CHEMICAL SCRUBBER WITH BIOLOGICAL REGENERATION

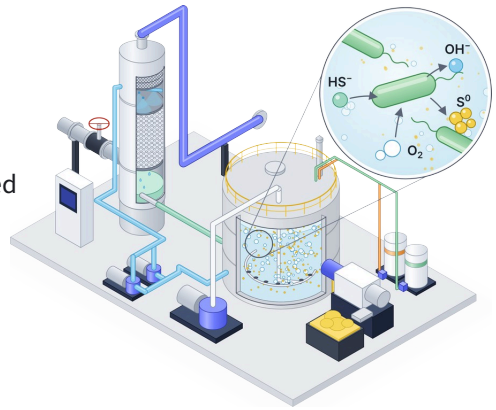
CRA
Engineering a Safer World

BULK H_2S REMOVAL FOR BIOGAS WITH UP TO 90% LESS CAUSTIC

The Chemical Scrubber with Biological Regeneration is CRA's bulk removal stage for biogas with a high H_2S load. A packed absorber column washes the gas with a mildly alkaline solution, and an aerated bioreactor regenerates that solution.

Bacteria in the bioreactor convert the absorbed sulphide to elemental sulphur and restore the alkalinity of the solution. Caustic is needed only as make-up, and the sulphur leaves the loop as a solid. The air is fed only to the bioreactor, so the treated gas carries no added oxygen or nitrogen.

CRA offers it as the base scrubber for CBG and biomethane plants and for any duty with inlet H_2S above about 5,000 ppm. It also suits engine sites that have no route for sulphate effluent. A polishing stage after it takes the gas below 5 ppm.



Below 100 ppm
Outlet H_2S after bulk removal

Below 5 ppm
Outlet H_2S with a polishing stage

Up to 90%
Less caustic than once-through scrubbing

Zero
Air added to the treated gas

SIZED BY SULPHUR LOAD

In the CRA range this unit is the Regenerative Scrubber, model code RS. The number after RS is the design sulphur load in kg a day, which is gas flow (Nm^3/h) × inlet H_2S (ppm) × 0.0000343.

Gas flow, Nm^3/h	Inlet H_2S, ppm	Sulphur load, kg a day	Model	Once-through caustic replaced, tonnes a year	Caustic saved by regeneration, tonnes a year
500	5,000	86	**RS-90**	At least 39	Up to 35
1,000	8,000	275	**RS-300**	At least 125	Up to 113
1,275	10,000	438	**RS-450**	At least 199	Up to 179
1,000	30,000	1,030	**RS-1050**	At least 469	Up to 422

These are design estimates from reaction stoichiometry. The once-through figure is the minimum, counted as 100% NaOH.

REFERENCE PROJECTS

Project	Supplied with	Gas flow	Inlet H_2S	Outlet H_2S
Dharavi STP, Mumbai	Carbon polishing	1,275 Nm^3/h	10,000 ppm	Below 100 ppm
Malad WwTF, Mumbai	Carbon polishing and booster blower	1,450 Nm^3/h	5,000 to 10,000 ppm	100 ppm or less

Both projects treat sewage digester gas. The inlet and outlet figures are design basis.

CRA · 7, Sector 140A, Noida, Uttar Pradesh 201305, India
contact@cra.energy · +91 120 415 6787 · +91 85060 09433

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WORKING AND CONFIGURATION

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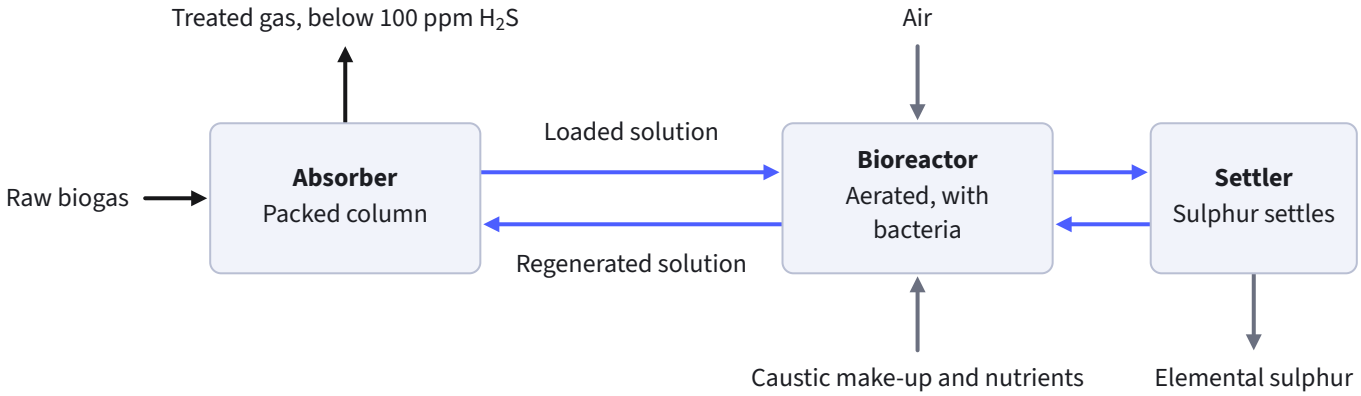
ABSORPTION AND BIOLOGICAL REGENERATION IN ONE CLOSED LOOP

HOW IT WORKS



1. Absorption
Biogas rises through a packed column against a mildly alkaline solution, which absorbs the H_2S as dissolved sulphide.

2. Regeneration
In the aerated bioreactor, sulphur-oxidising bacteria convert the sulphide to elemental sulphur and restore the alkalinity of the solution.

3. Sulphur recovery
The sulphur settles out as a slurry and is dewatered to a solid. The clarified solution returns to the loop, and caustic is dosed only as make-up.

TYPICAL CONFIGURATION

Inlet H_2S	High loads, typically above 5,000 ppm
Outlet H_2S	Below 100 ppm after bulk removal, and below 5 ppm with a polishing stage
Caustic consumption	Make-up only, up to 90% less than once-through scrubbing
Air added to the gas	None, because the aeration air is fed only to the bioreactor
By-product	Elemental sulphur, settled as a slurry and dewatered to a solid
Polishing stage	Iron Oxide Scrubber for CBG duty, or Carbon Scrubber ahead of engines and boilers
Absorber	Carbon steel packed column with FRP lining and polypropylene random packing
Process control	pH control on the solution and redox control on the aeration air, from one PLC panel
Electricals	Flameproof electrical equipment and motors for Zone 1 and Zone 2 areas
Utilities at site	Electrical power, soft water for solution make-up, caustic and nutrient

Materials, instruments and scope are confirmed for each project against the gas analysis and the site standards.

To size a unit, send CRA the gas flow, the inlet H_2S, the gas composition, the gas use and the utilities at site, or book a call with a process engineer at www.cra.energy.

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