CO_2 Capture by Tertiary Amine Absorbents: A Performance Comparison Study

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Supporting Information:

S1. Experimental CO_2 absorption-regeneration profiles of three different conventional amine absorbents monoethanolamine (MEA), diethanolamine (DEA) and *N*-methyldiethanolamine (MDEA) used for Figure 1 in the manuscript

S2. Experimental results for gas scrubbing test and heats of reaction measurement used for Figure 1 in the manuscript

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S16. Total ion chromatogram of absorbent **21**, 1-Methyl-2-piperidineethanol (**1M-2PPE**)

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S18. Equilibrium CO_2 solubility (g-CO_2/L-soln.) in aqueous amine solutions (amine mass fraction 30 %) at 20 kPa CO_2 partial pressure

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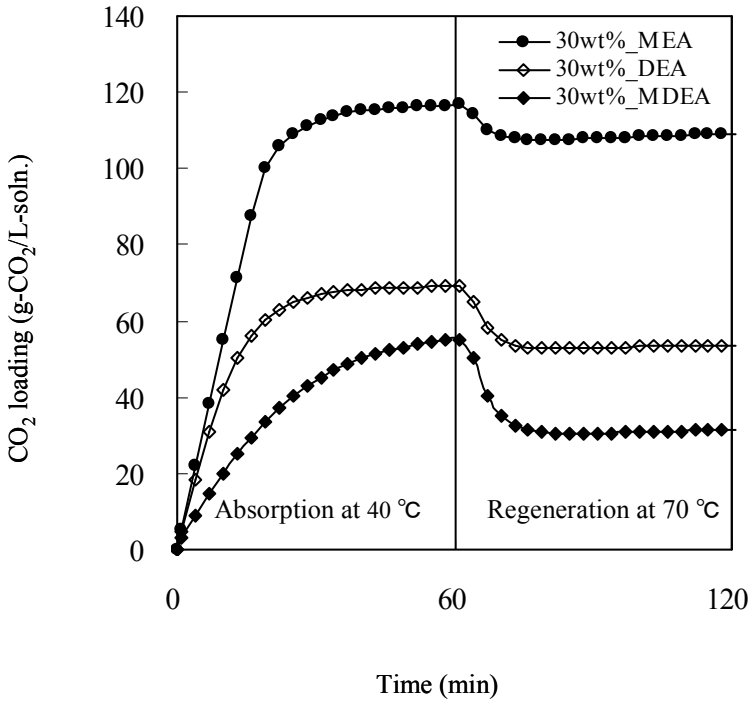
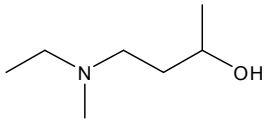


S2. Experimental results for gas scrubbing test and heats of reaction measurement used for Figure 1 in the manuscript

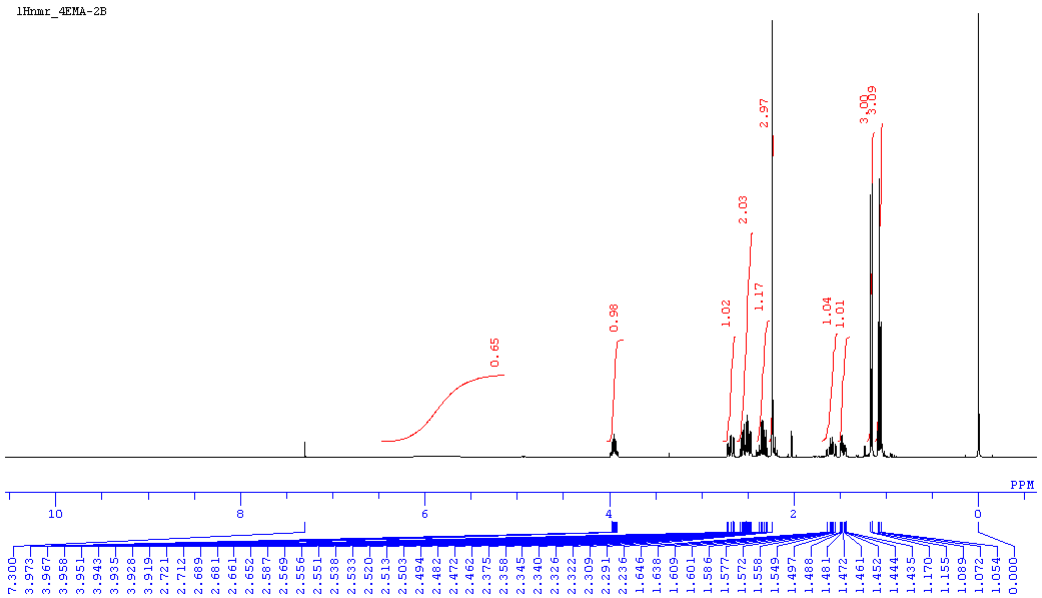
Absorbents 30wt% aqueous solutions	Absorption rate [a] g-CO_2/ L-soln./min	Absorption amount [b] g-CO_2/ L-soln.	Absorption capacity [c] g-CO_2/ L-soln.	Reaction Heat [d] kJ/ mol-CO_2	CO_2 loading g-CO_2/ L-soln.
MEA	5.47	117	9	86.9 (84)[e]	0.45-0.51
DEA	4.04	69	16	68.9 (72)[e]	0.44-0.53
MDEA	1.56	55	24	58.5 (59)[e]	0.46-0.58

[a] The gradient of the curve at 50% of the 60 min CO_2 loading, [b] CO_2 loading at 40 °C, 1h, [c] Difference between the maximum CO_2 loading at 40 °C and the minimum CO_2 loading at 70 °C, [d] Heats of reaction measured at 40 °C and around 0.5 mol-CO_2/mol-amine, [e] Heats of reaction in parenthesis are cited from Kohl and Nielsen (1997)

[e] Reference: Kohl, A.L., Nielsen, R., **1997**. *Gas Purification*, 5th ed. Gulf Publishing Co.



10. 4EMA-2B



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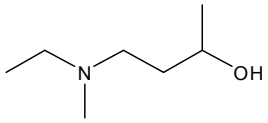

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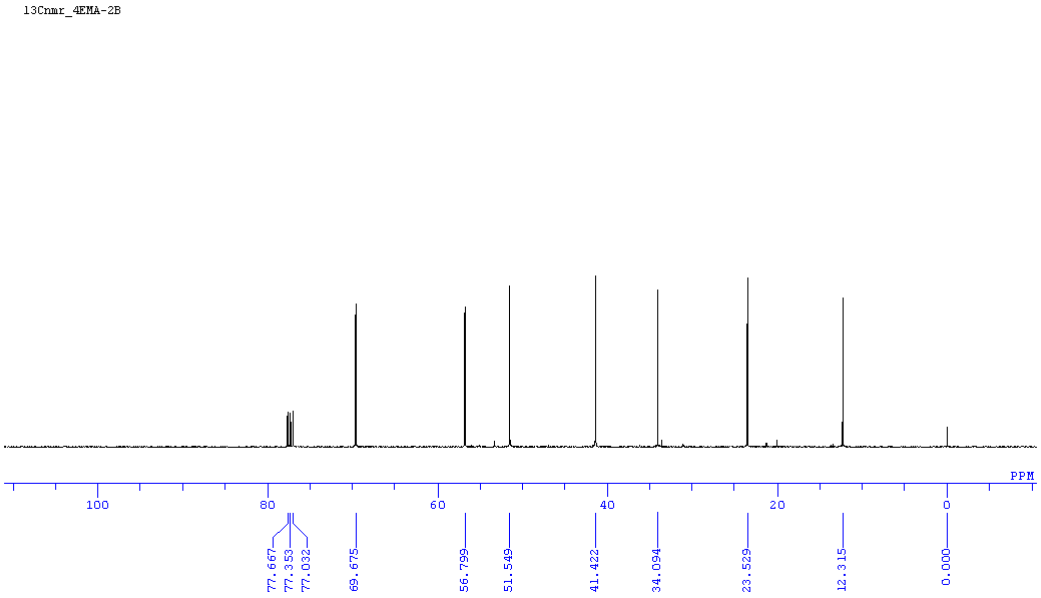
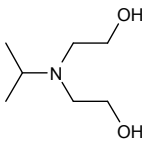
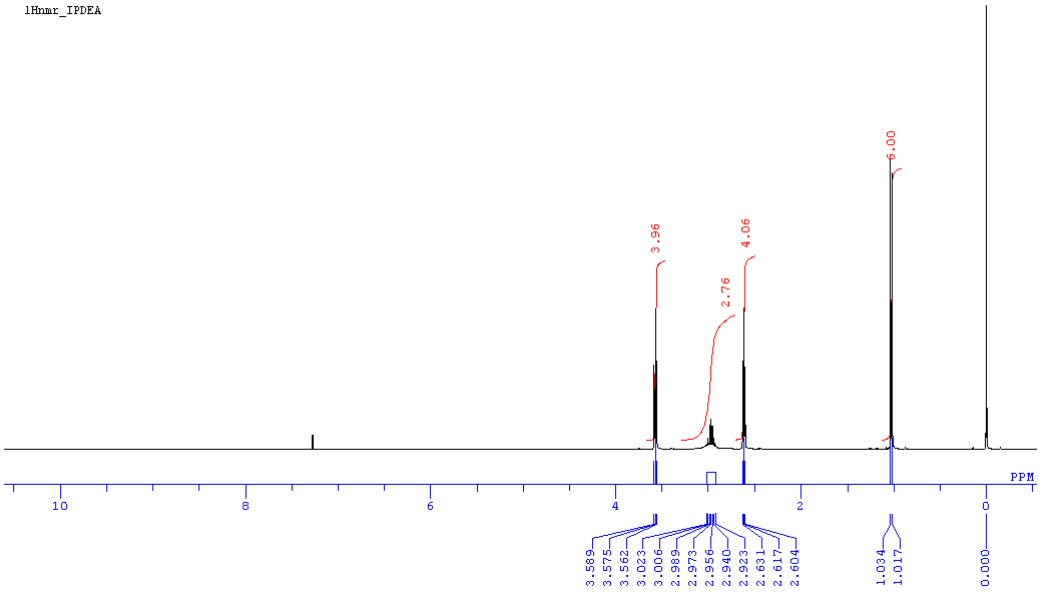


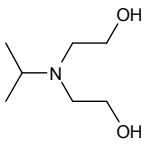
S4. ^{13}C NMR ($CDCl_3$) spectrum of absorbent **10**, 4-Ethylmethyamino-2-butanol (**4EMA-2B**)



12. IPDEA



S5. ^{1}H NMR ($CDCl_3$) spectrum of absorbent **12**, *N*-Isopropylaminodiethanol (**IPDEA**)



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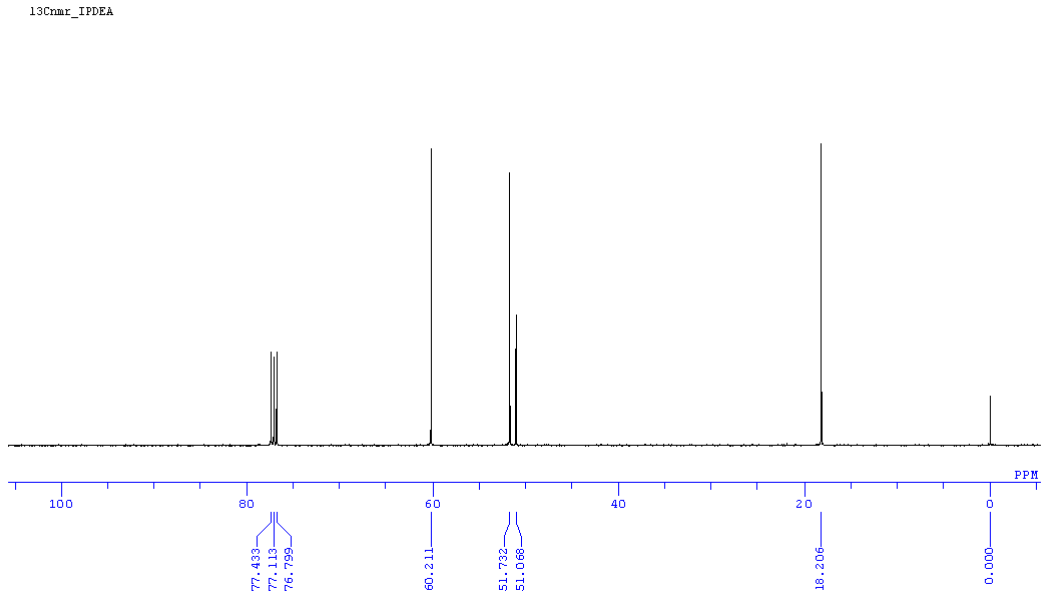
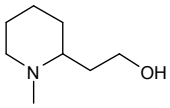
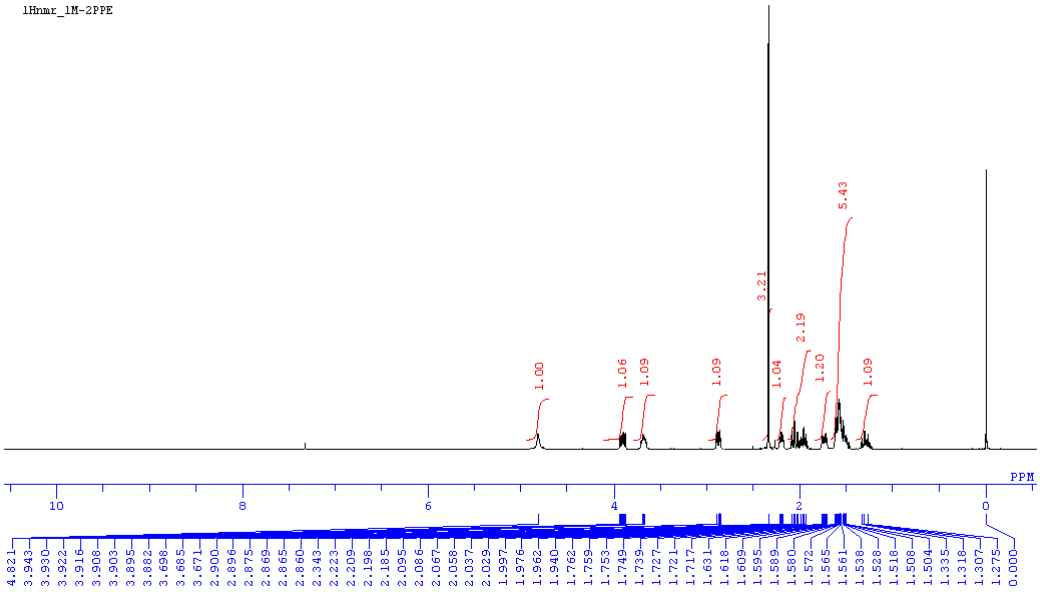


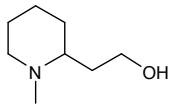
S6. ^{13}C NMR ($CDCl_3$) spectrum of absorbent **12**, *N*-Isopropylaminodiethanol (**IPDEA**)



21. 1M-2PPE



S7. ^{1}H NMR ($CDCl_3$) spectrum of absorbent **21**, 1-Methyl-2-piperidineethanol (**1M-2PPE**)



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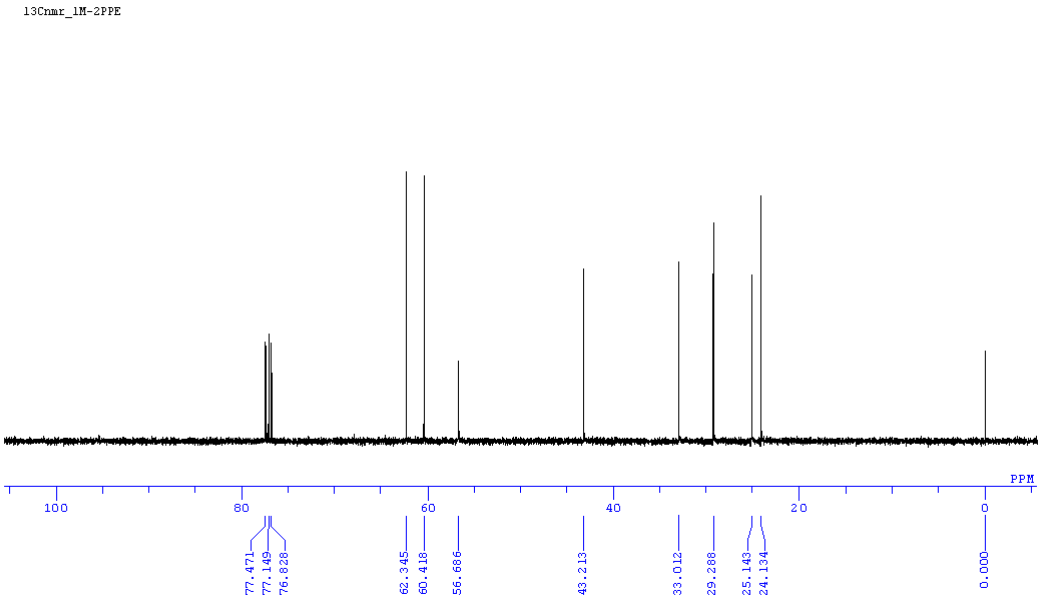
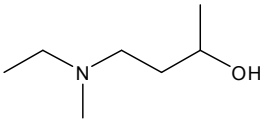


S8. ^{13}C NMR ($CDCl_3$) spectrum of absorbent **21**, 1-Methyl-2-piperidineethanol (**1M-2PPE**)



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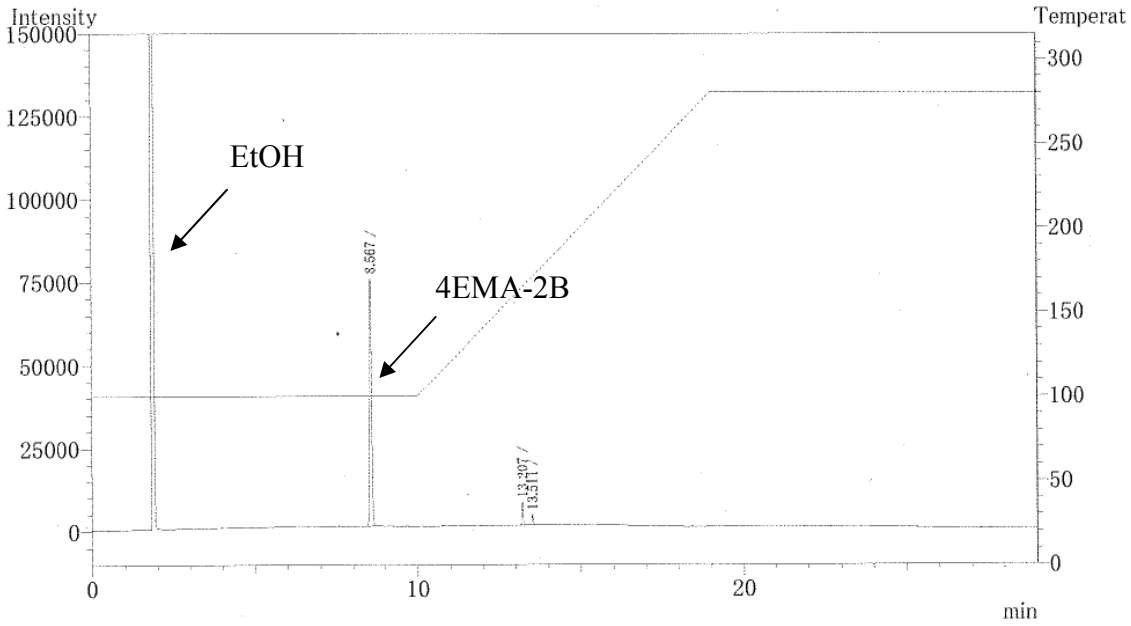
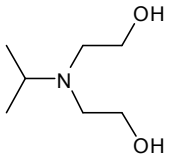
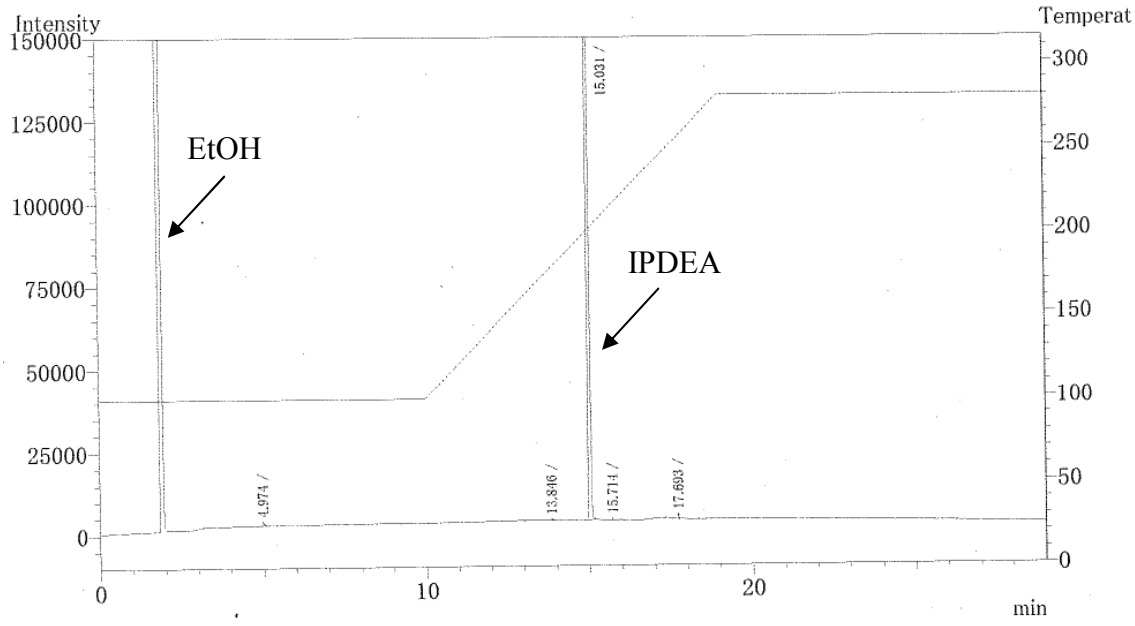


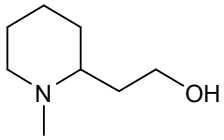
S9. GC spectrum of absorbent **10**, 4-Ethylmethyamino-2-butanol (**4EMA-2B**)



12. IPDEA



S10. GC spectrum of absorbent **12**, *N*-Isopropylaminodiethanol (**IPDEA**)



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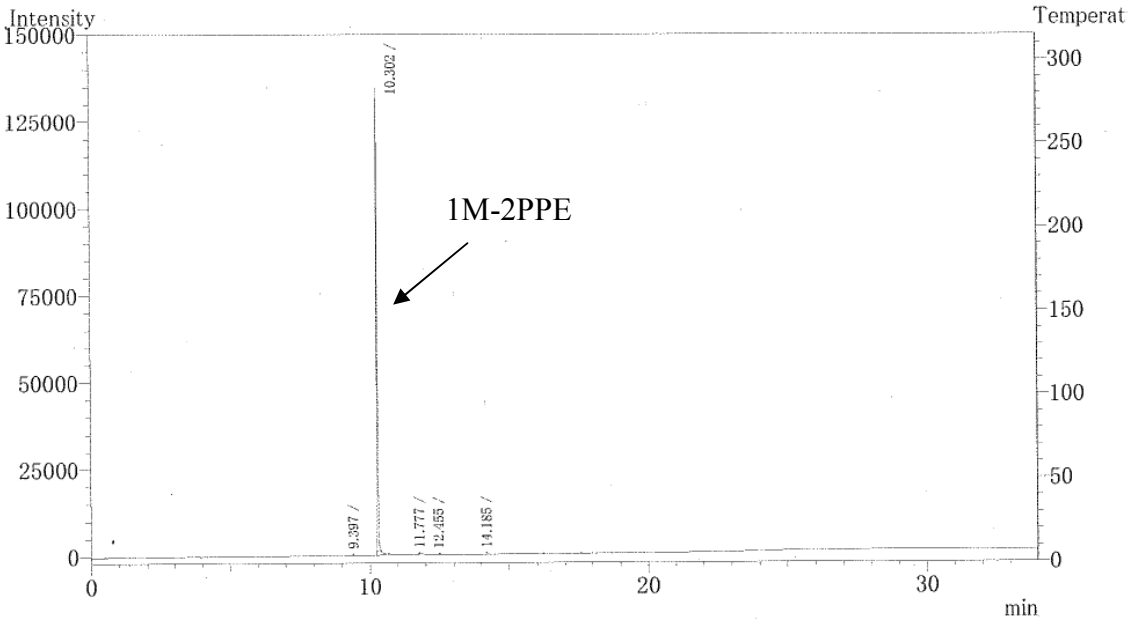
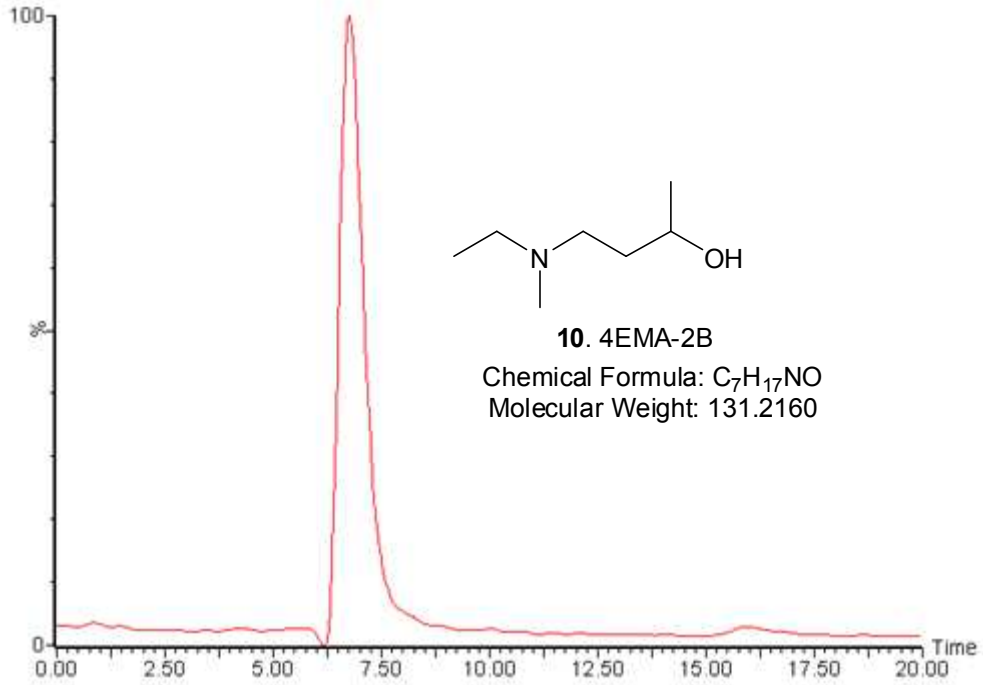


S11. GC spectrum of absorbent **21**, 1-Methyl-2-piperidineethanol (**1M-2PPE**)



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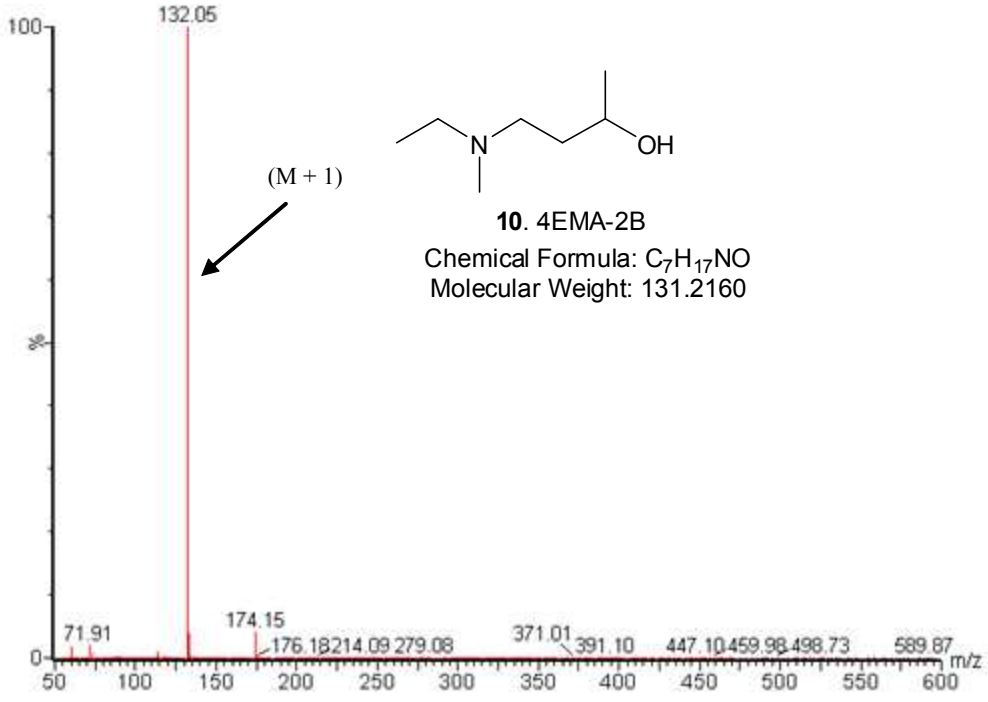
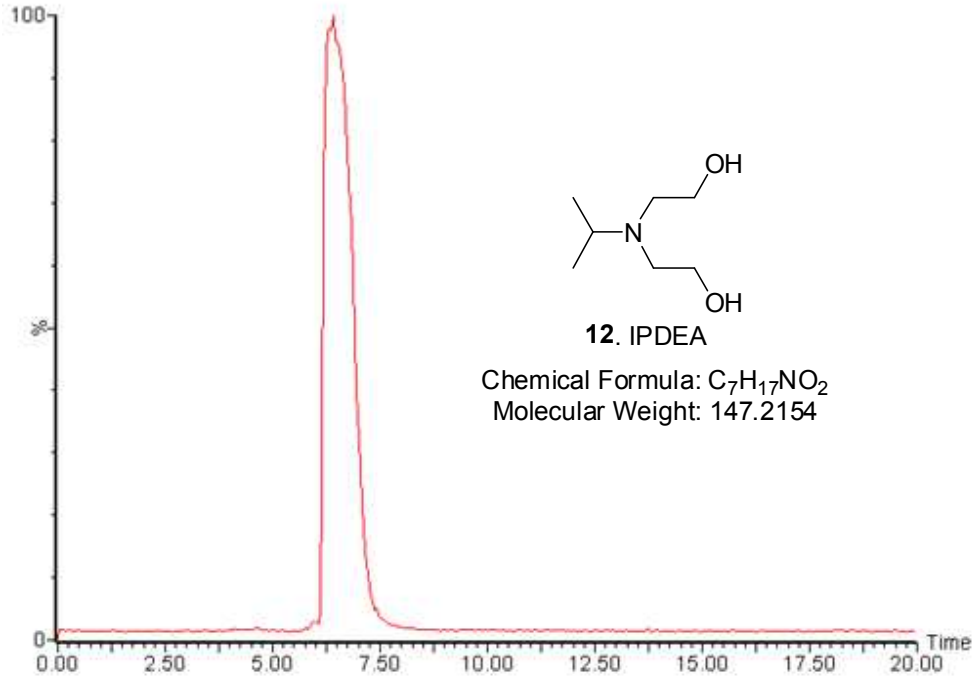


S13. Mass Spectrum of absorbent **10**, 4-Ethylmethyamino-2-butanol (**4EMA-2B**)



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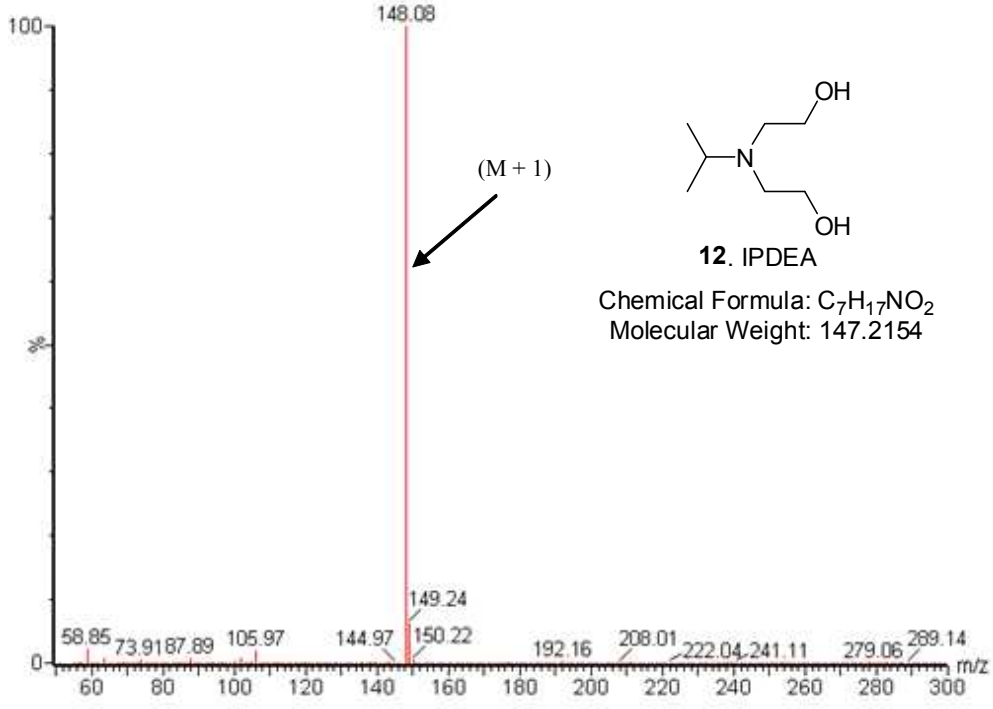
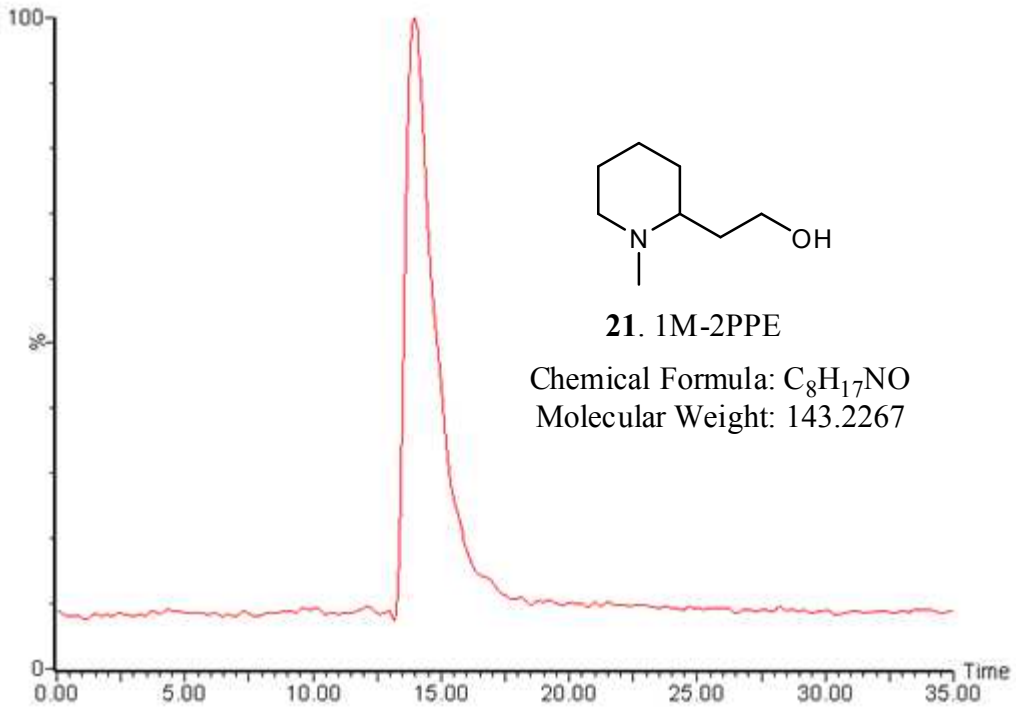


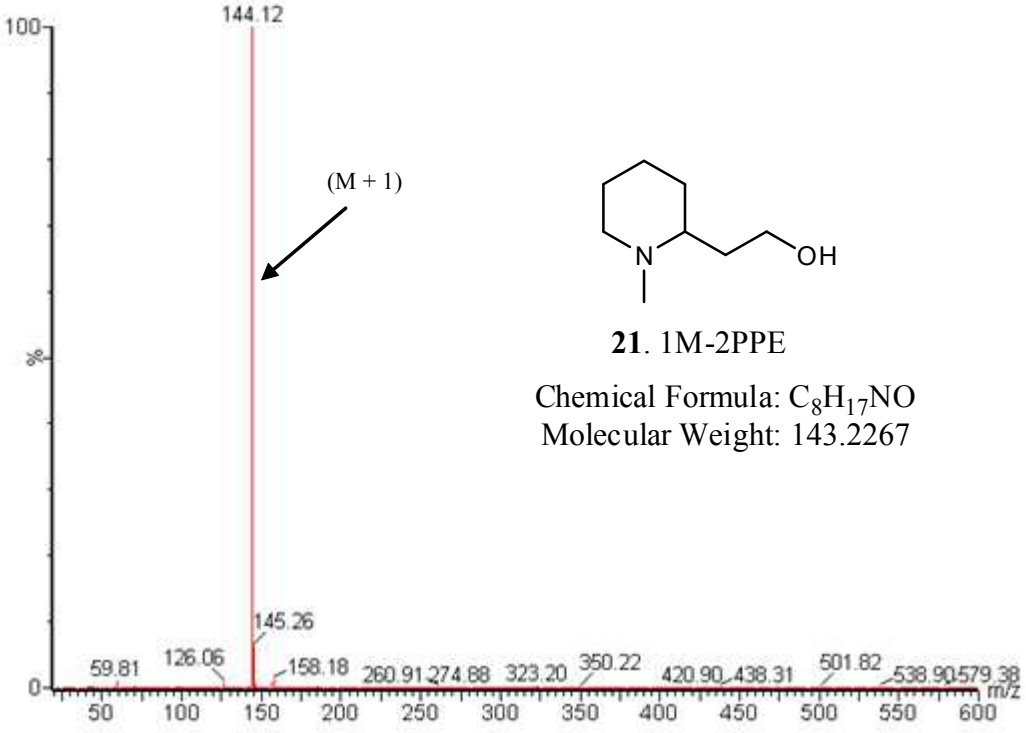
S15. Mass Spectrum of absorbent **12**, *N*-Isopropylaminodiethanol (**IPDEA**)



21. 1M-2PPE

Chemical Formula: $C_8H_{17}NO$
Molecular Weight: 143.2267

S16. Total ion chromatogram of absorbent **21**, 1-Methyl-2-piperidineethanol (**1M-2PPE**)



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S17. Mass Spectrum of absorbent **21**, 1-Methyl-2-piperidineethanol (**1M-2PPE**)

S18. Equilibrium CO_2 solubility (g-CO_2/L-soln.) in aqueous amine solutions (amine mass fraction 30 %) at 20 kPa CO_2 partial pressure

	Amine	40 °C	70 °C	120 °C
3	DEAE	89.4	54.4	7.2
4	DEA-1P	85.6	59.4	10.0
5	DMA-2P	94.4	49.4	5.6
11	EDEA	52.2	21.9	4.4
12	IPDEA	56.7	23.9	4.4
15	DEA-1,2-PD	72.8	43.3	6.7
16	TEA	21.0	7.8	1.8
19	1-(2HE)PP	78.9	36.7	6.7
21	1M-2PPE	87.8	48.3	9.4
24	MDEA	55.0	20.6	3.9