VALORIZATION OF BIOGAS THROUGH SIMULTANEOUS CO_2 AND H_2S REMOVAL BY RENEWABLE AQUEOUS AMMONIA SOLUTION IN MEMBRANE CONTACTOR

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SUPPLEMENTARY MATERIALS

Table S1 Specifications of the hollow fiber membrane contactor according to the manufacturer

Parameters	Values	Units
Fiber inner diameter	200	μm
Fiber outer diameter	300	μm
Membrane pore size	80–90	nm
Membrane porosity	33	%
Module inner diameter	20	mm
Module outer diameter	22	mm
Number of fibers	1000	–
Total module length	0.525	m
Effective hollow fiber length	0.375	m
Effective contact area	0.24	m^2

Chemical equilibrium constant K_t

K_1, and K_2 are the dissociation constants of carbonic acid (H_2CO_3) and hydrogen sulfide (H_2S), which have been evaluated as the following equations[1,2]:

$$K_1 = \frac{[HCO_3^-] \times [H^+]}{[H_2CO_3]} \tag{S1}$$

$$K_2 = \frac{[HS^-] \times [H^+]}{[H_2S]} \tag{S2}$$

The chemical equilibrium constant K_t of the reaction (4) has been calculated as

$$K_t = \frac{[HCO_3^-] \times [H_2S]}{[H_2CO_3] \times [HS^-]} \quad \text{(S3)}$$

According to (S1), (S2) and (S3), the chemical equilibrium constant K_t of the reaction (4) is also evaluated as:

$$K_t = \frac{K_1}{K_2} \quad \text{(S4)}$$

Specifically, while the ambient temperature is 25 ℃, $K_1 = 4.2 \times 10^{-7}$, $K_2 = 8.9 \times 10^{-8}$, so the calculated K_t is 4.7 by Eq. (S4).

Reaction quotient *R*

The reaction (4) of the reaction quotient *R* is evaluated as:

$$R = \frac{[HCO_3^-] \times [H_2S]}{[H_2CO_3] \times [HS^-]} \quad \text{(S5)}$$

Where $[HCO_3^-]$ is the concentration of HCO_3^-, about 0.12 mol·L^{-1}; $[HS^-]$ is the concentration of HS^-, about 0.003 mol·L^{-1}. The ratio of the concentration of H_2S and H_2CO_3 is about 5×10^{-4} during the process of physical absorption. Finally, the reaction quotient *R* is about 0.02.

REFERENCES

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