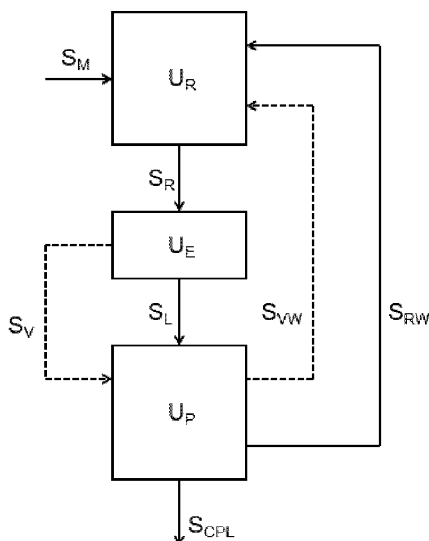




- (51) International Patent Classification:
C07D 201/12 (2006.01) *B01J 19/00* (2006.01)
- (21) International Application Number:
PCT/EP2024/058215
- (22) International Filing Date:
27 March 2024 (27.03.2024)
- (25) Filing Language: English
- (26) Publication Language: English
- (30) Priority Data:
PCT/CN2023/085480
31 March 2023 (31.03.2023) CN
PCT/CN2023/130784
09 November 2023 (09.11.2023) CN
- (71) Applicant: **BASF SE** [DE/DE]; Carl-Bosch-Strasse 38, 67056 Ludwigshafen am Rhein (DE).
- (72) Inventors: **BLEI, Stefan**; Carl-Bosch-Strasse 38, 67056 Ludwigshafen am Rhein (DE). **EL-TOUFAILI, Faissal-Ali**; Carl-Bosch-Strasse 38, 67056 Ludwigshafen am Rhein (DE). **MANGOLD, Hannah Stephanie**; Carl-Bosch-Strasse 38, 67056 Ludwigshafen am Rhein (DE). **BEYER, Caroline**; Carl-Bosch-Strasse 38, 67056 Ludwigshafen am Rhein (DE). **RICHTER, Florian**; Carl-Bosch-Strasse 38, 67056 Ludwigshafen am Rhein (DE). **VANDER STRAETEN, Bart**; Scheldelaan 600, 2040 Antwerpen (BE). **RAVIKUMAR, Vikram Raghavendhar**; Carl-Bosch-Strasse 38, 67056 Ludwigshafen am Rhein (DE). **LARYEA, Esther Matyka**; Carl-Bosch-Straße 38, 67056 Ludwigshafen am Rhein (DE). **LIU, Bao**; No. 300 Jiang Xin Sha Road, Shanghai, 200137 (CN). **WIEBEL-HAUS, Dag**; Carl-Bosch-Strasse 38, 67056 Ludwigshafen

(54) Title: HIGHLY INTEGRATED CAPROLACTAM RECYCLING PROCESS

Figure 1



(57) Abstract: The present invention relates to a recycling process for recovering ϵ -caprolactam from a solid material M comprising polyamide 6, comprising (i) providing a stream S_M comprising the solid material M; (ii) preparing an aqueous depolymerization mixture based on S_M ; (iii) subjecting the depolymerization mixture prepared according to (ii) to polyamide 6 depolymerization conditions in a reaction unit U_R , obtaining a liquid aqueous stream S_R comprising ϵ -caprolactam dissolved in water at a concentration C_{SR} , the stream S_R further comprising one or more impurities; (iv) passing the liquid aqueous stream S_R into an evaporation unit U_E , obtaining from S_R a liquid aqueous stream S_L comprising ϵ -caprolactam dissolved in water at a concentration C_{SL} with $C_{SL} > C_{SR}$, and further obtaining from S_R one or more aqueous vapor streams S_V ; (v) passing the aqueous stream S_L into a

[Continued on next page]

am Rhein (DE). **NEU, Volker**; Carl-Bosch-Straße 38,
67056 Ludwigshafen am Rhein (DE).

(74) **Agent: ALTMANN STÖSSEL DICK PATENTAN-
WÄLTE PARTG MBB**; Dr. Andreas Altmann, Isartorplatz
1, 80331 München (DE).

(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).

Published:

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

heat-consuming purification unit U_P , obtaining from S_L a stream S_{CPL} comprising ϵ -caprolactam at a concentration C_{SCPL} with $C_{SCPL} >> C_{SL}$, and further obtaining from S_L one or more aqueous streams S_{RW} , wherein at least part of the heat consumed in U_P is provided by at least one of the one or more streams S_V , thereby obtaining from the at least one stream S_V at least one at least partially condensed aqueous stream S_{VW} ; (vi) recycling at least one stream S_{VW} at least partially and at least one stream S_{RW} at least partially to the reaction unit U_R .