Coal Seam Gas: Water Treatment Innovation

Technical information

The challenge
Coal Seam Gas (CSG) Associated Water (AW) streams are essentially comprised of the salts sodium chloride, sodium carbonate and sodium bicarbonate. In addition there are variable levels of other minor constituents the most significant of which are calcium, magnesium, barium, strontium, fluoride, bromide and silica. A representative composition of AW is presented in Table 1.

Table 1: Typical CSG Water Quality

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>TDS (mg/L)</td>
<td>1,500 – 7,000</td>
</tr>
<tr>
<td>pH</td>
<td>8.8 – 9.4</td>
</tr>
<tr>
<td>Alkalinity (mg/L)</td>
<td>750 – 2,000</td>
</tr>
<tr>
<td>Silica (mg/L)</td>
<td>15 – 30</td>
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</tbody>
</table>

Scaling due to hardness and silica is a key issue in the treatment of AW. There are no commercially proven methods for the removal of silica. This places a constraint on further treatment or disposal and results in larger brine volumes than would exist if silica was capable of being removed economically.

GHD’s solution
GHD has developed a unique solution for the removal of silica from CSG brine. The novel system employs a continuous adsorption system utilising granular activated alumina media.

Key features
Key commercial and technical features include:
- Continuous process with high availability
- Low brine effluent volumes
- Ability to handle suspended solids in the feed
- Variable silica removal rates
- Media top-up without plant downtime
- Cost effective solution with maximum chemical efficiency
- Scalable design

Solution description
A brief description of the process follows.

Adsorption Column
CSG water flows up from the bottom of the column, allowing adsorption of silica onto the activated alumina media. By moving the media in a counter-current direction to the flow of feedwater, the driving force for the adsorption reaction is maximised, thereby giving a more efficient adsorption process.

Wash Column
The treated brine from the adsorption column then flows to a holding tank prior to further treatment.

The loaded activated alumina media is transferred from the bottom of the silica removal column via airlift to the Wash Column. The media in this column is briefly fluidised to remove any particulates retained in the media.
Regeneration Column

A batch of activated alumina media is transferred from the Wash Column to the top of the Regeneration Column. In this column the loaded media is regenerated by a counter-current flow of dilute caustic soda solution to elute the silica from the media.

Rinse Column

A batch of fully desorbed media is intermittently transferred from the bottom of the Regeneration Column to the Rinse Column. Water is pumped into the bottom of the Rinse Column to remove residual sodium hydroxide solution entrained with the media before returning it to the Adsorption Column. The overflow rinse water is mixed with concentrated sodium hydroxide to produce the dilute regeneration solution required for regeneration.

The degree of silica removal from the CSG brine is adjusted by altering the water to media ratio. In this way it is possible to achieve either partial or full silica removal depending on the performance objectives.

Contacts

If your organisation is interested in discussing further, please contact us and we can provide any additional information required.

Terry Collins
Service Group Manager – Industrial Water & Waste
T: +61 7 3316 3000
E: terry.collins@ghd.com

Matthew Bowler
Commercialisation Manager – Innovation
T: +61 3 8687 8000
E: matthew.bowler@ghd.com

Performance Expectations

The concentration of reactive silica in the CSG brine stream following RO treatment is typically in the range of 150 - 250 mg/L. The concentration of silica in treated brine will depend on the degree of removal required, however this would typically be 50 – 100 mg/L.

Loss of media due to attrition is expected to be less than 10% per annum.

Current Status

GHD has filed Australian Patent Application Number 2013901140 in relation to this concept and the invention is currently at the stage of requiring proof of concept.

Figure 1: Continuous Silica Removal Process

About GHD and Innovations

Established in 1928, GHD is one of the world’s leading engineering, architecture and environmental consulting firms. GHD’s award winning innovation program brings together our 6000 people around the globe to create, collaborate on and deliver new ideas.

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