Multifunctional polymers based on ionic liquid and Rose Bengal fragments for the conversion of CO_2 to carbonates.

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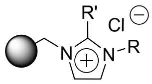
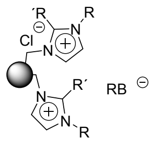
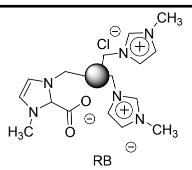
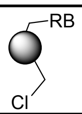
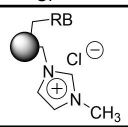
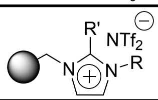
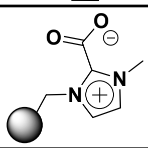
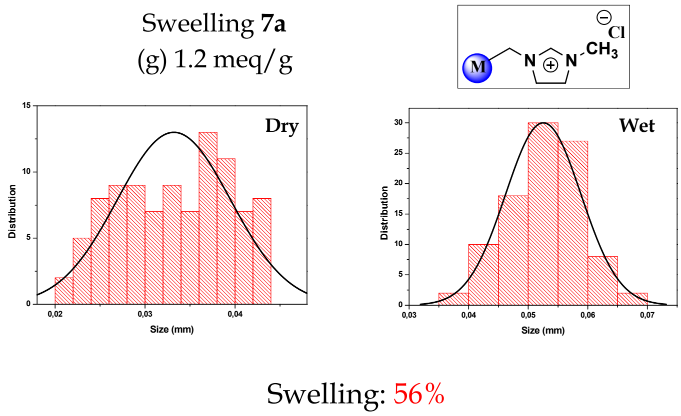
Table S1. Structure and properties for the different SILLPs prepared.

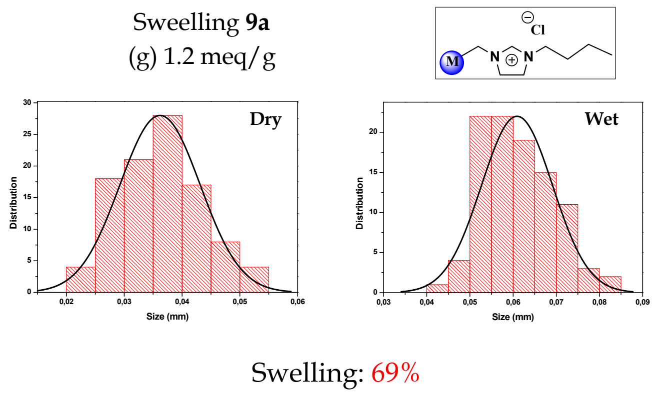
Structure	Code	Type	Loading (meq/g)	R	R´	Water content [a] (%)	Swelling (%)[c]
	7a	Gel	1.01	CH_3	H	1.81	56
	8a	Macroporous	1.09	CH_3	H	3.46	-
	9a	Gel	0.97	CH_4H_9	H	1,27	69
	10a	Macroporous	1.94	CH_4H_9	H	2.62	-
	11a	Gel	0.88	$CH_{10}H_{21}$	H	1.27	81
	12a	Macroporous	0.95	$CH_{10}H_{21}$	H	2.10	-
	13b	Gel	3.18	CH_3	H	11.35	-
	14b	Macroporous	3.79	CH_3	H	15.14	-
	15b	Macroporous	3.71	CH_3	CH_3	-	-
 [b]	16a	Gel	1.01	CH_3	H	2.01	-
	17a	Macroporous	1.09	CH_3	H	3.50	-
	18a	Gel	0.97	CH_4H_9	H	-	-
	19a	Macroporous	1.94	CH_4H_9	H	2.60	-
	20a	Gel	0.88	$CH_{10}H_{21}$	H	1.17	-
	21a	Macroporous	0.95	$CH_{10}H_{21}$	H	2.10	-
	22b	Gel	3.18	CH_3	H	-	-
	23b	Macroporous	3.79	CH_3	H	-	-
	24b	Macroporous	3.71	CH_3	CH_3	-	-
	25b	Macroporous	3.68	CH_3	H	-	-
	26	Macroporous	1.56	CH_3	H	-	-
	27	Macroporous	2.23	CH_3	H	-	-
	30a	Gel	1.1	CH_3	H	-	-
	31b	Macroporous	3.67	CH_3	H		

[a] Water content calculated from TGA, after equilibration at rt during 24 h. [b] RB loading 3.92 x 10^{-2} µmol RB / g of polymer. [c] $Swelling = \left(\frac{Wet\ size - Dry\ size}{Dry\ size}\right) \cdot 10^2$

a)



b)



c)

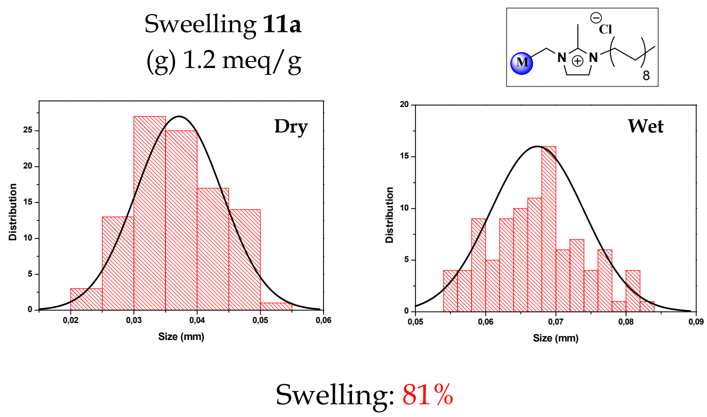


Fig. S1. Swelling of different RB-SILLPs resins in styrene oxide (SO) calculated as (a) **7a**. (b) **9a**. (c) **11a.** $Swelling = \left(\frac{Wet\ size - Dry\ size}{Dry\ size}\right) \cdot 10^2$-For each resin, the size distribution diagram on the left corresponds to the dry state, while the one on the right correspond the size distribution in the presence of SO.

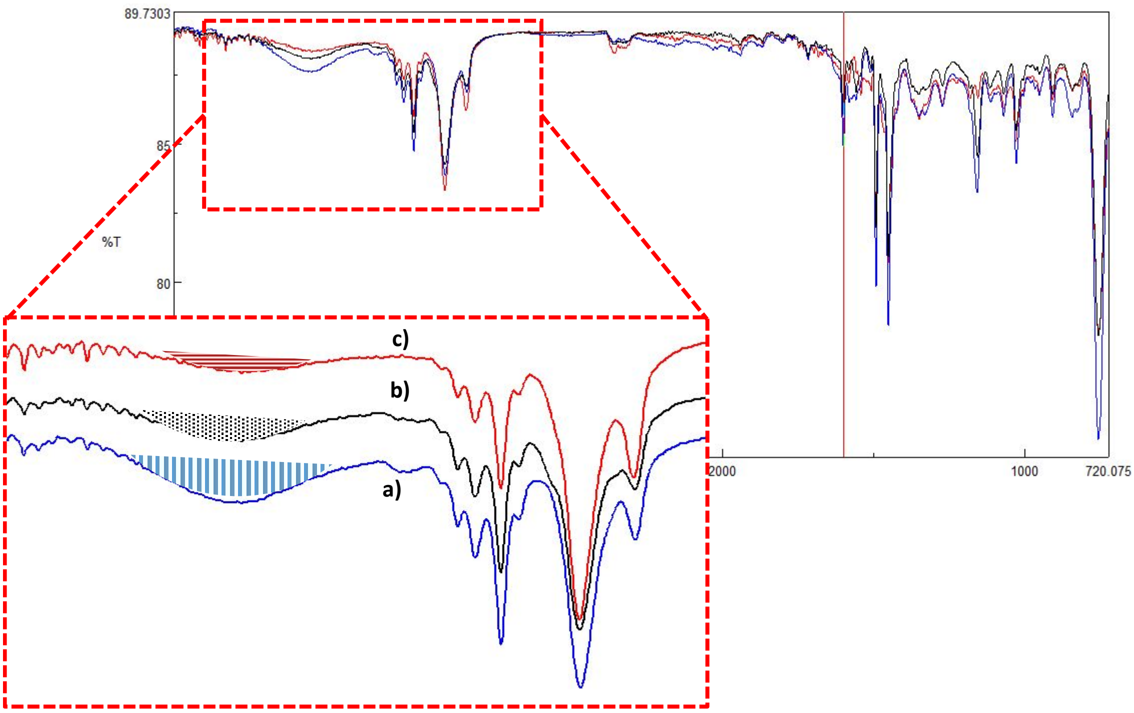


Fig. S2. FT-IR-ATR spectra obtained for the RB-SILLPs of ν(O–H) region showing the uptake of water from air as for the different low loading gel-type PS-DVB resin with different substitution pattern. a) **16a** (methyl). b) **18a** (butyl). c) **20a** (2-methyl-decyl).

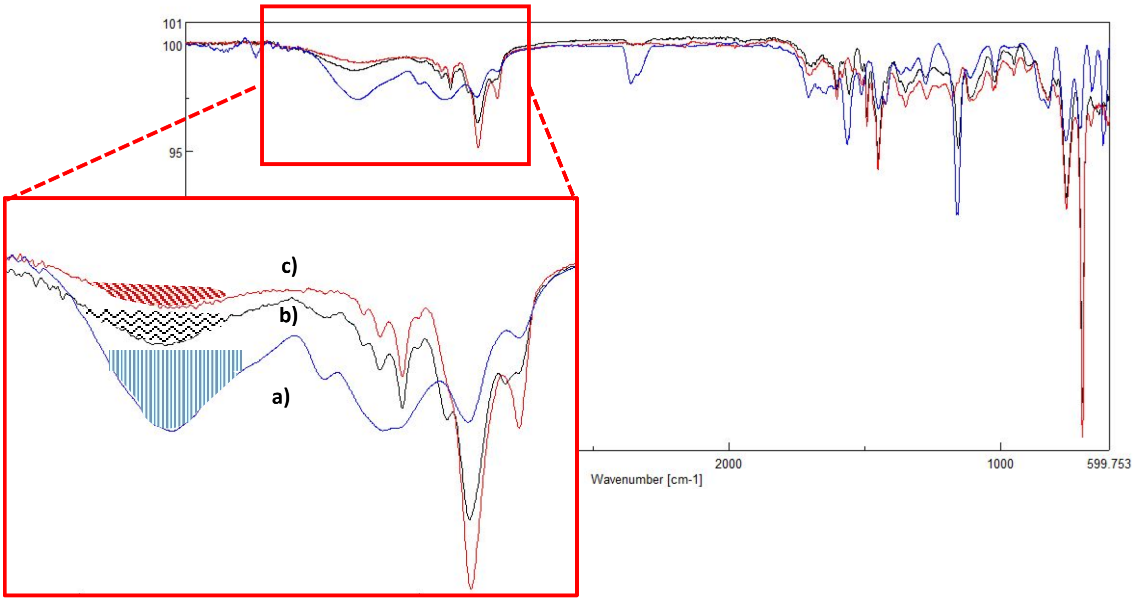


Fig. S3. FT- IR-ATR spectra obtained for the RB-SILLPs of ν(O–H) region showing the uptake of water from air as for the different of low loading macroporous type PS-DVB resin with different substitution pattern, a) **17a** (methyl). b) **19a** (butyl). c) **21a** (2-methyl-decyl).

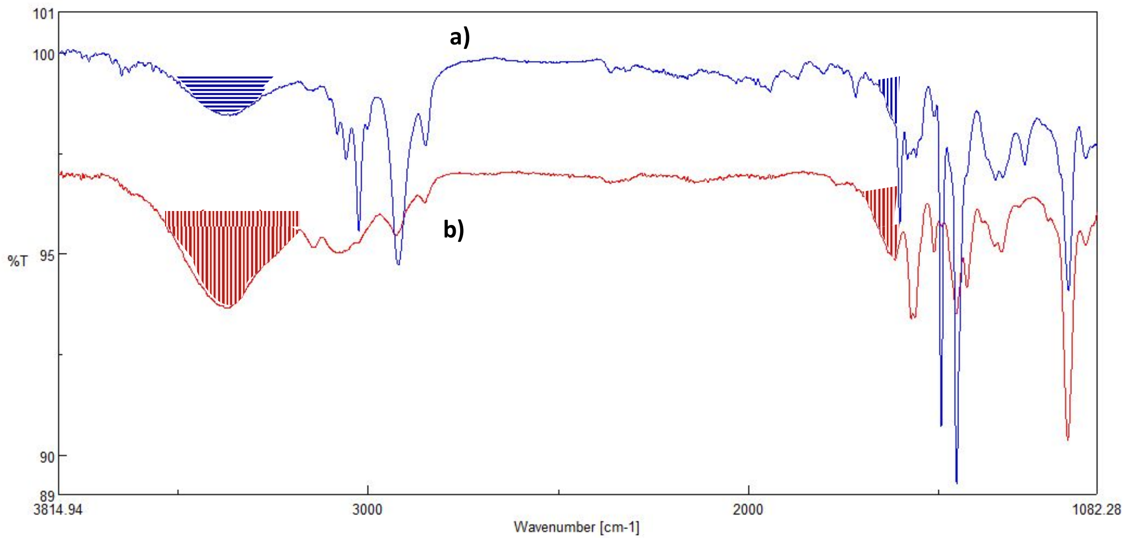


Fig. S4. FT-IR-ATR spectra obtained for the RB-SILLPs of ν(O–H) region showing the uptake of water from air as for the different for the RB-SILLPs of gel type PS-DVB resins with different loading. a) Low loading (**16a**). b) High loading (**22b**).

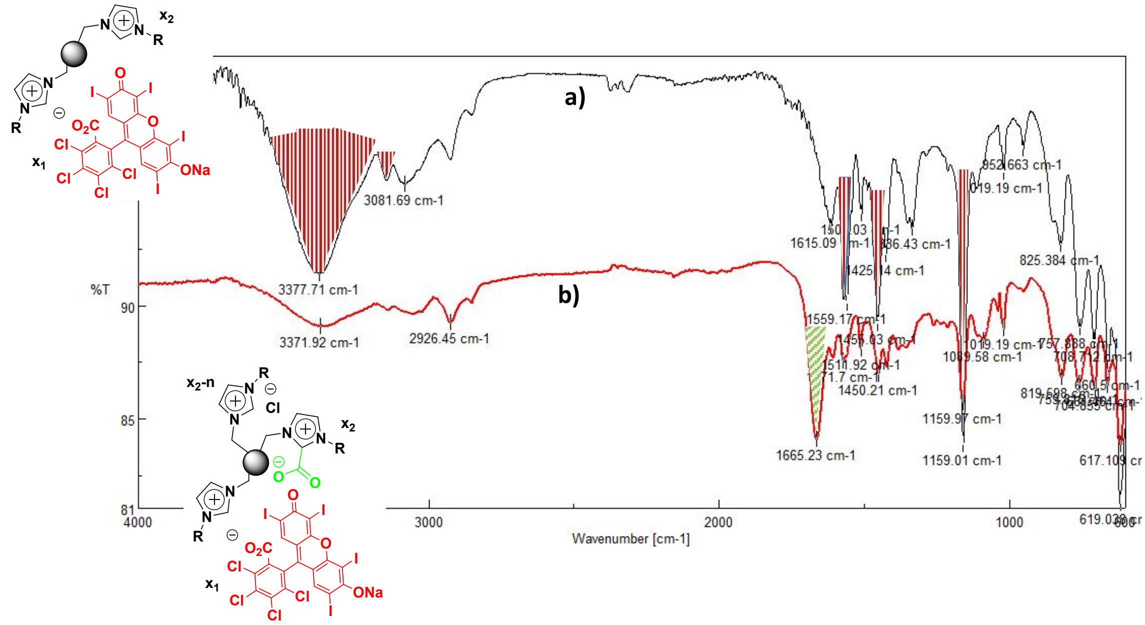


Fig. S5. FT-IR-ATR spectra obtained for the RB-SILLP **23b** a) before its use as catalyst. b) After its use in the catalytic reaction (36.7 mg RB-SILLP **23b**, for 5 h at 100 ºC, 10 bar of CO_2 and using 1 mL epoxide).

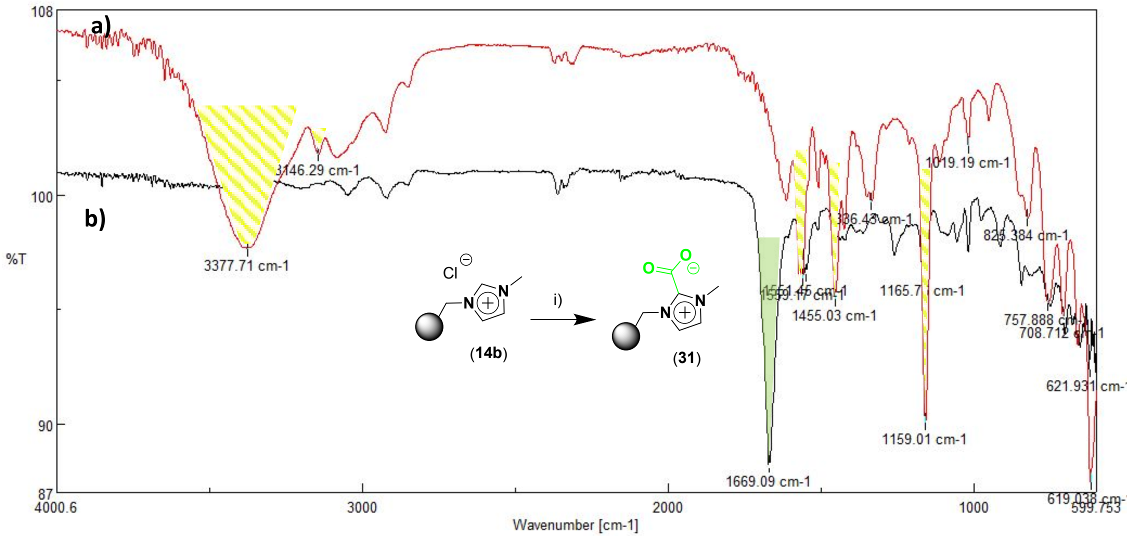


Fig. S6. FT-IR-ATR spectra for the synthesis of the zwitterionic NHC−CO_2 polymer **31** from **14b** (from a high loading chlorometilated resin, macroporous). i) Resin **14b** in 1,0 mL of dry THF, 8.5 equivalents of KHMDS at 80 ^oC and CO_2 (balloon). a) **14a**. b) **31.**

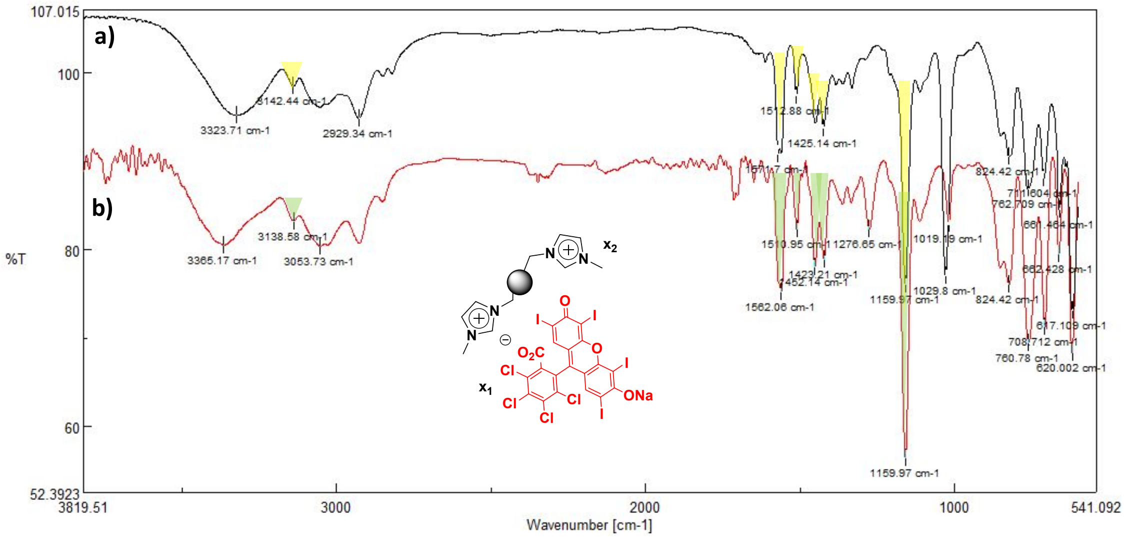


Fig. S7. FT-IR-ATR for RB-SILLP **17a**, a) before and b) after its use as catalyst (reaction conditions: solventless, 5 h, 100 ^oC, 10 bar CO_2, 1, mL epoxide and 36.7 mg catalyst).

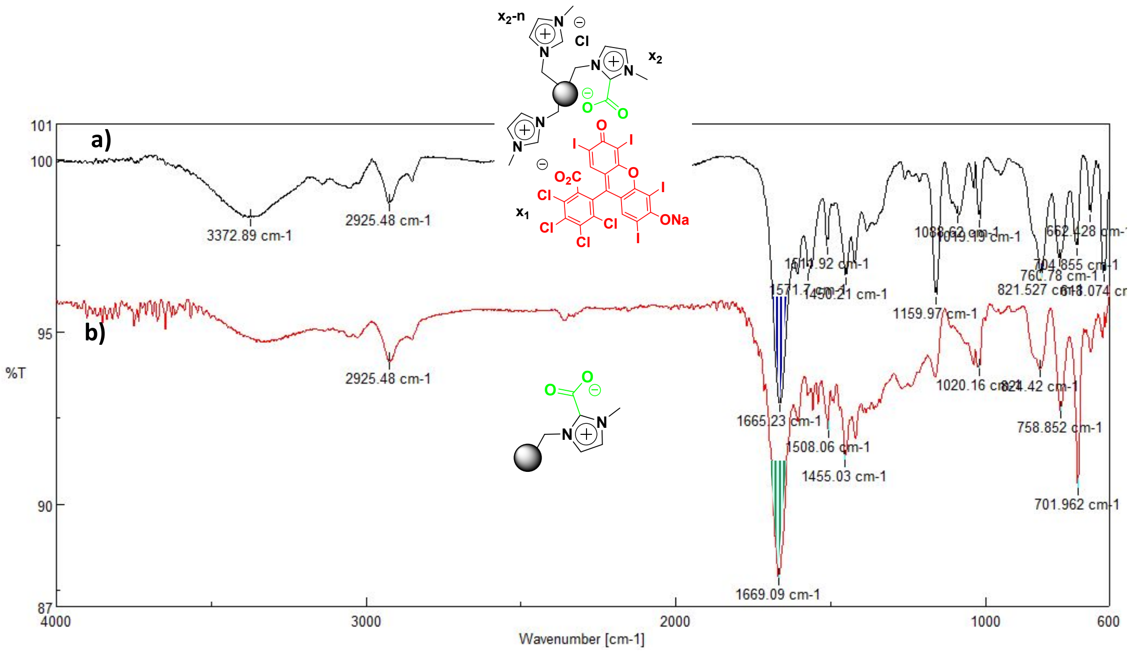


Fig. S8. FT-IR-ATR for RB-SILLP **25b** a) before and b) after its use as catalyst (reaction conditions: 5 h, 100 °C, 10 bar of CO_2 and using 1 mL epoxide and 36.7 mg of catalyst).

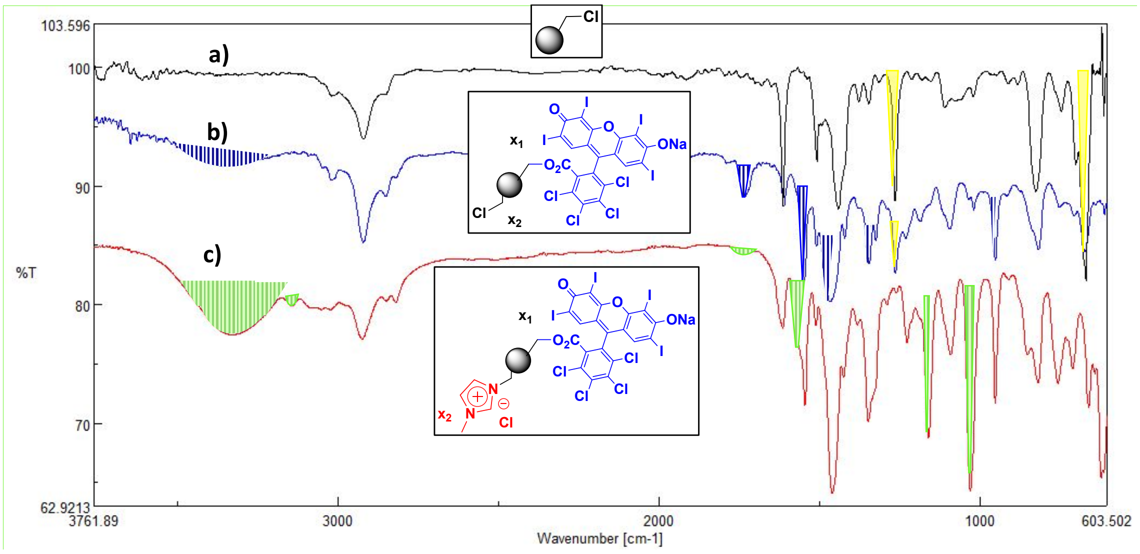


Fig. S9. FT-IR-ATR spectra obtained for a) Merrifield resin **2**. b) resin **26**. c) resin **27**.

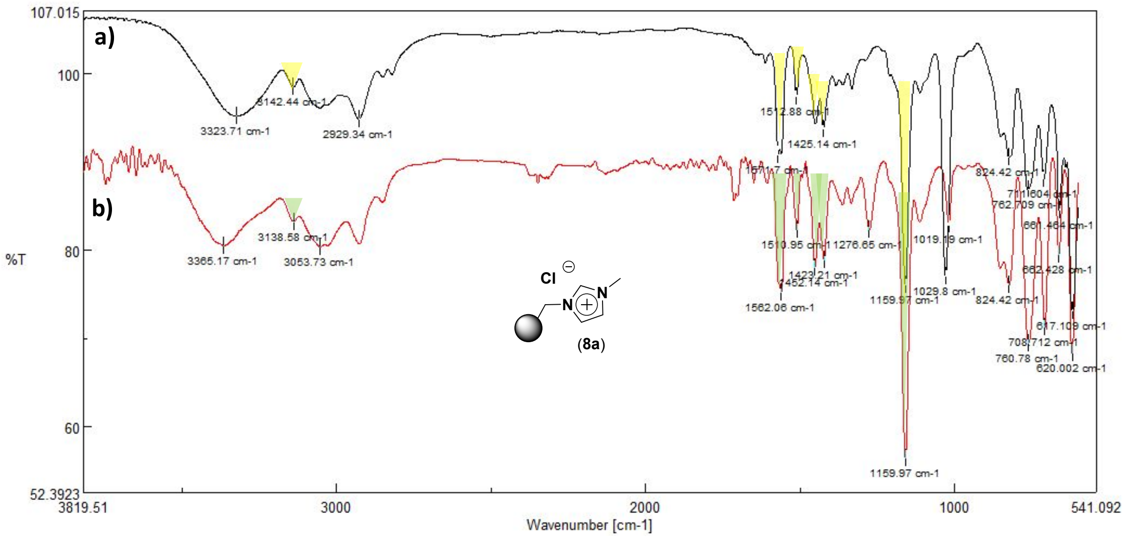


Fig. S10. FT-IR-ATR for SILLP **8a** a) before and b) after its use as catalyst (reaction conditions: 5 h, 100 °C, 10 bar of CO_2 and using 1 mL epoxide and 36.7 mg of catalyst).

Table S2. Comparison of SILPs **27** with relevant catalysts reported in the literature for cycloaddition of CO_2 under flow continuous.

Entry	Catalyst	(g)	Cocatalyst	Solvent	Substrate[a]	Flow Substrate (mL/min)	Flow CO_2 (mL/min)	Flow N_2 (mL/min)	Pressure (bar)	Temp. (ºC)	Time / Activity (h)	Yield (%)	Prod.$_T$ (g $_{epoxide}$ x g $_{cat}^{-1}$ x h^{-1})	Prod.$_{Exp}$ ($_{epoxide}$ x g $_{cat}^{-1}$ x h^{-1})	Leaching[b]
1	**27**	1.9	RB/H2O	-	SO	0.005	0.05	-	140	150	234	57	1.9808	1.1291	X
2	MCM-41/[Co(II)(salen)]	4	*n*-Bu_4NBr	-	EO	0.17	0.33	-	125	110	24	86	0.0901	0.775	X
3	Amorphous silica/[(salem)Al]$_2$O*t*Bu	0.43	-	-	EO	0.0025	0.017	0.042	1.01	150	6	57	0.3159	0.1801	✓
4	MCM-41/[(salem)Al]$_2$O*t*Bu	1.57	-	-	EO	0.0025	0.017	0.042	1.01	60	7	95	0.0865	0.0822	✓
5	Cs-P-Si-oxide	10	-	-	PO	0.05	0.2	-	140	200	3	50	0.0152	0.0076	✓
6	MOF MIL-101(Cr)	0.042	TBABr	Chlorobenzene	PO	0.25	4	-	50	100	5	80	1.0676	0.8541	✓
7	MOF MIL-101(Sc)	0.042	-	-	PO	0.25	4	-	50	100	5	57	1.0676	0.6085	✓

[a:] SO: Styrene oxide; EO = Ethylene Oxide; PO = Propylene Oxide.
[b:] X = No leaching; ✓= Leaching

Entry (References):

2. Chemical fixation of CO_2 to ethylene carbonate under supercritical conditions: continuous and selective. X.-B. Lu, J.-H. Xiau, R. He, K. Jin, L.-M. Luo, X.-J- Feng, *Appl. Catal. Gen*. **2004**. *275*. 73–78.

3 & 4. A Gas-phase flow reactor for ethylene carbonate synthesis from waste carbon dioxide. M. North, P. Villuendas, C. Young, *Chem. Eur. J*. **2009**. *15*. 11454-11457.

5. T. Non-halogen catalysts for propylene carbonate synthesis from CO_2 under supercritical conditions. H. Yasuda, L.-H. He, T. Takahashi, T. Sakakura, *Appl. Catal. Gen*. **2006**. *298*. 177-180.

6 & 7. Structure activity relationships in metal-organic framework catalysts for the continuous flow synthesis of propylene oxide carbonate from CO_2 and propylene oxide. B. R. James, J. A. Boissonnault, A. G. Wong-Foy, A. J. Matzger, M. S. Sanford, *RSC. Adv*. **2018**. *8*. 2132-2137