Electronic Supplementary Material (ESI) for New Journal of Chemistry.


**Supporting Information**

# Tetraalkylammonium based Dicationic Ionic Liquid (IL) for $CO_2$ Capture

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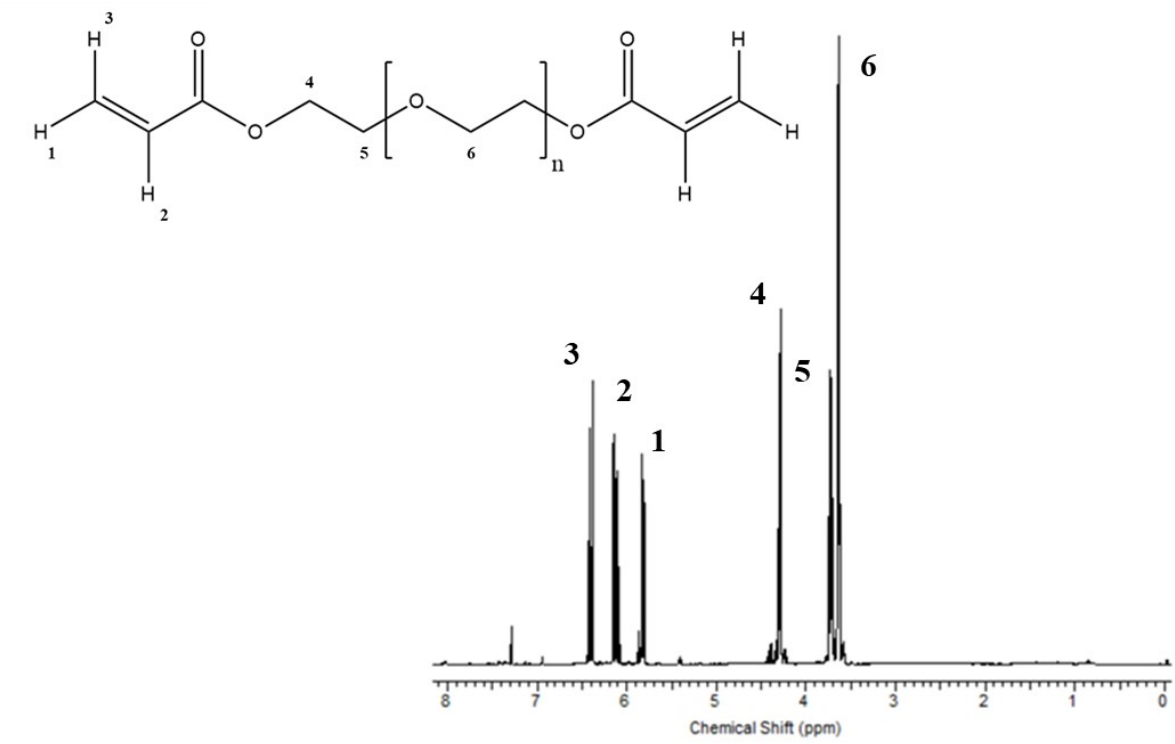


**Figure S1:** $^{1}$H NMR spectra of PEGDA.

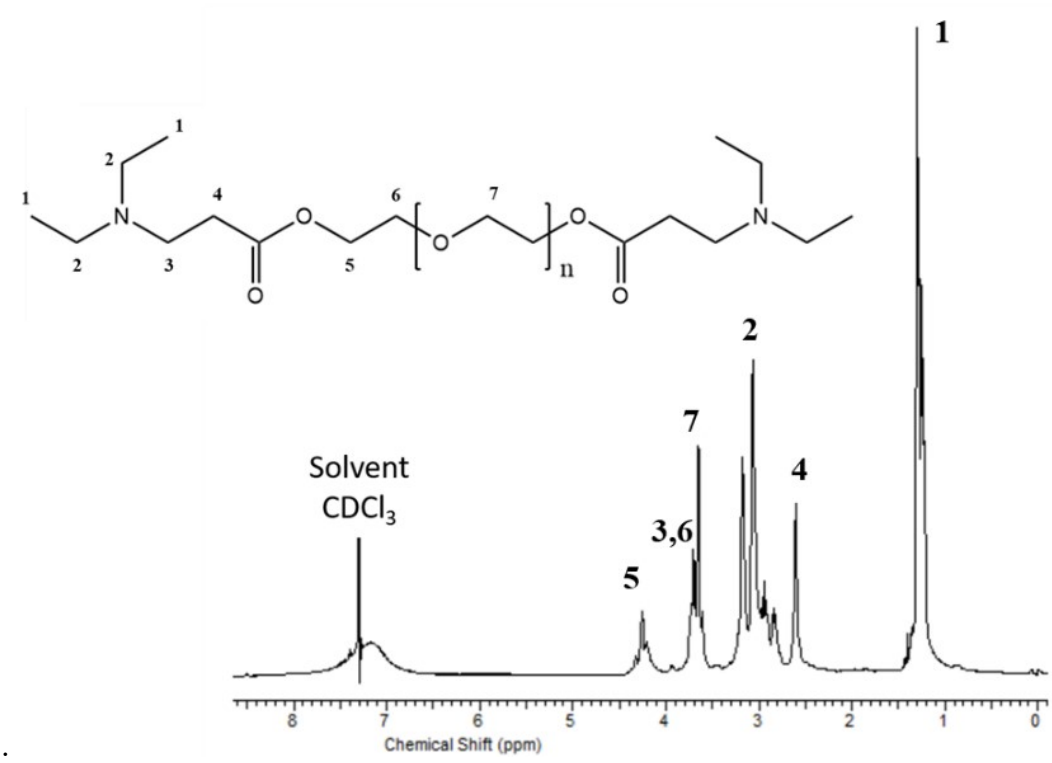


**Figure S2:** $^{1}$H NMR spectra of PEGDA-DEA product (PD).

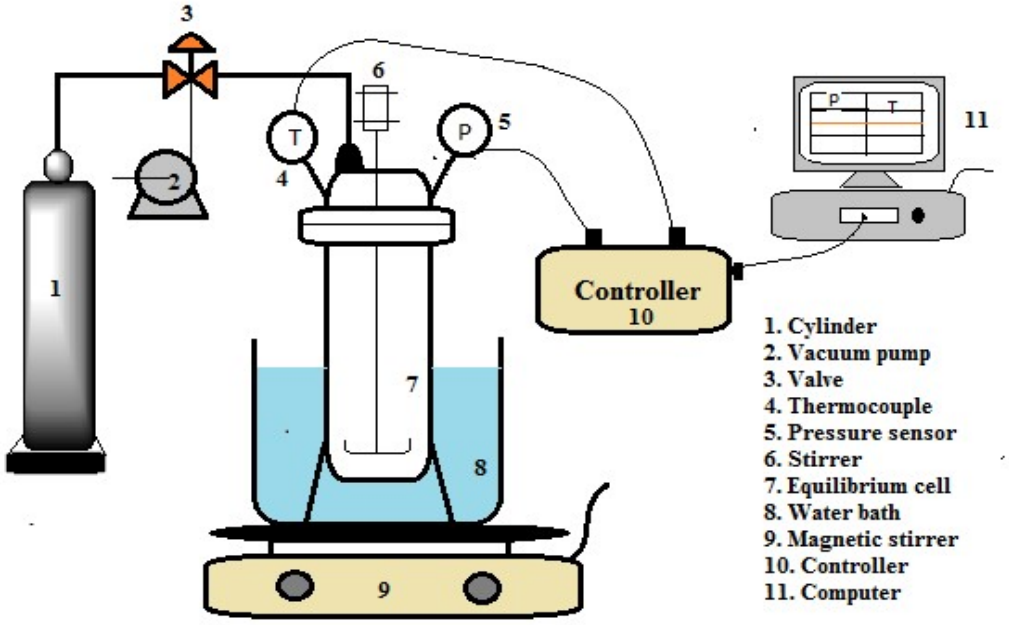


**Figure S3:** Schematic representation of fabricated $CO_2$ absorption apparatus.

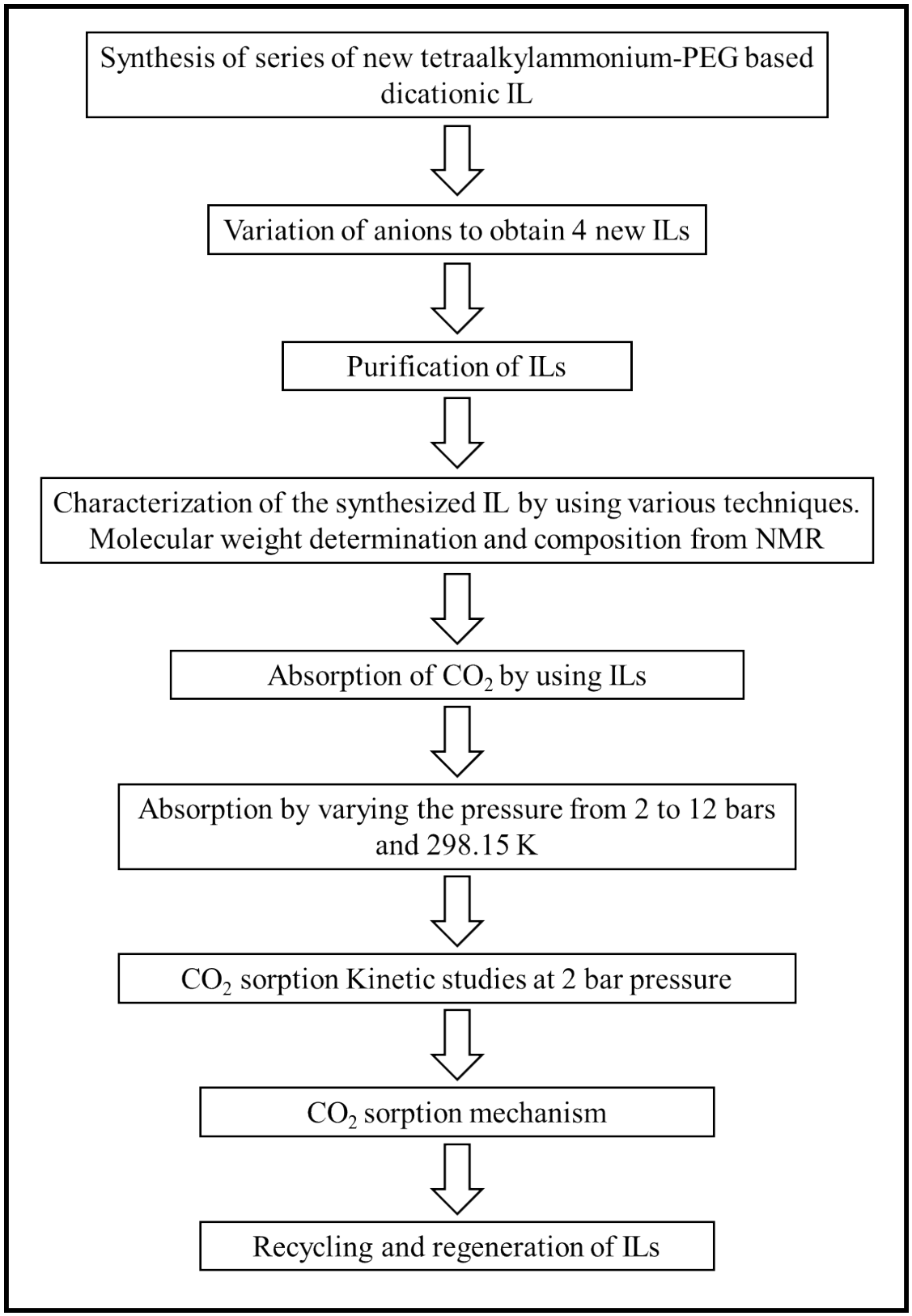


**Figure S4:** Flowchart - absorption of $CO_2$ by using tetraalkylammonium dicationic IL.

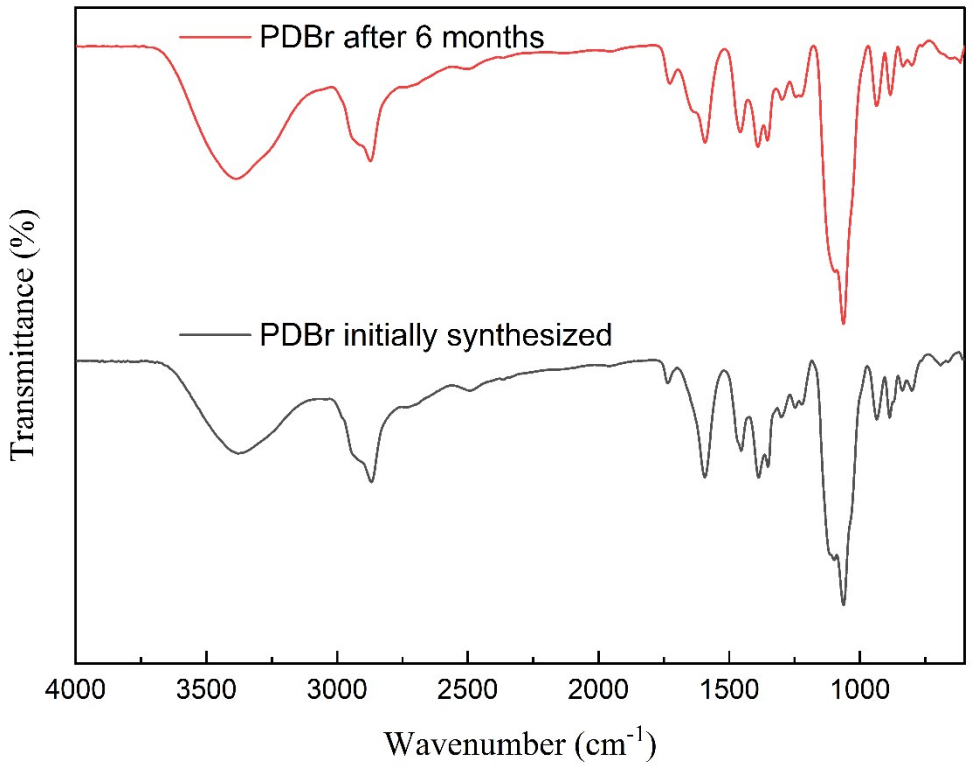


**Figure S5**: Chemical stability of PDBr IL after 6 months, as investigated by FTIR.

**Table S1:** Design of experiment with input parameters and operating conditions.

| Ionic Liquid (IL) | Operating Conditions | | | | | Outcomes | |
|---|---|---|---|---|---|---|---|
| | Pressure bar | Temperature K | Molecular Weight (g.mol-1) | Viscosity ($mm^2.s^{-1}$) (1 bar and 298.15 K) | Density ($g.cm^{-3}$) (1 bar and 298.15 K) | $x_{CO_2}$ | mol $CO_2$/ mol IL |
| $PDBF_4$ | 2 | 298.15 | 764.48 | 198.40 | 1.09 | 0.128 | 0.147 |
| | 4 | | | | | 0.193 | 0.239 |
| | 6 | | | | | 0.222 | 0.287 |
| | 8 | | | | | 0.368 | 0.584 |
| | 10 | | | | | 0.559 | 1.273 |
| | 12 | | | | | 0.577 | 1.365 |
| $PDNTf_2$ | 2 | 298.15 | 1151.17 | 84.74 | 1.40 | 0.095 | 0.105 |
| | 4 | | | | | 0.211 | 0.268 |
| | 6 | | | | | 0.334 | 0.502 |
| | 8 | | | | | 0.385 | 0.626 |
| | 10 | | | | | 0.443 | 0.797 |
| | 12 | | | | | 0.471 | 0.892 |
| $PDPF_6$ | 2 | 298.15 | 880.80 | 44.66 | 1.29 | 0.167 | 0.201 |
| | 4 | | | | | 0.181 | 0.222 |
| | 6 | | | | | 0.227 | 0.294 |
| | 8 | | | | | 0.283 | 0.396 |
| | 10 | | | | | 0.421 | 0.727 |
| | 12 | | | | | 0.459 | 0.849 |
| PDBr | 2 | 298.15 | 750.67 | 80.33 | 1.23 | 0.039 | 0.041 |
| | 4 | | | | | 0.160 | 0.191 |
| | 6 | | | | | 0.232 | 0.303 |
| | 8 | | | | | 0.243 | 0.321 |
| | 10 | | | | | 0.334 | 0.503 |
| | 12 | | | | | 0.362 | 0.568 |