CSG Waters can have a detrimental effect on surface waters, riperian vegetation, and aquatic ecosystems if not adequately disposed. Therefore, CSG waters need to be properly characterised, treated, and disposed of to safeguard the environment without compromising other natural resources.

The potential occurrence of dissolved organic constituents in CSG Water poses a health concern. Organics like PAHs are widely distributed in coal so there is concern about their potential occurrence in CSG Waters. To date, no significant organic concentrations have been detected in CSG Waters from the Surat Basin (QLD); special toxicity leaching tests are being conducted at QUT to assess their potential occurrence in CSG Water (Figure 3).

Treatment and management

- CSG Water research at QUT is directed towards understanding the wide range of dissolved constituents (including organic compounds) that may be present, as well as assessing potential health and environmental effects.
- Treatment options include adapting solar membrane distillation technology (Figure 4) to treat CSG waters as well as using Ion Exchange technology, to cover a wide range of applications.
- The use of naural and synthetic zeolites (Figure 5) is being investigated as a cost-effective method to produce a variety of geotechnical solutions including Permeable Reactive Barriers (PRB) and geomembranes to use for CSG water management. For example, these solutions could be used at CSG Water ponds, spillage and injection sites, or at strategic locations to protect valuable agricultural soils.

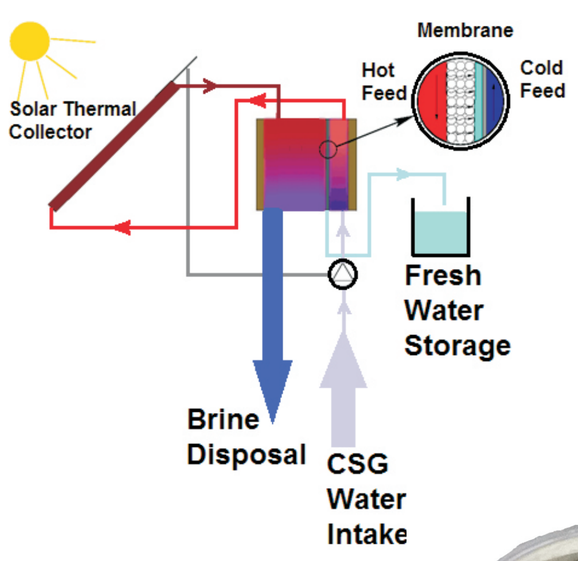

Figure 4. Testing of solar membrane distillation unit. Reduces the salinity of brines and is ideal for remote locations.

Figure 5. Escott zeolite sample from Werrris Creek (NSW). This zeolite is ideal for geotechnical applications at CSG Water-impacted sites.

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Acknowledgments

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