

01

Comparison of Desulphurization Method

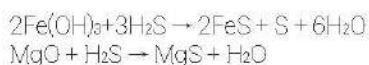
Focus of dry type desulphurization

Item	Existing desulphurization method	Hybrid desulphurization method
Media	<ul style="list-style-type: none"> Contains metal ions : Fe₂O₃, Fe(OH)₃ Activated carbon : impregnation ions 	<ul style="list-style-type: none"> Contains metal ions(Fe, Mg) and nutrient(N, P) → Hybrid media
Application Conditions	<ul style="list-style-type: none"> O₂ : below 0.1% RH : 40~70% Adsorption Capacity : 100~200g/kg 	<ul style="list-style-type: none"> O₂ : 0.2% or more RH : 95% or more Adsorption Capacity : 600~800g/kg
Removal Mechanism	<ul style="list-style-type: none"> Chemical reaction Fe₂O₃ + 2H₂S → Fe₂S₃ + 3H₂O 2Fe(OH)₃ + 3H₂S → 2FeS + S + 6H₂O 	<ul style="list-style-type: none"> Chemical+ Biological reaction(hybrid) 2Fe(OH)₃ + 3H₂S → 2FeS + S + 6H₂O MgO + H₂S → MgS + H₂O H₂S + 0.5O₂ → S + H₂O(microorganism) H₂S + 2O₂ → H₂SO₄(microorganism)
Characteristics	<ul style="list-style-type: none"> Require of pre-treatment dehumidifier facility because the pores are blocked by the moisture in inflow gas, the adsorption ability decreases. When air(oxygen) is introduced, there is a risk of fire due to oxidation of adsorption products. Short media lifetime and replacement cycle. Need to prevent fire and odor complaints 	<ul style="list-style-type: none"> No need dehumidifier facility due to the porous pallet of cellulose. Air(oxygen) within the inflow biogas is used as a source of oxygen for media regeneration and growth of microorganisms. Long media lifetime and replacement cycle by regeneration reaction. High adsorption rate of hydrogen sulfide(H₂S) (more than 5 times conventional media.) Stable high loading rate. No heat and odor and easy handling during replacement.

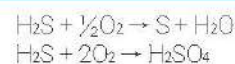
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Removal mechanism of hybrid desulphurization media

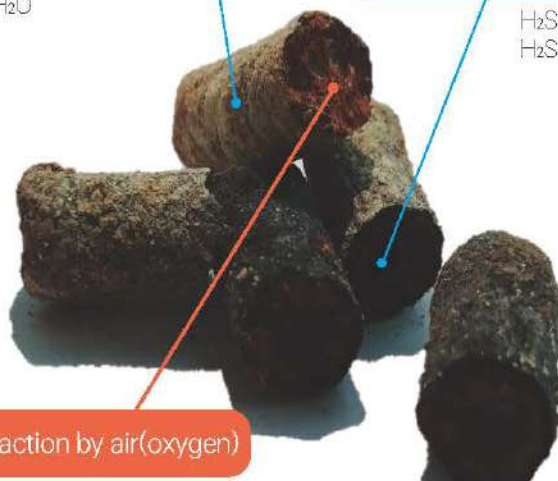
Chemical reaction of metal ions(Fe, Mg)



Biological reaction of sulfur oxidizing bacteria



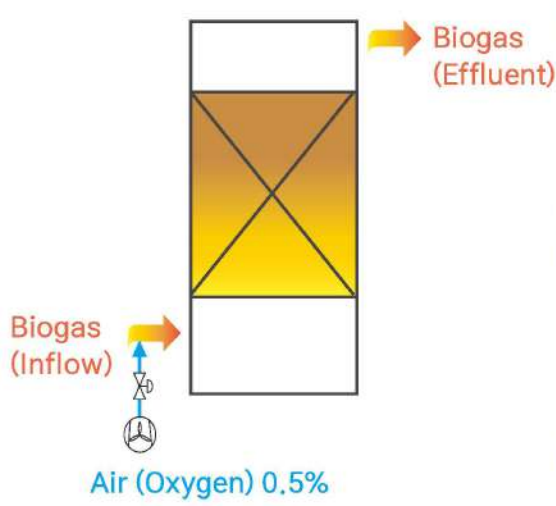
Regeneration reaction by air(oxygen)



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Process diagram of Hybrid Desulphurization System

- Characteristics** |
- Chemical + Biological desulphurization
 - Continuous regenerative mechanism

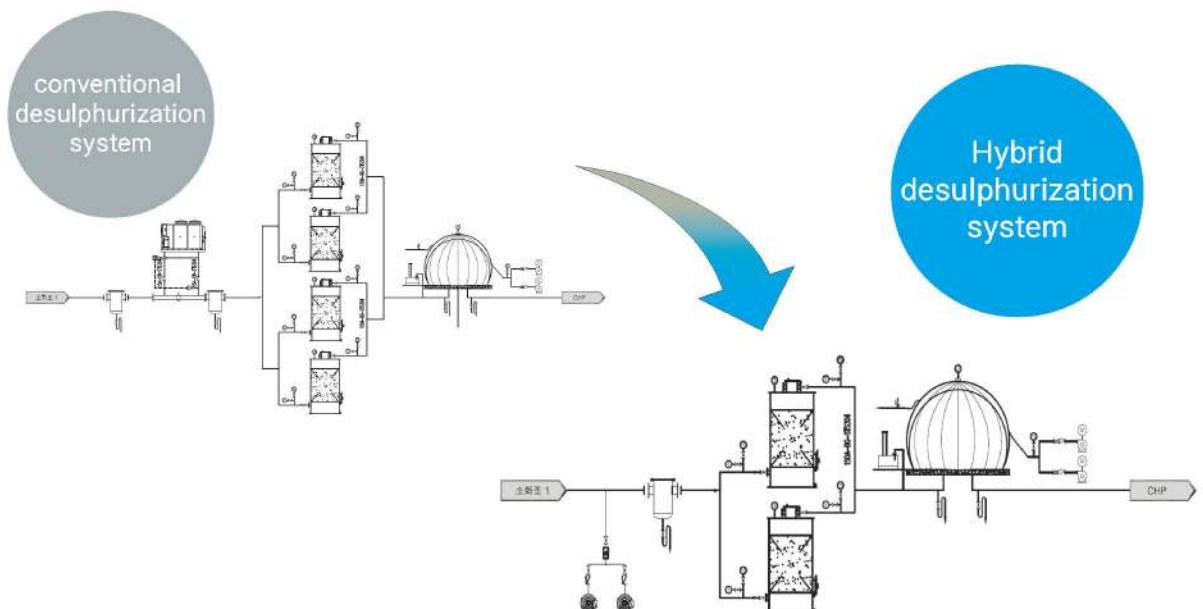


Example of Biogas Purification System

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Characteristics of Hybrid Desulphurization System (1)

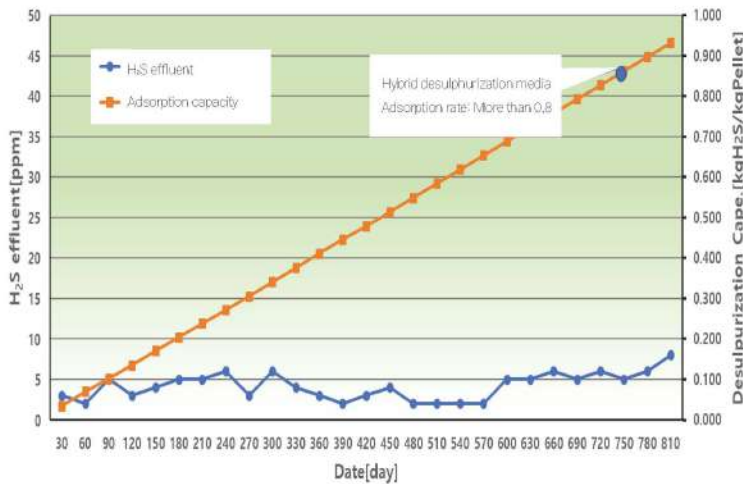
- No need dehumidifier because it is operated at 100% RH.
- Corrosion prevention of piping after desulphurization facility and dehumidifier unit



04

Characteristics of Hybrid Desulphurization System (2)

- Combination of chemical-biological removal and regeneration processes
 ⇒ Stable and high removal efficiency of H₂S ⇒ Long lifetime of media, Reduce replacement cost



Removal rates of H₂S in J STP



Characteristics of Hybrid Desulphurization System (3)

- Easy maintenance of media replacement etc.
 ⇒ No risk of fire during replacement
 ⇒ Waste media can be take out directly or store on site for long time
 ⇒ No civil complains due to odor

conventional desulphurization system

Heat & Odor generation

Hybrid desulphurization system

No heat & odor