

(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property
Organization
International Bureau

(43) International Publication Date
08 May 2025 (08.05.2025)



(10) International Publication Number
WO 2025/095856 A1

(51) International Patent Classification:

B01D 53/14 (2006.01) **B01D 53/62** (2006.01)
B01D 53/18 (2006.01) **B01D 53/96** (2006.01)

(21) International Application Number:

PCT/SG2024/050691

(22) International Filing Date:

30 October 2024 (30.10.2024)

(25) Filing Language:

English

(26) Publication Language:

English

(30) Priority Data:

10202303105R 02 November 2023 (02.11.2023) SG

(71) Applicant: **NANYANG TECHNOLOGICAL UNIVERSITY** [SG/SG]; 50 Nanyang Avenue, Singapore 639798 (SG).

(72) Inventors: **YANG, Lizhong**; c/o Nanyang Technological University, 50 Nanyang Avenue, Singapore 639798 (SG).
ROMAGNOLI, Alessandro; c/o Nanyang Technological University, 50 Nanyang Avenue, Singapore 639798 (SG).

(74) Agent: **KINNAIRD, James Welsh**; Marks & Clerk Singapore LLP, Tanjong Pagar Post Office, P.O. Box 636, Singapore 910816 (SG).

(81) Designated States (*unless otherwise indicated, for every kind of national protection available*): AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CV, CZ, DE, DJ, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IQ, IR, IS, IT, JM, JO, JP, KE, KG, KH, KN, KP, KR, KW, KZ, LA, LC, LK, LR, LS, LU, LY,

MA, MD, MG, MK, MN, MU, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SA, SC, SD, SE, SG, SK, SL, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, WS, ZA, ZM, ZW.

(84) Designated States (*unless otherwise indicated, for every kind of regional protection available*): ARIPO (BW, CV, GH, GM, KE, LR, LS, MW, MZ, NA, RW, SC, SD, SL, ST, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, ME, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, KM, ML, MR, NE, SN, TD, TG).

Declarations under Rule 4.17:

— of inventorship (Rule 4.17(iv))

Published:

— with international search report (Art. 21(3))

(54) Title: SYSTEMS AND METHODS FOR COMBINED CARBON CAPTURE AND THERMAL ENERGY STORAGE

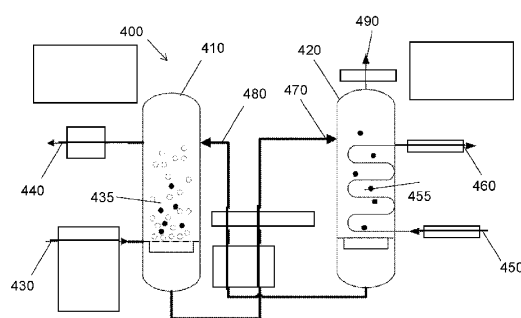


Fig.4A

(57) Abstract: Systems and methods for capturing carbon dioxide (CO₂) and storing thermal energy are disclosed. The systems and methods may comprise a capturing stage and a regeneration stage, and comprise the steps of, in the capturing stage: capturing CO₂ from a gas stream by a carbon capture medium, where the capture of CO₂ by the capture medium generates heat due to an exothermic reaction between CO₂ and the carbon capture medium; and, in the regeneration stage: applying a source of heat to the carbon capture medium to release CO₂ from the carbon capture medium. The carbon capture medium is capable of reacting with CO₂ in an exothermic reaction to provide a carbon storage medium and, during the capturing stage, the carbon capture medium is maintained at a temperature that is below a CO₂ regeneration temperature of the carbon capture medium by the application of cooling, and during the regeneration stage, the source of heat is provided to the carbon capture medium at a first temperature and exits the carbon capture medium at a second temperature, where the second temperature is lower than the first temperature.

WO 2025/095856 A1