BIOLOGICAL SCRUBBER

CRA
Engineering a Safer World

BULK H_2S REMOVAL FOR ENGINES AND BOILERS, WITHOUT CAUSTIC

The Biological Scrubber is CRA's bulk removal stage for biogas that feeds gas engines and boilers. Raw biogas passes through a packed column irrigated with water and nutrients, where sulphur-oxidising bacteria oxidise the H_2S.

A small dose of air supplies the oxygen the bacteria need, and the sulphur leaves the column as a dilute sulphate effluent. The scrubber uses no caustic, which gives engines and boilers the lowest running cost.

It suits sites with a wastewater facility to take the effluent. For CBG and biomethane, CRA offers the Regenerative Scrubber, which adds no air to the gas. CRA builds this scrubber under a technology collaboration with S&H Umweltengineering of Germany.



Below 100 ppm
Outlet H_2S after bulk removal

Below 5 ppm
Outlet H_2S with a polishing stage

Zero
Caustic used

10,000 ppm
Inlet H_2S, up to about this level

SIZED BY SULPHUR LOAD

The model code BS is followed by the design sulphur load in kg a day, which is gas flow (Nm^3/h) × inlet H_2S (ppm) × 0.0000343. The scrubber uses no caustic, so it avoids all of the caustic a once-through scrubber would need.

Gas flow, Nm^3/h	Inlet H_2S, ppm	Sulphur load, kg a day	Model	Once-through caustic avoided, tonnes a year
250	2,000	17	**BS-20**	At least 7.8
500	3,000	51	**BS-60**	At least 23
500	5,000	86	**BS-90**	At least 39
1,000	5,000	172	**BS-200**	At least 78

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

REFERENCE PROJECTS

Project	Gas flow	Inlet H_2S	Outlet H_2S
Bhandup STP, Mumbai	590 Nm^3/h	7,000 ppm	200 ppm
Municipal WWTP, Mozambique	240 Nm^3/h	900 ppm	100 ppm

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

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WORKING AND CONFIGURATION

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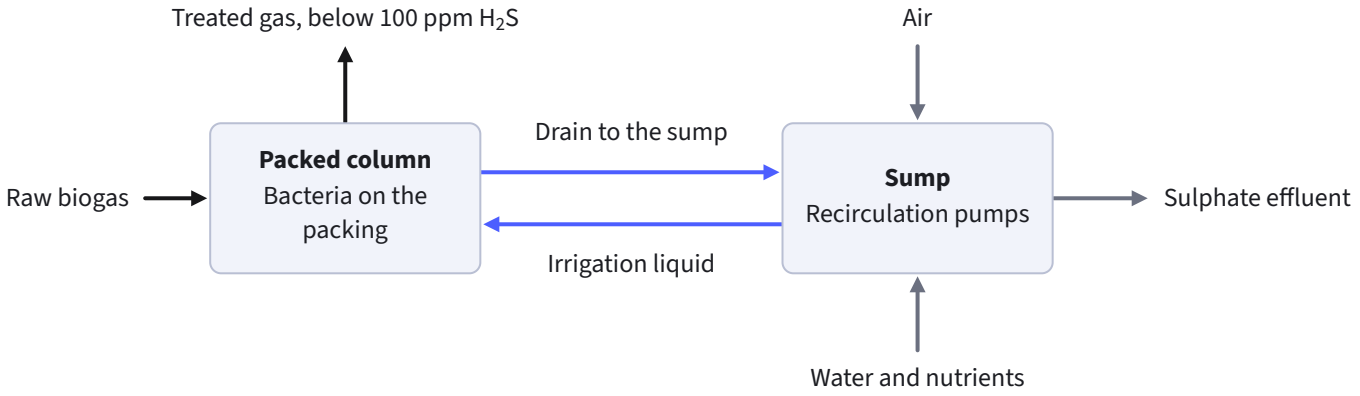
BIO-TRICKLING COLUMN WITH WATER, NUTRIENTS AND AIR

HOW IT WORKS



1. Irrigation
A dilute nutrient solution trickles over the packing, which keeps the bacteria active.

2. Biological conversion
Bacteria on the packing take up the H_2S and oxidise it to sulphate, with a small share of elemental sulphur.

3. Air and bleed
A controlled air dose supplies the oxygen, and a bleed carries the sulphate to wastewater treatment.

TYPICAL CONFIGURATION

Inlet H_2S	Up to about 10,000 ppm
Outlet H_2S	Below 100 ppm after bulk removal, and below 5 ppm with a polishing stage
Consumables	Water and nutrients, with no caustic
Air added to the gas	A small dose, which engines and boilers tolerate
By-product	Dilute sulphate effluent, sent to the site's wastewater treatment
Column	PP or FRP bio-trickling tower with packing and an internal sump
Recirculation	Pumps, one working and one standby
Air dosing	Side-channel blowers on ratio control to the gas flow
Stages	One to four, set by the sulphur load
Polishing stage	Carbon Scrubber, where the engine needs a lower outlet
Utilities at site	Electrical power, fresh water, nutrients and a route for the effluent

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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