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APPENDICES

Appendix A The Calculation of Gas Permeation Rate

The permeance or pressure normalized flux of component 'i' is expressed as a thickness normalized permeation rate, $\left(\frac{P}{\delta}\right)_i$. Permeances are expressed in gas permeation units, GPU, where GPU = $1 \times 10^{-6} \text{ cm}^3(\text{STP})/\text{cm}^2 \cdot \text{sec} \cdot \text{cmHg}$.

$$\left(\frac{P}{\delta}\right)_i = \frac{Q_i \times 14.7 \times 10^6}{(A) \times (\Delta P) \times 76}$$

Where

$\left(\frac{P}{\delta}\right)_i$ = permeance of gas 'i' (GPU)

P = permeability of gas 'i' ($\text{cm}^3(\text{STP}) \cdot \text{cm}/\text{cm}^2 \cdot \text{sec} \cdot \text{cmHg}$)

δ = thickness of membrane (cm)

Q_i = volumetric flow rate of gas 'i' (cm^3/sec)

A = area of membrane (cm^2)

ΔP = pressure different across membrane (psi)

Appendix B The Experimental Flow Rate of Carbon Dioxide (CO₂), Methane (CH₄) and Nitrogen (N₂) of Mixed Matrix Membranes in Plasticization Study at Room Temperature and Pressure Between 25-250 psia

Table B1 SR/porous supporting CA

Gas	Pressure (psia)	vol. (ml)	time (sec)	Flow rate (ml/sec)	Permeance (GPU)*	Average of Permeance (GPU)	STDEV of Permeance
CO ₂	25	1	3.51	0.2849	49.87	49.54	0.29
		1	3.53	0.2833	49.59		
		1	3.52	0.2841	49.73		
		1	3.56	0.2809	49.17		
		1	3.55	0.2817	49.31		
	50	10	12.77	0.7831	68.54	68.61	0.10
		10	12.73	0.7855	68.76		
		10	12.75	0.7843	68.65		
		10	12.76	0.7837	68.60		
		10	12.78	0.7825	68.49		
	75	10	7.75	1.2903	75.29	75.25	0.18
		10	7.76	1.2887	75.20		
		10	7.78	1.2853	75.00		
		10	7.73	1.2937	75.49		
		10	7.75	1.2903	75.29		
	100	10	5.47	1.8282	80.01	79.80	0.24
		10	5.48	1.8248	79.86		
		10	5.47	1.8282	80.01		
		10	5.49	1.8215	79.72		
		10	5.51	1.8149	79.43		
	125	10	4.04	2.4752	86.66	86.96	0.45
		10	4.03	2.4814	86.88		
		10	4.05	2.4691	86.45		
		10	4	2.5000	87.53		
		10	4.01	2.4938	87.31		
150	100	30.81	3.2457	94.70	94.73	0.05	
	100	30.79	3.2478	94.76			
	100	30.8	3.2468	94.73			
	100	30.78	3.2489	94.79			
	100	30.82	3.2446	94.67			
175	100	24.87	4.0209	100.55	100.53	0.26	
	100	24.84	4.0258	100.68			
	100	24.81	4.0306	100.80			
	100	24.98	4.0032	100.11			
	100	24.88	4.0193	100.51			
200	100	20.87	4.7916	104.85	104.97	0.17	
	100	20.84	4.7985	105.00			
	100	20.81	4.8054	105.15			
	100	20.82	4.8031	105.10			
	100	20.89	4.7870	104.75			

Gas	Pressure (psia)	vol. (ml)	time (sec)	Flow rate (ml/sec)	Permeance (GPU)	Average of Permeance (GPU)	STDEV of Permeance
CO ₂	225	100	18	5.5556	108.06	107.86	0.19
		100	18.01	5.5525	108.00		
		100	18.08	5.5310	107.58		
		100	18.05	5.5402	107.76		
		100	18.03	5.5463	107.88		
	250	100	15.91	6.2854	110.03	110.03	0.08
		100	15.89	6.2933	110.17		
		100	15.92	6.2814	109.96		
		100	15.92	6.2814	109.96		
		100	15.91	6.2854	110.03		
CH ₄	25	1	48.23	0.0207	3.63	3.63	0.00
		1	48.28	0.0207	3.63		
		1	48.25	0.0207	3.63		
		1	48.31	0.0207	3.62		
		1	48.35	0.0207	3.62		
	50	1	23.59	0.0424	3.71	3.71	0.00
		1	23.58	0.0424	3.71		
		1	23.56	0.0424	3.72		
		1	23.61	0.0424	3.71		
		1	23.62	0.0423	3.71		
	75	1	15.23	0.0657	3.83	3.77	0.06
		1	15.26	0.0655	3.82		
		1	15.48	0.0646	3.77		
		1	15.68	0.0638	3.72		
		1	15.78	0.0634	3.70		
	100	1	10.52	0.0951	4.16	4.16	0.00
		1	10.51	0.0951	4.16		
		1	10.53	0.0950	4.16		
		1	10.51	0.0951	4.16		
		1	10.52	0.0951	4.16		
	125	1	8.25	0.1212	4.24	4.23	0.02
		1	8.35	0.1198	4.19		
		1	8.29	0.1206	4.22		
		1	8.27	0.1209	4.23		
		1	8.25	0.1212	4.24		
	150	1	6.79	0.1473	4.30	4.30	0.01
		1	6.78	0.1475	4.30		
		1	6.79	0.1473	4.30		
		1	6.81	0.1468	4.28		
		1	6.77	0.1477	4.31		
175	1	5.78	0.1730	4.33	4.35	0.03	
	1	5.76	0.1736	4.34			
	1	5.72	0.1748	4.37			
	1	5.7	0.1754	4.39			
	1	5.77	0.1733	4.33			
200	1	5.03	0.1988	4.35	4.34	0.01	
	1	5.04	0.1984	4.34			
	1	5.04	0.1984	4.34			
	1	5.05	0.1980	4.33			
	1	5.04	0.1984	4.34			

Gas	Pressure (psia)	vol. (ml)	time (sec)	Flow rate (ml/sec)	Permeance (GPU)	Average of Permeance (GPU)	STDEV of Permeance
N ₂	25	1	78.25	0.0128	2.24	2.24	0.00
		1	78.31	0.0128	2.24		
		1	78.3	0.0128	2.24		
		1	78.35	0.0128	2.23		
		1	78.36	0.0128	2.23		
	50	1	37.33	0.0268	2.34	2.33	0.02
		1	37.66	0.0266	2.32		
		1	37.34	0.0268	2.34		
		1	37.37	0.0268	2.34		
		1	37.89	0.0264	2.31		
	75	1	25.1	0.0398	2.32	2.33	0.00
		1	25.13	0.0398	2.32		
		1	25.11	0.0398	2.32		
		1	25.06	0.0399	2.33		
		1	25.08	0.0399	2.33		
100	1	18.25	0.0548	2.40	2.41	0.01	
	1	18.12	0.0552	2.42			
	1	18.16	0.0551	2.41			
	1	18.21	0.0549	2.40			
	1	18.24	0.0548	2.40			

Table B2 SR/porous supporting CA: Treated at 170 °C

Gas	P (psia)	vol. (ml)	time (sec)	Flow rate (ml/sec)	Permeance (GPU)	Average of Permeance (GPU)	STDEV of Permeance
CO ₂	25	1	7.34	0.1362	23.85	23.82	0.08
		1	7.35	0.1361	23.82		
		1	7.39	0.1353	23.69		
		1	7.32	0.1366	23.91		
		1	7.34	0.1362	23.85		
	50	10	27.63	0.3619	31.68	31.67	0.03
		10	27.61	0.3622	31.70		
		10	27.67	0.3614	31.63		
		10	27.63	0.3619	31.68		
		10	27.64	0.3618	31.67		
	75	10	17.31	0.5777	33.71	33.73	0.03
		10	17.29	0.5784	33.75		
		10	17.28	0.5787	33.77		
		10	17.31	0.5777	33.71		
		10	17.32	0.5774	33.69		
	100	10	12.12	0.8251	36.11	36.07	0.06
		10	12.13	0.8244	36.08		
		10	12.11	0.8258	36.14		
		10	12.14	0.8237	36.05		
		10	12.16	0.8224	35.99		
125	10	9.29	1.0764	37.69	37.66	0.04	
	10	9.29	1.0764	37.69			
	10	9.31	1.0741	37.61			
	10	9.3	1.0753	37.65			
	10	9.29	1.0764	37.69			

Gas	P (psia)	vol. (ml)	time (sec)	Flow rate (ml/sec)	Permeance (GPU)	Average of Permeance (GPU)	STDEV of Permeance
CO ₂	150	10	7.47	1.3387	39.06	39.00	0.12
		10	7.49	1.3351	38.95		
		10	7.51	1.3316	38.85		
		10	7.49	1.3351	38.95		
		10	7.45	1.3423	39.16		
	175	10	6.24	1.6026	40.08	40.12	0.13
		10	6.24	1.6026	40.08		
		10	6.25	1.6000	40.01		
		10	6.2	1.6129	40.34		
		10*	6.24	1.6026	40.08		
	200	10	5.33	1.8762	41.05	41.21	0.12
		10	5.31	1.8832	41.21		
		10	5.32	1.8797	41.13		
		10	5.29	1.8904	41.36		
		10	5.3	1.8868	41.29		
	225	10	4.63	2.1598	42.01	42.03	0.16
		10	4.64	2.1552	41.92		
		10	4.61	2.1692	42.19		
		10	4.65	2.1505	41.83		
		10	4.61	2.1692	42.19		
250	10	4.09	2.4450	42.80	42.76	0.12	
	10	4.11	2.4331	42.59			
	10	4.1	2.4390	42.70			
	10	4.09	2.4450	42.80			
	10	4.08	2.4510	42.91			

Table B3 SR/porous supporting CA: Treated at 190 °C

Gas	P (psia)	vol. (ml)	time (sec)	Flow rate (ml/sec)	Permeance (GPU)	Average of Permeance (GPU)	STDEV of Permeance
CO ₂	25	1	9.11	0.1098	19.22	19.19	0.04
		1	9.14	0.1094	19.15		
		1	9.12	0.1096	19.19		
		1	9.1	0.1099	19.24		
		1	9.14	0.1094	19.15		
	50	10	43.25	0.2312	20.24	20.22	0.03
		10	43.27	0.2311	20.23		
		10	43.21	0.2314	20.26		
		10	43.35	0.2307	20.19		
		10	43.37	0.2306	20.18		
	75	10	28.54	0.3504	20.45	20.44	0.03
		10	28.56	0.3501	20.43		
		10	28.61	0.3495	20.40		
		10	28.55	0.3503	20.44		
		10	28.5	0.3509	20.47		
	100	10	20.17	0.4958	21.70	21.68	0.02
		10	20.19	0.4953	21.68		
		10	20.21	0.4948	21.65		
		10	20.19	0.4953	21.68		
		10	20.16	0.4960	21.71		

Gas	P (psia)	vol. (ml)	time (sec)	Flow rate (ml/sec)	Permeance (GPU)	Average of Permeance (GPU)	STDEV of Permeance
CO ₂	125	10	16.12	0.6203	21.72	21.71	0.02
		10	16.11	0.6207	21.73		
		10	16.15	0.6192	21.68		
		10	16.13	0.6200	21.71		
		10	16.11	0.6207	21.73		
	150	10	12.99	0.7698	22.46	22.50	0.04
		10	12.95	0.7722	22.53		
		10	12.96	0.7716	22.51		
		10	12.94	0.7728	22.55		
		10	12.99	0.7698	22.46		
	175	10	10.9	0.9174	22.94	22.91	0.04
		10	10.94	0.9141	22.86		
		10	10.92	0.9158	22.90		
		10	10.93	0.9149	22.88		
		10	10.9	0.9174	22.94		
	200	10	9.22	1.0846	23.73	23.71	0.06
		10	9.27	1.0787	23.61		
		10	9.23	1.0834	23.71		
		10	9.21	1.0858	23.76		
		10	9.21	1.0858	23.76		
	225	10	8.17	1.2240	23.81	23.81	0.04
		10	8.16	1.2255	23.84		
		10	8.17	1.2240	23.81		
		10	8.16	1.2255	23.84		
		10	8.19	1.2210	23.75		
250	10	7.21	1.3870	24.28	24.20	0.07	
	10	7.25	1.3793	24.15			
	10	7.23	1.3831	24.21			
	10	7.26	1.3774	24.11			
	10	7.22	1.3850	24.25			

Table B4 10%NaX/SR/porous supporting CA

Gas	P (psia)	vol. (ml)	time (sec)	Flow rate (ml/sec)	Permeance (GPU)	Average of Permeance (GPU)	STDEV of Permeance
CO ₂	25	1	5.97	0.1675	29.32	29.58	0.22
		1	5.85	0.1709	29.92		
		1	5.91	0.1692	29.62		
		1	5.94	0.1684	29.47		
		1	5.92	0.1689	29.57		
	50	10	25.51	0.3920	34.31	34.42	0.10
		10	25.37	0.3942	34.50		
		10	25.36	0.3943	34.51		
		10	25.38	0.3940	34.49		
		10	25.51	0.3920	34.31		
	75	10	16.34	0.6120	35.71	35.72	0.02
		10	16.32	0.6127	35.75		
		10	16.34	0.6120	35.71		
		10	16.35	0.6116	35.69		

Gas	P (psia)	vol. (ml)	time (sec)	Flow rate (ml/sec)	Permeance (GPU)	Average of Permeance (GPU)	STDEV of Permeance
CO ₂	75	10	16.33	0.6124	35.73		
	100	10	11.98	0.8347	36.53	36.59	0.08
		10	11.95	0.8368	36.62		
		10	11.99	0.8340	36.50		
		10	11.96	0.8361	36.59		
		10	11.92	0.8389	36.71		
	125	10	9.23	1.0834	37.93	37.95	0.07
		10	9.21	1.0858	38.01		
		10	9.25	1.0811	37.85		
		10	9.21	1.0858	38.01		
		10	9.23	1.0834	37.93		
	150	10	7.42	1.3477	39.32	39.30	0.06
		10	7.43	1.3459	39.27		
		10	7.41	1.3495	39.37		
		10	7.44	1.3441	39.22		
		10	7.42	1.3477	39.32		
	175	10	6.19	1.6155	40.40	40.52	0.16
		10	6.18	1.6181	40.47		
		10	6.13	1.6313	40.80		
		10	6.17	1.6207	40.53		
		10	6.19	1.6155	40.40		
	200	10	5.19	1.9268	42.16	42.21	0.09
		10	5.18	1.9305	42.24		
		10	5.2	1.9231	42.08		
		10	5.17	1.9342	42.32		
		10	5.18	1.9305	42.24		
	225	10	4.62	2.1645	42.10	42.08	0.08
		10	4.61	2.1692	42.19		
10		4.63	2.1598	42.01			
10		4.62	2.1645	42.10			
10		4.63	2.1598	42.01			
250	10	3.99	2.5063	43.87	43.68	0.16	
	10	4	2.5000	43.76			
	10	4.01	2.4938	43.65			
	10	4.03	2.4814	43.44			
	10	4.01	2.4938	43.65			

Table B5 10%NaX/SR/porous supporting CA: Treated at 170 °C

Gas	P (psia)	vol. (ml)	time (sec)	Flow rate (ml/sec)	Permeance (GPU)	Average of Permeance (GPU)	STDEV of Permeance
CO ₂	25	1	9.35	0.1070	18.72	18.77	0.06
		1	9.36	0.1068	18.70		
		1	9.31	0.1074	18.80		
		1	9.33	0.1072	18.76		
		1	9.29	0.1076	18.84		

Gas	P (psia)	vol. (ml)	time (sec)	Flow rate (ml/sec)	Permeance (GPU)	Average of Permeance (GPU)	STDEV of Permeance
CO ₂	50	1	4.34	0.2304	20.17	21.43	2.80
		1	3.31	0.3021	26.44		
		1	4.35	0.2299	20.12		
		1	4.3	0.2326	20.36		
		1	4.36	0.2294	20.08		
	75	10	26.45	0.3781	22.06	22.02	0.03
		10	26.54	0.3768	21.99		
		10	26.51	0.3772	22.01		
		10	26.49	0.3775	22.03		
		10	26.51	0.3772	22.01		
	100	10	18.56	0.5388	23.58	23.68	0.15
		10	18.42	0.5429	23.76		
		10	18.37	0.5444	23.82		
		10	18.65	0.5362	23.47		
		10	18.41	0.5432	23.77		
	125	10	14.34	0.6974	24.42	24.38	0.07
		10	14.35	0.6969	24.40		
		10	14.31	0.6988	24.47		
		10	14.38	0.6954	24.35		
		10	14.41	0.6940	24.30		
	150	10	11.76	0.8503	24.81	24.74	0.06
		10	11.81	0.8467	24.70		
		10	11.78	0.8489	24.77		
		10	11.83	0.8453	24.66		
		10	11.79	0.8482	24.75		
	175	10	9.85	1.0152	25.39	25.32	0.16
		10	9.88	1.0121	25.31		
		10	9.81	1.0194	25.49		
		10	9.98	1.0020	25.06		
		10	9.87	1.0132	25.34		
	200	10	8.43	1.1862	25.96	26.04	0.13
		10	8.46	1.1820	25.87		
		10	8.39	1.1919	26.08		
		10	8.36	1.1962	26.17		
		10	8.37	1.1947	26.14		
	225	10	7.34	1.3624	26.50	26.36	0.10
		10	7.36	1.3587	26.43		
		10	7.41	1.3495	26.25		
		10	7.39	1.3532	26.32		
		10	7.4	1.3514	26.28		
	250	10	6.45	1.5504	27.14	26.98	0.10
		10	6.49	1.5408	26.97		
		10	6.51	1.5361	26.89		
		10	6.49	1.5408	26.97		
		10	6.5	1.5385	26.93		

Table B6 10%NaX/SR/porous supporting CA: Treated at 190 °C

Gas	P (psia)	vol. (ml)	time (sec)	Flow rate (ml/sec)	Permeance (GPU)	Average of Permeance (GPU)	STDEV of Permeance
CO ₂	25	1	10.72	0.0933	16.33	16.28	0.03
		1	10.74	0.0931	16.30		
		1	10.78	0.0928	16.24		
		1	10.76	0.0929	16.27		
		1	10.75	0.0930	16.28		
	50	1	4.89	0.2045	17.90	17.98	0.05
		1	4.86	0.2058	18.01		
		1	4.87	0.2053	17.97		
		1	4.85	0.2062	18.05		
		1	4.87	0.2053	17.97		
	75	10	30.12	0.3320	19.37	19.37	0.01
		10	30.15	0.3317	19.35		
		10	30.13	0.3319	19.37		
		10	30.11	0.3321	19.38		
		10	30.15	0.3317	19.35		
	100	10	22.28	0.4488	19.64	19.72	0.05
		10	22.16	0.4513	19.75		
		10	22.18	0.4509	19.73		
		10	22.15	0.4515	19.76		
		10	22.2	0.4505	19.71		
	125	10	17.11	0.5845	20.46	20.46	0.02
		10	17.12	0.5841	20.45		
		10	17.12	0.5841	20.45		
		10	17.1	0.5848	20.47		
		10	17.09	0.5851	20.49		
	150	10	13.65	0.7326	21.37	21.39	0.05
		10	13.59	0.7358	21.47		
		10	13.67	0.7315	21.34		
		10	13.63	0.7337	21.41		
		10	13.66	0.7321	21.36		
	175	10	11.37	0.8795	21.99	21.99	0.03
		10	11.39	0.8780	21.96		
		10	11.36	0.8803	22.01		
		10	11.38	0.8787	21.98		
		10	11.35	0.8811	22.03		
200	10	9.69	1.0320	22.58	22.47	0.17	
	10	9.66	1.0352	22.65			
	10	9.78	1.0225	22.37			
	10	9.72	1.0288	22.51			
	10	9.84	1.0163	22.24			
225	10	8.41	1.1891	23.13	23.16	0.11	
	10	8.43	1.1862	23.07			
	10	8.42	1.1876	23.10			
	10	8.4	1.1905	23.16			
	10	8.33	1.2005	23.35			

Gas	P (psia)	vol. (ml)	time (sec)	Flow rate (ml/sec)	Permeance (GPU)	Average of Permeance (GPU)	STDEV of Permeance
CO ₂	250	10	7.35	1.3605	23.82	23.77	0.05
		10	7.37	1.3569	23.75		
		10	7.36	1.3587	23.78		
		10	7.39	1.3532	23.69		
		10	7.36	1.3587	23.78		

Table B7 20%NaX/SR/porous supporting CA

Gas	P (psia)	vol. (ml)	time (sec)	Flow rate (ml/sec)	Permeance (GPU)	Average of Permeance (GPU)	STDEV of Permeance
CO ₂	25	1	7.02	0.1425	24.94	24.80	0.13
		1	7.08	0.1412	24.73		
		1	7.05	0.1418	24.83		
		1	7.03	0.1422	24.90		
		1	7.11	0.1406	24.62		
	50	10	30.41	0.3288	28.78	28.84	0.13
		10	30.24	0.3307	28.94		
		10	30.33	0.3297	28.86		
		10	30.23	0.3308	28.95		
		10	30.56	0.3272	28.64		
	75	10	18.88	0.5297	30.91	30.91	0.02
		10	18.87	0.5299	30.92		
		10	18.89	0.5294	30.89		
		10	18.86	0.5302	30.94		
		10	18.88	0.5297	30.91		
	100	10	13.31	0.7513	32.88	32.68	0.13
		10	13.45	0.7435	32.54		
		10	13.38	0.7474	32.71		
		10	13.4	0.7463	32.66		
		10	13.42	0.7452	32.61		
125	10	10.33	0.9681	33.89	33.94	0.11	
	10	10.35	0.9662	33.83			
	10	10.29	0.9718	34.02			
	10	10.27	0.9737	34.09			
	10	10.34	0.9671	33.86			
150	10	8.29	1.2063	35.19	35.33	0.13	
	10	8.27	1.2092	35.28			
	10	8.21	1.2180	35.54			
	10	8.27	1.2092	35.28			
	10	8.25	1.2121	35.36			
175	10	6.91	1.4472	36.19	36.39	0.15	
	10	6.87	1.4556	36.40			
	10	6.89	1.4514	36.30			
	10	6.85	1.4599	36.51			
	10	6.84	1.4620	36.56			
200	10	5.84	1.7123	37.47	37.34	0.13	
	10	5.89	1.6978	37.15			
	10	5.85	1.7094	37.41			
	10	5.87	1.7036	37.28			

Gas	P (psia)	vol. (ml)	time (sec)	Flow rate (ml/sec)	Permeance (GPU)	Average of Permeance (GPU)	STDEV of Permeance
CO ₂	200	10	5.85	1.7094	37.41	38.40	0.24
		10	5.07	1.9724	38.36		
	225	10	5.03	1.9881	38.67	38.96	0.33
		10	5.04	1.9841	38.59		
		10	5.11	1.9569	38.06		
		10	5.08	1.9685	38.29		
		10	4.49	2.2272	38.99		
	250	10	4.51	2.2173	38.82	38.96	0.33
		10	4.46	2.2422	39.25		
		10	4.55	2.1978	38.47		
10		4.46	2.2422	39.25			
10		4.46	2.2422	39.25			

Table B8 20%NaX/SR/porous supporting CA: Treated at 170 °C

Gas	P (psia)	vol. (ml)	time (sec)	Flow rate (ml/sec)	Permeance (GPU)	Average of Permeance (GPU)	STDEV of Permeance
CO ₂	25	1	9.86	0.1014	17.75	17.68	0.04
		1	9.91	0.1009	17.66		
		1	9.92	0.1008	17.65		
		1	9.91	0.1009	17.66		
		1	9.91	0.1009	17.66		
	50	1	4.39	0.2278	19.94	19.99	0.13
		1	4.4	0.2273	19.89		
		1	4.39	0.2278	19.94		
		1	4.38	0.2283	19.98		
		1	4.33	0.2309	20.21		
	75	10	27.53	0.3632	21.20	21.22	0.01
		10	27.51	0.3635	21.21		
		10	27.49	0.3638	21.23		
		10	27.48	0.3639	21.23		
		10	27.5	0.3636	21.22		
	100	10	19.89	0.5028	22.00	22.01	0.01
		10	19.87	0.5033	22.03		
		10	19.88	0.5030	22.01		
		10	19.9	0.5025	21.99		
		10	19.87	0.5033	22.03		
	125	10	15.26	0.6553	22.94	22.95	0.03
		10	15.28	0.6545	22.91		
		10	15.27	0.6549	22.93		
		10	15.25	0.6557	22.96		
		10	15.23	0.6566	22.99		
	150	10	12.47	0.8019	23.40	23.42	0.03
		10	12.44	0.8039	23.45		
		10	12.45	0.8032	23.43		
		10	12.48	0.8013	23.38		
		10	12.44	0.8039	23.45		
175	10	10.48	0.9542	23.86	23.85	0.03	
	10	10.49	0.9533	23.84			
	10	10.5	0.9524	23.82			
	10	10.49	0.9533	23.84			

Gas	P (psia)	vol. (ml)	time (sec)	Flow rate (ml/sec)	Permeance (GPU)	Average of Permeance (GPU)	STDEV of Permeance
CO ₂	175	10	10.47	0.9551	23.89	24.27	0.04
		10	9.01	1.1099	24.29		
	10	9	1.1111	24.31			
	10	9.04	1.1062	24.21			
	10	9.01	1.1099	24.29			
	10	9.02	1.1086	24.26			
	225	10	7.85	1.2739	24.78	24.73	0.07
		10	7.89	1.2674	24.65		
		10	7.84	1.2755	24.81		
		10	7.88	1.2690	24.68		
		10	7.87	1.2706	24.71		
	250	10	6.9	1.4493	25.37	25.31	0.06
		10	6.92	1.4451	25.30		
		10	6.94	1.4409	25.22		
		10	6.9	1.4493	25.37		
		10	6.92	1.4451	25.30		

Table B9 20%NaX/SR/porous supporting CA: Treated at 190 °C

Gas	P (psia)	vol. (ml)	time (sec)	Flow rate (ml/sec)	Permeance (GPU)	Average of Permeance (GPU)	STDEV of Permeance
CO ₂	25	1	11.89	0.0841	14.72	14.74	0.04
		1	11.91	0.0840	14.70		
		1	11.84	0.0845	14.79		
		1	11.85	0.0844	14.77		
		1	11.89	0.0841	14.72		
	50	1	5.32	0.1880	16.45	16.42	0.08
		1	5.33	0.1876	16.42		
		1	5.37	0.1862	16.30		
		1	5.3	0.1887	16.51		
		1	5.34	0.1873	16.39		
	75	10	32.65	0.3063	17.87	17.87	0.02
		10	32.66	0.3062	17.87		
		10	32.69	0.3059	17.85		
		10	32.61	0.3067	17.89		
		10	32.66	0.3062	17.87		
	100	10	23.69	0.4221	18.47	18.43	0.04
		10	23.81	0.4200	18.38		
		10	23.71	0.4218	18.46		
		10	23.72	0.4216	18.45		
		10	23.81	0.4200	18.38		
	125	10	18.29	0.5467	19.14	19.11	0.04
		10	18.28	0.5470	19.15		
		10	18.36	0.5447	19.07		
		10	18.36	0.5447	19.07		
		10	18.32	0.5459	19.11		
	150	10	14.78	0.6766	19.74	19.74	0.08
		10	14.77	0.6770	19.75		
		10	14.89	0.6716	19.59		
		10	14.76	0.6775	19.77		

Gas	P (psia)	vol. (ml)	time (sec)	Flow rate (ml/sec)	Permeance (GPU)	Average of Permeance (GPU)	STDEV of Permeance		
CO ₂	150	10	14.72	0.6793	19.82	20.38	0.01		
		10	12.26	0.8157	20.40				
	175	10	12.27	0.8150	20.38				
		10	12.27	0.8150	20.38				
		10	12.28	0.8143	20.36				
		10	12.26	0.8157	20.40				
		10	12.26	0.8157	20.40				
	200	10	10.62	0.9416	20.60			20.64	0.05
		10	10.61	0.9425	20.62				
		10	10.59	0.9443	20.66				
		10	10.63	0.9407	20.59				
		10	10.57	0.9461	20.70				
	225	10	9.09	1.1001	21.40			21.44	0.05
		10	9.06	1.1038	21.47				
		10	9.1	1.0989	21.37				
		10	9.05	1.1050	21.49				
		10	9.07	1.1025	21.45				
	250	10	8.1	1.2346	21.61			21.74	0.08
		10	8.03	1.2453	21.80				
		10	8.05	1.2422	21.75				
10		8.06	1.2407	21.72					
10		8.03	1.2453	21.80					

Table B10 30%NaX/SR/porous supporting CA

Gas	P (psia)	vol. (ml)	time (sec)	Flow rate (ml/sec)	Permeance (GPU)	Average of Permeance (GPU)	STDEV of Permeance
CO ₂	25	1	10.78	0.0928	16.24	16.48	0.25
		1	10.76	0.0929	16.27		
		1	10.39	0.0962	16.85		
		1	10.54	0.0949	16.61		
		1	10.65	0.0939	16.44		
	50	1	5.04	0.1984	17.37	17.72	0.29
		1	4.95	0.2020	17.68		
		1	4.96	0.2016	17.65		
		1	4.93	0.2028	17.75		
		1	4.82	0.2075	18.16		
	75	10	31.15	0.3210	18.73	18.72	0.03
		10	31.12	0.3213	18.75		
		10	31.18	0.3207	18.71		
		10	31.14	0.3211	18.74		
		10	31.23	0.3202	18.68		
	100	10	22.05	0.4535	19.85	19.78	0.06
		10	22.07	0.4531	19.83		
		10	22.12	0.4521	19.78		
		10	22.17	0.4511	19.74		
		10	22.21	0.4502	19.70		
125	10	16.44	0.6083	21.30	21.30	0.09	
	10	16.43	0.6086	21.31			
	10	16.33	0.6124	21.44			
	10	16.53	0.6050	21.18			

Gas	P (psia)	vol. (ml)	time (sec)	Flow rate (ml/sec)	Permeance (GPU)	Average of Permeance (GPU)	STDEV of Permeance
CO ₂	125	10	16.47	0.6072	21.26		
		10	13.19	0.7582	22.12		
	150	10	13.28	0.7530	21.97	22.05	0.07
		10	13.21	0.7570	22.09		
		10	13.22	0.7564	22.07		
		10	13.27	0.7536	21.99		
		10	10.98	0.9107	22.78		
	175	10	10.95	0.9132	22.84	22.86	0.08
		10	10.92	0.9158	22.90		
		10	10.96	0.9124	22.82		
		10	10.88	0.9191	22.99		
		10	9.29	1.0764	23.55		
	200	10	9.27	1.0787	23.61	23.56	0.13
		10	*9.33	1.0718	23.45		
		10	9.34	1.0707	23.43		
		10	9.21	1.0858	23.76		
		10	8.01	1.2484	24.28		
	225	10	8.05	1.2422	24.16	24.20	0.11
		10	8.09	1.2361	24.04		
		10	8.03	1.2453	24.22		
		10	8	1.2500	24.31		
		10	7.01	1.4265	24.97		
	250	10	7.01	1.4265	24.97	24.91	0.14
		10	6.99	1.4306	25.04		
10		7.09	1.4104	24.69			
10		7.04	1.4205	24.87			

Table B11 30%NaX/SR/porous supporting CA: Treated at 170 °C

Gas	P (psia)	vol. (ml)	time (sec)	Flow rate (ml/sec)	Permeance (GPU)	Average of Permeance (GPU)	STDEV of Permeance
CO ₂	25	1	14.45	0.0692	12.11	12.08	0.03
		1	14.51	0.0689	12.06		
		1	14.49	0.0690	12.08		
		1	14.53	0.0688	12.05		
		1	14.46	0.0692	12.11		
	50	1	6.23	0.1605	14.05	14.02	0.05
		1	6.25	0.1600	14.00		
		1	6.27	0.1595	13.96		
		1	6.25	0.1600	14.00		
		1	6.21	0.1610	14.09		
	75	1	4.03	0.2481	14.48	14.34	0.11
		1	4.06	0.2463	14.37		
		1	4.09	0.2445	14.27		
		1	4.06	0.2463	14.37		
		1	4.11	0.2433	14.20		
	100	10	28.21	0.3545	15.51	15.40	0.10
		10	28.27	0.3537	15.48		
		10	28.45	0.3515	15.38		
		10	28.54	0.3504	15.33		

Gas	P (psia)	vol. (ml)	time (sec)	Flow rate (ml/sec)	Permeance (GPU)	Average of Permeance (GPU)	STDEV of Permeance
CO ₂	100	10	28.67	0.3488	15.26		
		125	10	21.14	0.4730	16.56	16.53
	10	21.19	0.4719	16.52			
	10	21.21	0.4715	16.51			
	10	21.19	0.4719	16.52			
	10	21.18	0.4721	16.53			
	150	10	17.04	0.5869	17.12	17.05	0.04
		10	17.13	0.5838	17.03		
		10	17.15	0.5831	17.01		
		10	17.11	0.5845	17.05		
		10	17.14	0.5834	17.02		
	175	10	14.09	0.7097	17.75	17.75	0.06
		10	14.12	0.7082	17.71		
		10	14.15	0.7067	17.67		
		10	14.07	0.7107	17.77		
		10	14.02	0.7133	17.84		
	200	10	11.92	0.8389	18.36	18.34	0.05
		10	11.89	0.8410	18.40		
		10	11.94	0.8375	18.33		
		10	11.98	0.8347	18.27		
		10	11.92	0.8389	18.36		
	225	10	10.51	0.9515	18.51	18.39	0.10
		10	10.53	0.9497	18.47		
		10	10.58	0.9452	18.38		
		10	10.61	0.9425	18.33		
		10	10.65	0.9390	18.26		
	250	10	9.21	1.0858	19.01	18.83	0.25
		10	9.28	1.0776	18.86		
10		9.25	1.0811	18.92			
10		9.23	1.0834	18.97			
10		9.52	1.0504	18.39			

Table B12 30%NaX/SR/porous supporting CA: Treated at 190 °C

Gas	P (psia)	vol. (ml)	time (sec)	Flow rate (ml/sec)	Permeance (GPU)	Average of Permeance (GPU)	STDEV of Permeance
CO ₂	25	1	24.65	0.0406	7.10	7.10	0.01
		1	24.61	0.0406	7.11		
		1	24.66	0.0406	7.10		
		1	24.69	0.0405	7.09		
		1	24.6	0.0407	7.12		
	50	1	10.45	0.0957	8.38	8.39	0.02
		1	10.41	0.0961	8.41		
		1	10.43	0.0959	8.39		
		1	10.46	0.0956	8.37		
		1	10.42	0.0960	8.40		
	75	1	6.35	0.1575	9.19	9.08	0.07
		1	6.43	0.1555	9.07		
		1	6.48	0.1543	9.00		
		1	6.45	0.1550	9.05		

Gas	P (psia)	vol. (ml)	time (sec)	Flow rate (ml/sec)	Permeance (GPU)	Average of Permeance (GPU)	STDEV of Permeance
CO ₂	75	1	6.41	0.1560	9.10		
	100	10	45.54	0.2196	9.61	9.59	0.01
		10	45.63	0.2192	9.59		
		10	45.67	0.2190	9.58		
		10	45.69	0.2189	9.58		
		10	45.61	0.2193	9.60		
	125	10	32.93	0.3037	10.63	10.56	0.05
		10	33.35	0.2999	10.50		
		10	33.12	0.3019	10.57		
		10	33.24	0.3008	10.53		
		10	33.19	0.3013	10.55		
	150	10	24.99	0.4002	11.68	11.64	0.04
		10	25.01	0.3998	11.67		
		10	25.02	0.3997	11.66		
		10	25.12	0.3981	11.61		
		10	25.17	0.3973	11.59		
	175	10	21.11	0.4737	11.85	11.85	0.01
		10	21.14	0.4730	11.83		
		10	21.09	0.4742	11.86		
		10	21.08	0.4744	11.86		
		10	21.1	0.4739	11.85		
	200	10	17.56	0.5695	12.46	12.41	0.03
		10	17.62	0.5675	12.42		
		10	17.65	0.5666	12.40		
		10	17.68	0.5656	12.38		
		10	17.62	0.5675	12.42		
	225	10	15.21	0.6575	12.79	12.78	0.02
		10	15.24	0.6562	12.76		
10		15.19	0.6583	12.80			
10		15.2	0.6579	12.80			
10		15.23	0.6566	12.77			
250	10	13.45	0.7435	13.02	13.03	0.02	
	10	13.47	0.7424	13.00			
	10	13.42	0.7452	13.04			
	10	13.44	0.7440	13.02			
	10	13.41	0.7457	13.05			

Table B13 40%NaX/SR/porous supporting CA

Gas	P (psia)	vol. (ml)	time (sec)	Flow rate (ml/sec)	Permeance (GPU)	Average of Permeance (GPU)	STDEV of Permeance
CO ₂	25	1	19.19	0.0521	9.12	9.13	0.01
		1	19.17	0.0522	9.13		
		1	19.16	0.0522	9.14		
		1	19.21	0.0521	9.11		
		1	19.18	0.0521	9.13		
	50	1	7.31	0.1368	11.97	11.78	0.12
		1	7.46	0.1340	11.73		
		1	7.41	0.1350	11.81		
		1	7.52	0.1330	11.64		
		1	7.52	0.1330	11.64		

Gas	P (psia)	vol. (ml)	time (sec)	Flow rate (ml/sec)	Permeance (GPU)	Average of Permeance (GPU)	STDEV of Permeance
CO ₂	50	1	7.45	0.1342	11.75		
	75	10	44.46	0.2249	13.12	13.17	0.06
		10	44.41	0.2252	13.14		
		10	44.53	0.2246	13.10		
		10	44.04	0.2271	13.25		
		10	44.15	0.2265	13.22		
	100	10	31.11	0.3214	14.07	14.06	0.03
		10	31.1	0.3215	14.07		
		10	31.11	0.3214	14.07		
		10	31.09	0.3216	14.08		
		10	31.27	0.3198	14.00		
	125	10	23.48	0.4259	14.91	14.90	0.08
		10	23.65	0.4228	14.80		
		10	23.37	0.4279	14.98		
		10	23.39	0.4275	14.97		
		10	23.61	0.4235	14.83		
	150	10	18.95	0.5277	15.40	15.42	0.04
		10	18.93	0.5283	15.41		
		10	18.97	0.5271	15.38		
		10	18.84	0.5308	15.49		
		10	18.89	0.5294	15.45		
	175	10	15.63	0.6398	16.00	16.02	0.06
		10	15.64	0.6394	15.99		
		10	15.68	0.6378	15.95		
		10	15.52	0.6443	16.11		
		10	15.6	0.6410	16.03		
	200	10	13.48	0.7418	16.23	16.25	0.04
		10	13.42	0.7452	16.31		
		10	13.49	0.7413	16.22		
		10	13.44	0.7440	16.28		
		10	13.49	0.7413	16.22		
	225	10	11.6	0.8621	16.77	16.79	0.05
		10	11.59	0.8628	16.78		
		10	11.52	0.8681	16.88		
		10	11.59	0.8628	16.78		
		10	11.61	0.8613	16.75		
250	10	10.34	0.9671	16.93	16.91	0.02	
	10	10.35	0.9662	16.91			
	10	10.37	0.9643	16.88			
	10	10.34	0.9671	16.93			
	10	10.36	0.9653	16.90			

Table B14 40%NaX/SR/porous supporting CA: Treated at 170 °C

Gas	P (psia)	vol. (ml)	time (sec)	Flow rate (ml/sec)	Permeance (GPU)	Average of Permeance (GPU)	STDEV of Permeance
CO ₂	25	1	19.87	0.0503	8.81	8.82	0.01
		1	19.85	0.0504	8.82		
		1	19.87	0.0503	8.81		
		1	19.83	0.0504	8.83		

Gas	P (psia)	vol. (ml)	time (sec)	Flow rate (ml/sec)	Permeance (GPU)	Average of Permeance (GPU)	STDEV of Permeance
CO ₂	25	1	19.81	0.0505	8.84		
	50	1	7.88	0.1269	11.11	11.16	0.06
		1	7.81	0.1280	11.21		
		1	7.89	0.1267	11.09		
		1	7.84	0.1276	11.16		
		1	7.8	0.1282	11.22		
	75	10	47.18	0.2120	12.37	12.31	0.07
		10	47.23	0.2117	12.35		
		10	47.4	0.2109	12.31		
		10	47.82	0.2091	12.20		
		10	47.41	0.2109	12.31		
	100	10	33.43	0.2991	13.09	13.13	0.04
		10	33.34	0.2999	13.13		
		10	33.23	0.3009	13.17		
		10	33.42	0.2992	13.10		
		10	33.19	0.3013	13.19		
	125	10	25.07	0.3989	13.97	13.96	0.02
		10	25.12	0.3981	13.94		
		10	25.07	0.3989	13.97		
		10	25.03	0.3995	13.99		
		10	25.09	0.3986	13.95		
	150	10	20.35	0.4914	14.34	14.33	0.02
		10	20.34	0.4916	14.34		
		10	20.33	0.4919	14.35		
		10	20.38	0.4907	14.32		
		10	20.39	0.4904	14.31		
	175	10	16.73	0.5977	14.95	14.94	0.06
		10	16.65	0.6006	15.02		
		10	16.73	0.5977	14.95		
		10	16.78	0.5959	14.90		
10		16.82	0.5945	14.87			
200	10	14.26	0.7013	15.35	15.33	0.03	
	10	14.28	0.7003	15.32			
	10	14.25	0.7018	15.36			
	10	14.31	0.6988	15.29			
	10	14.26	0.7013	15.35			
225	10	12.47	0.8019	15.60	15.69	0.06	
	10	12.35	0.8097	15.75			
	10	12.39	0.8071	15.70			
	10	12.41	0.8058	15.67			
	10	12.37	0.8084	15.72			
250	10	11.03	0.9066	15.87	15.87	0.02	
	10	11.04	0.9058	15.86			
	10	11.02	0.9074	15.89			
	10	11.05	0.9050	15.84			
	10	11.02	0.9074	15.89			

Table B15 40%NaX/SR/porous supporting CA: Treated at 190 °C

Gas	P (psia)	vol. (ml)	time (sec)	Flow rate (ml/sec)	Permeance (GPU)	Average of Permeance (GPU)	STDEV of Permeance
CO ₂	25	1	33.81	0.0296	5.18	5.21	0.03
		1	33.45	0.0299	5.23		
		1	33.34	0.0300	5.25		
		1	33.73	0.0296	5.19		
		1	33.67	0.0297	5.20		
	50	1	13.09	0.0764	6.69	6.68	0.01
		1	13.1	0.0763	6.68		
		1	13.14	0.0761	6.66		
		1	13.08	0.0765	6.69		
		1	13.12	0.0762	6.67		
	75	1	8.06	0.1241	7.24	7.21	0.02
		1	8.12	0.1232	7.19		
		1	8.07	0.1239	7.23		
		1	8.09	0.1236	7.21		
		1	8.11	0.1233	7.20		
	100	10	56.88	0.1758	7.69	7.70	0.01
		10	56.83	0.1760	7.70		
		10	56.92	0.1757	7.69		
		10	56.87	0.1758	7.70		
		10	56.81	0.1760	7.70		
	125	10	43.18	0.2316	8.11	8.11	0.00
		10	43.17	0.2316	8.11		
		10	43.21	0.2314	8.10		
		10	43.2	0.2315	8.10		
		10	43.19	0.2315	8.11		
	150	10	35.24	0.2838	8.28	8.25	0.04
		10	35.23	0.2838	8.28		
		10	35.63	0.2807	8.19		
		10	35.41	0.2824	8.24		
		10	35.33	0.2830	8.26		
	175	10	28.95	0.3454	8.64	8.63	0.01
		10	28.94	0.3455	8.64		
		10	28.98	0.3451	8.63		
		10	29.05	0.3442	8.61		
		10	29.03	0.3445	8.61		
	200	10	24.99	0.4002	8.76	8.77	0.01
		10	24.91	0.4014	8.78		
		10	24.92	0.4013	8.78		
		10	24.95	0.4008	8.77		
		10	24.98	0.4003	8.76		
225	10	21.65	0.4619	8.98	8.98	0.01	
	10	21.69	0.4610	8.97			
	10	21.66	0.4617	8.98			
	10	21.65	0.4619	8.98			
	10	21.71	0.4606	8.96			
250	10	19.35	0.5168	9.05	9.07	0.01	
	10	19.3	0.5181	9.07			
	10	19.31	0.5179	9.07			
	10	19.28	0.5187	9.08			

Table B16 SR/dense supporting CA

Gas	P (psia)	vol. (ml)	time (sec)	Flow rate (ml/sec)	Permeance (GPU)	Average of Permeance (GPU)	STDEV of Permeance
CO ₂	25	1	7.74	0.1292	22.62	22.50	0.11
		1	7.78	0.1285	22.50		
		1	7.76	0.1289	22.56		
		1	7.84	0.1276	22.33		
		1	7.79	0.1284	22.47		
	50	10	32.59	0.3068	26.86	26.85	0.04
		10	32.62	0.3066	26.83		
		10	32.67	0.3061	26.79		
		10	32.58	0.3069	26.87		
		10	32.54	0.3073	26.90		
	75	10	20.39	0.4904	28.62	28.65	0.04
		10	20.38	0.4907	28.63		
		10	20.39	0.4904	28.62		
		10	20.33	0.4919	28.70		
		10	20.35	0.4914	28.67		
	100	10	14.49	0.6901	30.20	30.42	0.15
		10	14.35	0.6969	30.50		
		10	14.31	0.6988	30.58		
		10	14.42	0.6935	30.35		
		10	14.36	0.6964	30.48		
	125	10	10.95	0.9132	31.97	31.96	0.14
		10	10.98	0.9107	31.89		
		10	10.98	0.9107	31.89		
		10	10.99	0.9099	31.86		
		10	10.87	0.9200	32.21		
	150	10	8.74	1.1442	33.38	33.34	0.05
		10	8.76	1.1416	33.31		
		10	8.74	1.1442	33.38		
		10	8.77	1.1403	33.27		
		10	8.75	1.1429	33.34		
	175	10	7.28	1.3736	34.35	34.50	0.11
		10	7.26	1.3774	34.45		
		10	7.22	1.3850	34.64		
10		7.25	1.3793	34.49			
10		7.23	1.3831	34.59			
200	10	6.19	1.6155	35.35	35.32	0.08	
	10	6.21	1.6103	35.24			
	10	6.19	1.6155	35.35			
	10	6.18	1.6181	35.41			
	10	6.21	1.6103	35.24			
225	10	5.38	1.8587	36.15	36.34	0.23	
	10	5.36	1.8657	36.29			
	10	5.34	1.8727	36.42			
	10	5.3	1.8868	36.70			
250	10	4.64	2.1552	37.73	37.63	0.11	
	10	4.67	2.1413	37.49			
	10	4.65	2.1505	37.65			
	10	4.66	2.1459	37.57			

Table B17 SR/dense supporting CA: Treated at 170 °C

Gas	P (psia)	vol. (ml)	time (sec)	Flow rate (ml/sec)	Permeance (GPU)	Average of Permeance (GPU)	STDEV of Permeance
CO ₂	25	1	11.34	0.0882	15.44	15.45	0.02
		1	11.31	0.0884	15.48		
		1	11.33	0.0883	15.45		
		1	11.34	0.0882	15.44		
		1	11.34	0.0882	15.44		
	50	1	4.49	0.2227	19.49	19.43	0.11
		1	4.55	0.2198	19.24		
		1	4.51	0.2217	19.41		
		1	4.49	0.2227	19.49		
		1	4.49	0.2227	19.49		
	75	10	27.61	0.3622	21.13	21.16	0.02
		10	27.58	0.3626	21.16		
		10	27.59	0.3625	21.15		
		10	27.53	0.3632	21.20		
		10	27.57	0.3627	21.17		
	100	10	19.65	0.5089	22.27	22.30	0.03
		10	19.62	0.5097	22.31		
		10	19.59	0.5105	22.34		
		10	19.63	0.5094	22.29		
		10	19.65	0.5089	22.27		
	125	10	15.05	0.6645	23.26	23.27	0.04
		10	15.01	0.6662	23.33		
		10	15.04	0.6649	23.28		
		10	15.04	0.6649	23.28		
		10	15.09	0.6627	23.20		
	150	10	12.18	0.8210	23.95	23.90	0.06
		10	12.2	0.8197	23.91		
		10	12.19	0.8203	23.93		
		10	12.23	0.8177	23.86		
		10	12.25	0.8163	23.82		
	175	10	10.19	0.9814	24.54	24.56	0.02
		10	10.18	0.9823	24.57		
		10	10.17	0.9833	24.59		
		10	10.19	0.9814	24.54		
		10	10.18	0.9823	24.57		
	200	10	8.75	1.1429	25.01	25.03	0.04
		10	8.74	1.1442	25.04		
		10	8.76	1.1416	24.98		
		10	8.72	1.1468	25.09		
		10	8.74	1.1442	25.04		
225	10	7.65	1.3072	25.43	25.49	0.14	
	10	7.69	1.3004	25.29			
	10	7.61	1.3141	25.56			
	10	7.63	1.3106	25.49			
	10	7.58	1.3193	25.66			
250	10	6.61	1.5129	26.48	26.30	0.14	
	10	6.66	1.5015	26.28			
	10	6.63	1.5083	26.40			
	10	6.69	1.4948	26.17			

Table B18 SR/densesupporting CA: Treated at 190 °C

Gas	P (psia)	vol. (ml)	time (sec)	Flow rate (ml/sec)	Permeance (GPU)	Average of Permeance (GPU)	STDEV of Permeance
CO ₂	25	1	15.73	0.0636	11.13	11.13	0.03
		1	15.75	0.0635	11.11		
		1	15.79	0.0633	11.09		
		1	15.69	0.0637	11.16		
		1	15.7	0.0637	11.15		
	50	1	6.68	0.1497	13.10	13.08	0.04
		1	6.7	0.1493	13.06*		
		1	6.67	0.1499	13.12		
		1	6.72	0.1488	13.02		
		1	6.68	0.1497	13.10		
	75	10	43.67	0.2290	13.36	13.37	0.01
		10	43.61	0.2293	13.38		
		10	43.69	0.2289	13.36		
		10	43.59	0.2294	13.39		
		10	43.62	0.2293	13.38		
	100	10	31.11	0.3214	14.07	14.07	0.02
		10	31.09	0.3216	14.08		
		10	31.08	0.3218	14.08		
		10	31.15	0.3210	14.05		
		10	31.06	0.3220	14.09		
	125	10	24.31	0.4114	14.40	14.42	0.03
		10	24.23	0.4127	14.45		
		10	24.22	0.4129	14.46		
		10	24.28	0.4119	14.42		
		10	24.35	0.4107	14.38		
	150	10	19.89	0.5028	14.67	14.64	0.04
		10	19.93	0.5018	14.64		
		10	20.01	0.4998	14.58		
		10	19.86	0.5035	14.69		
		10	19.94	0.5015	14.63		
	175	10	16.43	0.6086	15.22	15.22	0.06
		10	16.37	0.6109	15.28		
		10	16.45	0.6079	15.20		
		10	16.52	0.6053	15.14		
		10	16.38	0.6105	15.27		
200	10	14.15	0.7067	15.46	15.46	0.03	
	10	14.13	0.7077	15.49			
	10	14.17	0.7057	15.44			
	10	14.2	0.7042	15.41			
	10	14.14	0.7072	15.48			
225	10	12.35	0.8097	15.75	15.67	0.07	
	10	12.38	0.8078	15.71			
	10	12.41	0.8058	15.67			
	10	12.45	0.8032	15.62			
	10	12.48	0.8013	15.59			
250	10	11.03	0.9066	15.87	15.87	0.05	
	10	11.02	0.9074	15.89			
	10	10.98	0.9107	15.94			
	10	11.04	0.9058	15.86			

Table B19 10%NaX/SR/dense supporting CA

Gas	P (psia)	vol. (ml)	time (sec)	Flow rate (ml/sec)	Permeance (GPU)	Average of Permeance (GPU)	STDEV of Permeance
CO ₂	25	1	10.49	0.0953	16.69	16.69	0.06
		1	10.51	0.0951	16.66		
		1	10.46	0.0956	16.74		
		1	10.53	0.0950	16.62		
		1	10.44	0.0958	16.77		
	50	1	3.85	0.2597	22.73	22.65	0.11
		1	3.84	0.2604	22.79		
		1	3.87	0.2584	22.62		
		1	3.89	0.2571	22.50		
		1	3.87	0.2584	22.62		
	75	10	23.37	0.4279	24.97	25.01	0.04
		10	23.36	0.4281	24.98		
		10	23.35	0.4283	24.99		
		10	23.32	0.4288	25.02		
		10	23.28	0.4296	25.07		
	100	10	16.81	0.5949	26.03	26.01	0.04
		10	16.79	0.5956	26.07		
		10	16.85	0.5935	25.97		
		10	16.84	0.5938	25.99		
		10	16.83	0.5942	26.00		
	125	10	12.88	0.7764	27.18	27.43	0.59
		10	12.29	0.8137	28.49		
		10	12.91	0.7746	27.12		
		10	12.88	0.7764	27.18		
		10	12.89	0.7758	27.16		
150	10	10.38	0.9634	28.11	28.12	0.09	
	10	10.41	0.9606	28.03			
	10	10.39	0.9625	28.08			
	10	10.32	0.9690	28.27			
	10	10.38	0.9634	28.11			
175	10	8.59	1.1641	29.11	29.07	0.08	
	10	8.57	1.1669	29.18			
	10	8.61	1.1614	29.05			
	10	8.63	1.1587	28.98			
	10	8.61	1.1614	29.05			
200	10	7.31	1.3680	29.93	29.93	0.12	
	10	7.28	1.3736	30.06			
	10	7.36	1.3587	29.73			
	10	7.31	1.3680	29.93			
	10	7.3	1.3699	29.98			
225	10	6.38	1.5674	30.49	30.39	0.12	
	10	6.39	1.5649	30.44			
	10	6.41	1.5601	30.34			
	10	6.38	1.5674	30.49			
	10	6.44	1.5528	30.20			

Gas	P (psia)	vol. (ml)	time (sec)	Flow rate (ml/sec)	Permeance (GPU)	Average of Permeance (GPU)	STDEV of Permeance
CO ₂	250	10	5.57	1.7953	31.43	31.24	0.28
		10	5.64	1.7730	31.04		
		10	5.61	1.7825	31.20		
		10	5.66	1.7668	30.93		
		10	5.54	1.8051	31.60		

Table B20 10%NaX/SR/dense supporting CA: Treated at 170 °C

Gas	P (psia)	vol. (ml)	time (sec)	Flow rate (ml/sec)	Permeance (GPU)	Average of Permeance (GPU)	STDEV of Permeance
CO ₂	25	1	12.89	0.0776	13.58	13.66	0.13
		1	12.68	0.0789	13.81		
		1	12.75	0.0784	13.73		
		1	12.98	0.0770	13.49		
		1	12.77	0.0783	13.71		
		1	12.77	0.0783	13.71		
	50	1	5.51	0.1815	15.89	15.74	0.14
		1	5.56	0.1799	15.74		
		1	5.63	0.1776	15.55		
		1	5.59	0.1789	15.66		
		1	5.52	0.1812	15.86		
	75	10	33.49	0.2986	17.42	17.36	0.05
		10	33.59	0.2977	17.37		
		10	33.58	0.2978	17.38		
		10	33.71	0.2966	17.31		
		10	33.68	0.2969	17.33		
	100	10	23.66	0.4227	18.50	18.50	0.02
		10	23.65	0.4228	18.50		
		10	23.67	0.4225	18.49		
		10	23.68	0.4223	18.48		
		10	23.63	0.4232	18.52		
	125	10	18.05	0.5540	19.40	19.38	0.04
		10	18.09	0.5528	19.35		
		10	18.02	0.5549	19.43		
		10	18.09	0.5528	19.35		
10		18.1	0.5525	19.34			
150	10	14.42	0.6935	20.23	20.26	0.02	
	10	14.39	0.6949	20.28			
	10	14.38	0.6954	20.29			
	10	14.41	0.6940	20.25			
	10	14.4	0.6944	20.26			
175	10	12.01	0.8326	20.82	20.81	0.01	
	10	12.02	0.8319	20.81			
	10	12.02	0.8319	20.81			
	10	12.01	0.8326	20.82			
	10	12.03	0.8313	20.79			
200	10	10.15	0.9852	21.56	21.51	0.08	
	10	10.12	0.9881	21.62			
	10	10.18	0.9823	21.50			

Gas	P (psia)	vol. (ml)	time (sec)	Flow rate (ml/sec)	Permeance (GPU)	Average of Permeance (GPU)	STDEV of Permeance
CO ₂	200	10	10.22	0.9785	21.41		
		10	10.19	0.9814	21.47		
	225	10	8.81	1.1351	22.08	22.15	0.06
		10	8.78	1.1390	22.15		
		10	8.8	1.1364	22.10		
		10	8.75	1.1429	22.23		
		10	8.76	1.1416	22.20		
	250	10	7.61	1.3141	23.00	22.72	0.16
		10	7.73	1.2937	22.65		
		10	7.74	1.2920	22.62		
		10	7.73	1.2937	22.65		
		10	7.71	1.2970	22.71		

Table B21 10%NaX/SR/dense supporting CA: Treated at 190 °C

Gas	P (psia)	vol. (ml)	time (sec)	Flow rate (ml/sec)	Permeance (GPU)	Average of Permeance (GPU)	STDEV of Permeance
CO ₂	25	1	18.41	0.0543	9.51	9.51	0.03
		1	18.45	0.0542	9.49		
		1	18.44	0.0542	9.49		
		1	18.46	0.0542	9.48		
		1	18.32	0.0546	9.56		
	50	1	7.76	0.1289	11.28	11.32	0.03
		1	7.72	0.1295	11.34		
		1	7.71	0.1297	11.35		
		1	7.71	0.1297	11.35		
		1	7.75	0.1290	11.29		
	75	10	47.16	0.2120	12.37	12.37	0.01
		10	47.14	0.2121	12.38		
		10	47.15	0.2121	12.38		
		10	47.21	0.2118	12.36		
		10	47.18	0.2120	12.37		
	100	10	33.66	0.2971	13.00	13.04	0.03
		10	33.55	0.2981	13.04		
		10	33.59	0.2977	13.03		
		10	33.46	0.2989	13.08		
		10	33.51	0.2984	13.06		
	125	10	25.61	0.3905	13.67	13.67	0.03
		10	25.69	0.3893	13.63		
		10	25.58	0.3909	13.69		
		10	25.55	0.3914	13.70		
		10	25.63	0.3902	13.66		
	150	10	20.73	0.4824	14.07	14.07	0.02
		10	20.74	0.4822	14.07		
		10	20.72	0.4826	14.08		
		10	20.71	0.4829	14.09		
		10	20.77	0.4815	14.05		

Gas	P (psia)	vol. (ml)	time (sec)	Flow rate (ml/sec)	Permeance (GPU)	Average of Permeance (GPU)	STDEV of Permeance
CO ₂	175	10	17.23	0.5804	14.51	14.51	0.02
		10	17.26	0.5794	14.49		
		10	17.24	0.5800	14.51		
		10	17.21	0.5811	14.53		
		10	17.26	0.5794	14.49		
	200	10	14.89	0.6716	14.70	14.73	0.03
		10	14.84	0.6739	14.75		
		10	14.83	0.6743	14.76		
		10	14.89	0.6716	14.70		
		10	14.82	0.6748	14.77		
	225	10	12.78	0.7825	15.22	15.23	0.02
		10	12.79	0.7819	15.21		
		10	12.74	0.7849	15.27		
		10	12.76	0.7837	15.24		
		10	12.77	0.7821	15.23		
	250	10	11.26	0.8881	15.55	15.56	0.02
		10	11.24	0.8897	15.57		
		10	11.25	0.8889	15.56		
		10	11.23	0.8905	15.59		
		10	11.27	0.8873	15.53		

Table B22 20%NaX/SR/dense supporting CA

Gas	P (psia)	vol. (ml)	time (sec)	Flow rate (ml/sec)	Permeance (GPU)	Average of Permeance (GPU)	STDEV of Permeance
CO ₂	25	1	13.47	0.0742	13.00	13.08	0.07
		1	13.36	0.0749	13.10		
		1	13.39	0.0747	13.07		
		1	13.42	0.0745	13.04		
		1	13.29	0.0752	13.17		
		1	13.29	0.0752	13.17		
	50	1	5.17	0.1934	16.93	16.99	0.05
		1	5.15	0.1942	17.00		
		1	5.13	0.1949	17.06		
		1	5.15	0.1942	17.00		
		1	5.16	0.1938	16.96		
	75	10	31.35	0.3190	18.61	18.62	0.01
		10	31.32	0.3193	18.63		
		10	31.36	0.3189	18.61		
		10	31.34	0.3191	18.62		
		10	31.32	0.3193	18.63		
	100	10	21.63	0.4623	20.23	20.22	0.08
		10	21.65	0.4619	20.21		
		10	21.56	0.4638	20.30		
		10	21.78	0.4591	20.09		
		10	21.59	0.4632	20.27		
	125	10	16.12	0.6203	21.72	21.79	0.05
		10	16.03	0.6238	21.84		
		10	16.04	0.6234	21.83		

Gas	P (psia)	vol. (ml)	time (sec)	Flow rate (ml/sec)	Permeance (GPU)	Average of Permeance (GPU)	STDEV of Permeance
CO ₂	125	10	16.1	0.6211	21.75	22.02	0.12
		10	16.05	0.6231	21.81		
	150	10	13.21	0.7570	22.09		
		10	13.31	0.7513	21.92		
		10	13.29	0.7524	21.95		
		10	13.3	0.7519	21.94		
		10	13.14	0.7610	22.20		
	175	10	10.95	0.9132	22.74		
		10	10.96	0.9124	22.82		
		10	10.94	0.9141	22.86		
		10	10.98	0.9107	22.78		
		10	10.93	0.9149	22.88		
	200	10	9.49	1.0537	23.06		
		10	9.29	1.0764	23.55		
		10	9.33	1.0718	23.45		
		10	9.48	1.0549	23.08		
		10	9.43	1.0604	23.20		
	225	10	8.21	1.2180	23.69		
		10	8.14	1.2285	23.90		
		10	8.19	1.2210	23.75		
10		8.14	1.2285	23.90			
10		8.17	1.2240	23.81			
250	10	7.25	1.3793	24.15			
	10	7.21	1.3870	24.28			
	10	7.26	1.3774	24.11			
	10	7.22	1.3850	24.25			
	10	7.23	1.3831	24.21			

Table B23 20%NaX/SR/dense supporting CA: Treated at 170 °C

Gas	P (psia)	vol. (ml)	time (sec)	Flow rate (ml/sec)	Permeance (GPU)	Average of Permeance (GPU)	STDEV of Permeance
CO ₂	25	1	14.06	0.0711	12.45	12.45	0.03
		1	14.09	0.0710	12.42		
		1	14.03	0.0713	12.48		
		1	14.02	0.0713	12.49		
		1	14.1	0.0709	12.42		
	50	1	5.51	0.1815	15.89		
		1	5.53	0.1808	15.83		
		1	5.54	0.1805	15.80		
		1	5.52	0.1812	15.86		
		1	5.59	0.1789	15.66		
	75	10	33.92	0.2948	17.20		
		10	33.84	0.2955	17.24		
		10	33.87	0.2952	17.23		
		10	33.85	0.2954	17.24		
		10	33.91	0.2949	17.21		

Gas	P (psia)	vol. (ml)	time (sec)	Flow rate (ml/sec)	Permeance (GPU)	Average of Permeance (GPU)	STDEV of Permeance
CO ₂	100	10	23.43	0.4268	18.68	18.63	0.03
		10	23.48	0.4259	18.64		
		10	23.51	0.4254	18.62		
		10	23.49	0.4257	18.63		
		10	23.54	0.4248	18.59		
	125	10	18.04	0.5543	19.41	19.42	0.04
		10	18.01	0.5552	19.44		
		10	18.03	0.5546	19.42		
		10	18.07	0.5534	19.38		
		10	17.98	0.5562	19.47		
	150	10	14.61	0.6845	19.97	19.97	0.03
		10	14.64	0.6831	19.93		
		10	14.6	0.6849	19.98		
		10	14.58	0.6859	20.01		
		10	14.62	0.6840	19.96		
	175	10	12.21	0.8190	20.48	20.47	0.04
		10	12.2	0.8197	20.50		
		10	12.23	0.8177	20.45		
		10	12.19	0.8203	20.52		
		10	12.25	0.8163	20.41		
	200	10	10.45	0.9569	20.94	20.92	0.03
		10	10.46	0.9560	20.92		
		10	10.48	0.9542	20.88		
		10	10.45	0.9569	20.94		
		10	10.47	0.9551	20.90		
225	10	9.12	1.0965	21.33	21.29	0.06	
	10	9.17	1.0905	21.21			
	10	9.15	1.0929	21.26			
	10	9.13	1.0953	21.30			
	10	9.11	1.0977	21.35			
250	10	8.12	1.2315	21.56	21.57	0.03	
	10	8.13	1.2300	21.53			
	10	8.12	1.2315	21.56			
	10	8.11	1.2330	21.59			
	10	8.1	1.2346	21.61			

TableB24 20%NaX/SR/dense supporting CA: Treated at 190 °C

Gas	P (psia)	vol. (ml)	time (sec)	Flow rate (ml/sec)	Permeance (GPU)	Average of Permeance (GPU)	STDEV of Permeance
CO ₂	25	1	20.25	0.0494	8.64	8.64	0.01
		1	20.24	0.0494	8.65		
		1	20.26	0.0494	8.64		
		1	20.29	0.0493	8.63		
		1	20.28	0.0493	8.63		
	50	1	8.87	0.1127	9.87	9.87	0.04
		1	8.89	0.1125	9.85		
		1	8.91	0.1122	9.82		

Gas	P (psia)	vol. (ml)	time (sec)	Flow rate (ml/sec)	Permeance (GPU)	Average of Permeance (GPU)	STDEV of Permeance
CO ₂	50	1	8.83	0.1133	9.91		
		1	8.84	0.1131	9.90		
	75	1	5.62	0.1779	10.38	10.38	0.03
		1	5.63	0.1776	10.36		
		1	5.59	0.1789	10.44		
		1	5.64	0.1773	10.35		
		1	5.62	0.1779	10.38		
	100	10	38.54	0.2595	11.36	11.35	0.01 *
		10	38.56	0.2593	11.35		
		10	38.61	0.2590	11.33		
		10	38.56	0.2593	11.35		
		10	38.59	0.2591	11.34		
	125	10	29.78	0.3358	11.76	11.75	0.01
		10	29.79	0.3357	11.75		
		10	29.77	0.3359	11.76		
		10	29.81	0.3355	11.74		
		10	29.8	0.3356	11.75		
	150	10	24.25	0.4124	12.03	12.04	0.01
		10	24.26	0.4122	12.03		
		10	24.24	0.4125	12.04		
		10	24.24	0.4125	12.04		
		10	24.22	0.4129	12.05		
	175	10	20.25	0.4938	12.35	12.35	0.01
		10	20.26	0.4936	12.34		
		10	20.24	0.4941	12.36		
		10	20.23	0.4943	12.36		
		10	20.26	0.4936	12.34		
200	10	17.34	0.5767	12.62	12.62	0.01	
	10	17.35	0.5764	12.61			
	10	17.37	0.5757	12.60			
	10	17.32	0.5774	12.63			
	10	17.34	0.5767	12.62			
225	10	15.23	0.6566	12.77	12.76	0.02	
	10	15.24	0.6562	12.76			
	10	15.2	0.6579	12.80			
	10	15.27	0.6549	12.74			
	10	15.26	0.6553	12.75			
250	10	13.46	0.7429	13.01	12.99	0.04	
	10	13.48	0.7418	12.99			
	10	13.51	0.7402	12.96			
	10	13.42	0.7452	13.04			
	10	13.52	0.7396	12.95			

Table B25 30%NaX/SR/dense supporting CA

Gas	P (psia)	vol. (ml)	time (sec)	Flow rate (ml/sec)	Permeance (GPU)	Average of Permeance (GPU)	STDEV of Permeance
CO ₂	25	1	18.67	0.0536	9.38	9.39	0.01
		1	18.63	0.0537	9.40		
		1	18.66	0.0536	9.38		
		1	18.65	0.0536	9.39		
		1	18.64	0.0536	9.35 ^a		
	50	1	6.55	0.1527	13.36	13.33	0.04
		1	6.57	0.1522	13.32		
		1	6.57	0.1522	13.32		
		1	6.54	0.1529	13.38		
		1	6.59	0.1517	13.28		
	75	10	37.06	0.2698	15.75	15.75	0.01
		10	37.04	0.2700	15.75		
		10	37.06	0.2698	15.75		
		10	37.01	0.2702	15.77		
		10	37.09	0.2696	15.73		
	100	10	25.54	0.3915	17.14	17.13	0.01
		10	25.52	0.3918	17.15		
		10	25.57	0.3911	17.12		
		10	25.54	0.3915	17.14		
		10	25.56	0.3912	17.12		
	125	10	19.26	0.5192	18.18	18.18	0.02
		10	19.25	0.5195	18.19		
		10	19.28	0.5187	18.16		
		10	19.23	0.5200	18.21		
		10	19.29	0.5184	18.15		
	150	10	15.33	0.6523	19.03	19.03	0.02
		10	15.31	0.6532	19.06		
		10	15.32	0.6527	19.04		
		10	15.34	0.6519	19.02		
		10	15.35	0.6515	19.01		
	175	10	12.69	0.7880	19.71	19.75	0.03
		10	12.67	0.7893	19.74		
		10	12.66	0.7899	19.75		
10		12.65	0.7905	19.77			
10		12.65	0.7905	19.77			
200	10	10.84	0.9225	20.19	20.18	0.06	
	10	10.89	0.9183	20.09			
	10	10.85	0.9217	20.17			
	10	10.82	0.9242	20.22			
	10	10.81	0.9251	20.24			
225	10	9.33	1.0718	20.85	20.91	0.04	
	10	9.31	1.0741	20.89			
	10	9.29	1.0764	20.94			
	10	9.29	1.0764	20.94			
	10	9.3	1.0753	20.91			
250	10	8.23	1.2151	21.27	21.19	0.06	
	10	8.29	1.2063	21.12			

Gas	P (psia)	vol. (ml)	time (sec)	Flow rate (ml/sec)	Permeance (GPU)	Average of Permeance (GPU)	STDEV of Permeance
CO ₂	250	10	8.25	1.2121	21.22		
		10	8.27	1.2092	21.17		
		10	8.26	1.2107	21.19		

Table B26 30%NaX/SR/dense supporting CA: Treated at 170°C

Gas	P (psia)	vol. (ml)	time (sec)	Flow rate (ml/sec)	Permeance (GPU)	Average of Permeance (GPU)	STDEV of Permeance
CO ₂	25	1	13.23	0.0756	13.23	11.49	0.97
		1	15.78	0.0634	11.09		
		1	15.79	0.0633	11.09		
		1	15.85	0.0631	11.04		
		1	15.92	0.0628	11.00		
	50	1	6.67	0.1499	13.12	13.15	0.05
		1	6.66	0.1502	13.14		
		1	6.65	0.1504	13.16		
		1	6.69	0.1495	13.08		
		1	6.62	0.1511	13.22		
	75	10	37.87	0.2641	15.41	15.39	0.02
		10	37.98	0.2633	15.36		
		10	37.89	0.2639	15.40		
		10	37.9	0.2639	15.40		
		10	37.93	0.2636	15.38		
	100	10	27.11	0.3689	16.14	16.16	0.03
		10	27.12	0.3687	16.14		
		10	27.09	0.3691	16.16		
		10	27.08	0.3693	16.16		
		10	27.01	0.3702	16.20		
	125	10	20.98	0.4766	16.69	16.77	0.05
		10	20.87	0.4792	16.78		
		10	20.89	0.4787	16.76		
		10	20.85	0.4796	16.79		
		10	20.81	0.4805	16.82		
150	10	17.21	0.5811	16.95	16.96	0.01	
	10	17.19	0.5817	16.97			
	10	17.2	0.5814	16.96			
	10	17.19	0.5817	16.97			
	10	17.22	0.5807	16.94			
175	10	14.32	0.6983	17.46	17.43	0.04	
	10	14.35	0.6969	17.43			
	10	14.31	0.6988	17.48			
	10	14.38	0.6954	17.39			
	10	14.38	0.6954	17.39			
200	10	12.21	0.8190	17.92	17.91	0.04	
	10	12.2	0.8197	17.94			
	10	12.19	0.8203	17.95			
	10	12.23	0.8177	17.89			
	10	12.25	0.8163	17.86			

Gas	P (psia)	vol. (ml)	time (sec)	Flow rate (ml/sec)	Permeance (GPU)	Average of Permeance (GPU)	STDEV of Permeance
CO ₂	225	10	10.71	0.9337	18.16	18.18	0.02
		10	10.7	0.9346	18.18		
		10	10.69	0.9355	18.20		
		10	10.71	0.9337	18.16		
		10	10.69	0.9355	18.20		
	250	10	9.45	1.0582	18.52	18.54	0.05
		10	9.48	1.0549	18.47		
		10	9.43	1.0604	18.56		
		10	9.43	1.0604	18.56		
		10	9.41	1.0627	18.60		

Table B27 30%NaX/SR/dense supporting CA: Treated at 190 °C

Gas	P (psia)	vol. (ml)	time (sec)	Flow rate (ml/sec)	Permeance (GPU)	Average of Permeance (GPU)	STDEV of Permeance
CO ₂	25	1	22.23	0.0450	7.87	7.89	0.03
		1	22.19	0.0451	7.89		
		1	22.16	0.0451	7.90		
		1	22.28	0.0449	7.86		
		1	22.03	0.0454	7.95		
	50	1	9.95	0.1005	8.80	8.76	0.02
		1	9.99	0.1001	8.76		
		1	10.02	0.0998	8.74		
		1	10.01	0.0999	8.74		
		1	10	0.1000	8.75		
	75	10	60.33	0.1658	9.67	9.63	0.07
		10	60.34	0.1657	9.67		
		10	60.23	0.1660	9.69		
		10	61.12	0.1636	9.55		
		10	60.96	0.1640	9.57		
	100	10	42.44	0.2356	10.31	10.26	0.04
		10	42.65	0.2345	10.26		
		10	42.65	0.2345	10.26		
		10	42.67	0.2344	10.26		
		10	42.87	0.2333	10.21		
	125	10	33.43	0.2991	10.47	10.42	0.09
		10	33.23	0.3009	10.54		
		10	33.67	0.2970	10.40		
		10	33.96	0.2945	10.31		
		10	33.79	0.2952	10.36		
	150	10	26.61	0.3758	10.96	10.97	0.02
		10	26.59	0.3761	10.97		
		10	26.58	0.3762	10.98		
		10	26.68	0.3748	10.94		
		10	26.54	0.3768	10.99		
175	10	22.19	0.4507	11.27	11.27	0.01	
	10	22.18	0.4509	11.28			
	10	22.21	0.4502	11.26			
	10	22.23	0.4498	11.25			
	10	22.18	0.4509	11.28			

Gas	P (psia)	vol. (ml)	time (sec)	Flow rate (ml/sec)	Permeance (GPU)	Average of Permeance (GPU)	STDEV of Permeance
CO ₂	200	10	19.31	0.5179	11.33	11.35	0.02
		10	19.28	0.5187	11.35		
		10	19.25	0.5195	11.37		
		10	19.3	0.5181	11.34		
		10	19.26	0.5192	11.36		
	225	10	16.65	0.6006	11.68	11.68	0.03
		10	16.63	0.6013	11.70		
		10	16.69	0.5992	11.65		
		10	16.72	0.5981	11.63		
		10	16.61	0.6020	11.71		
	250	10	14.78	0.6766	11.84	11.84	0.02
		10	14.75	0.6780	11.87		
		10	14.76	0.6775	11.86		
		10	14.81	0.6752	11.82		
		10	14.8	0.6757	11.83		

Table B28 40%NaX/SR/dense supporting CA

Gas	P (psia)	vol. (ml)	time (sec)	Flow rate (ml/sec)	Permeance (GPU)	Average of Permeance (GPU)	STDEV of Permeance
CO ₂	25	1	15.21	0.0657	11.51	11.41	0.10
		1	15.53	0.0644	11.27		
		1	15.34	0.0652	11.41		
		1	15.22	0.0657	11.50		
		1	15.43	0.0648	11.35		
	50	1	6.69	0.1495	13.08	12.92	0.24
		1	6.63	0.1508	13.20		
		1	6.85	0.1460	12.78		
		1	6.95	0.1439	12.59		
		1	6.76	0.1479	12.95		
	75	10	40.64	0.2461	14.36	14.35	0.01
		10	40.68	0.2458	14.34		
		10	40.69	0.2458	14.34		
		10	40.66	0.2459	14.35		
		10	40.71	0.2456	14.33		
	100	10	28.24	0.3541	15.50	15.48	0.03
		10	28.25	0.3540	15.49		
		10	28.29	0.3535	15.47		
		10	28.23	0.3542	15.50		
		10	28.37	0.3525	15.43		
	125	10	21.64	0.4621	16.18	16.20	0.01
		10	21.59	0.4632	16.22		
		10	21.62	0.4625	16.19		
		10	21.61	0.4627	16.20		
		10	21.61	0.4627	16.20		
150	10	17.22	0.5807	16.94	16.96	0.02	
	10	17.2	0.5814	16.96			
	10	17.19	0.5817	16.97			
	10	17.21	0.5811	16.95			

Gas	P (psia)	vol. (ml)	time (sec)	Flow rate (ml/sec)	Permeance (GPU)	Average of Permeance (GPU)	STDEV of Permeance	
CO ₂	150	10	17.17	0.5824	16.99			
		175	10	14.31	0.6988	17.48	17.38	0.06
			10	14.4	0.6944	17.37		
			10	14.38	0.6954	17.39		
			10	14.43	0.6930	17.33		
			10	14.41	0.6940	17.35		
	200	10	12.05	0.8299	18.16	18.10	0.04	
		10	12.12	0.8251	18.05			
		10	12.11	0.8258	18.07			
		10	12.07	0.8285	18.13			
		10	12.09	0.8271	18.10			
	225	10	10.59	0.9443	18.37	18.46	0.08	
		10	10.51	0.9515	18.51			
		10	10.56	0.9470	18.42			
		10	10.47	0.9551	18.58			
		10	10.55	0.9479	18.44			
	250	10	9.26	1.0799	18.90	18.94	0.06	
		10	9.24	1.0823	18.95			
		10	9.22	1.0846	18.99			
		10	9.28	1.0776	18.86			
10		9.21	1.0858	19.01				

Table B29 40%NaX/SR/dense supporting CA: Treated at 170 °C

Gas	P (psia)	vol. (ml)	time (sec)	Flow rate (ml/sec)	Permeance (GPU)	Average of Permeance (GPU)	STDEV of Permeance
CO ₂	25	1	18.87	0.0530	9.28	9.27	0.02
		1	18.89	0.0529	9.27		
		1	18.92	0.0529	9.25		
		1	18.83	0.0531	9.30		
		1	18.93	0.0528	9.25		
	50	1	8.21	0.1218	10.66	10.62	0.08
		1	8.17	0.1224	10.71		
		1	8.34	0.1199	10.49		
		1	8.27	0.1209	10.58		
		1	8.24	0.1214	10.62		
	75	10	48.89	0.2045	11.94	11.92	0.02
		10	48.99	0.2041	11.91		
		10	48.92	0.2044	11.93		
		10	49.04	0.2039	11.90		
		10	48.89	0.2045	11.94		
	100	10	33.61	0.2975	13.02	13.00	0.04
		10	33.49	0.2986	13.07		
		10	33.75	0.2963	12.97		
		10	33.66	0.2971	13.00		
		10	33.78	0.2960	12.96		
125	10	25.64	0.3900	13.65	13.63	0.02	
	10	25.67	0.3896	13.64			
	10	25.76	0.3882	13.59			

Gas	P (psia)	vol. (ml)	time (sec)	Flow rate (ml/sec)	Permeance (GPU)	Average of Permeance (GPU)	STDEV of Permeance	
CO ₂	125	10	25.69	0.3893	13.63			
		10	25.71	0.3890	13.62			
	150	10	20.29	0.4929	14.38	14.39	0.03	
		10	20.28	0.4931	14.39			
		10	20.35	0.4914	14.34			
		10	20.27	0.4933	14.39			
		10	20.22	0.4946	14.43			
	175	10	16.79	0.5956	14.89	14.91	0.03	
		10	16.76	0.5967	14.92			
		10	16.81	0.5949	14.88			
		10	16.73	0.5977	14.95			
		10	16.78	0.5959	14.90			
	200	10	14.23	0.7027	15.38	15.18	0.22	
		10	14.21	0.7037	15.40			
		10	14.53	0.6882	15.06			
		10	14.72	0.6793	14.87			
		10	14.38	0.6954	15.22			
		225	10	12.11	0.8258	16.06	16.08	0.02
			10	12.08	0.8278	16.10		
10			12.1	0.8264	16.07			
10			12.11	0.8258	16.06			
10			12.09	0.8271	16.09			
250		10	10.63	0.9407	16.47	16.43	0.03	
		10	10.67	0.9372	16.41			
		10	10.66	0.9381	16.42			
		10	10.63	0.9407	16.47			
		10	10.67	0.9372	16.41			

Table B30 40%NaX/SR/dense supporting CA: Treated at 190 °C

Gas	P (psia)	vol. (ml)	time (sec)	Flow rate (ml/sec)	Permeance (GPU)	Average of Permeance (GPU)	STDEV of Permeance
CO ₂	25	1	25.31	0.0395	6.92	6.93	0.02
		1	25.33	0.0395	6.91		
		1	25.18	0.0397	6.95		
		1	25.21	0.0397	6.94		
		1	25.2	0.0397	6.95		
	50	1	11.53	0.0867	7.59	7.54	0.05
		1	11.69	0.0855	7.49		
		1	11.51	0.0869	7.60		
		1	11.63	0.0860	7.53		
		1	11.68	0.0856	7.49		
	75	1	7.35	0.1361	7.94	7.95	0.08
		1	7.22	0.1385	8.08		
		1	7.34	0.1362	7.95		
		1	7.42	0.1348	7.86		
		1	7.39	0.1353	7.90		
	100	10	49.95	0.2002	8.76	8.77	0.01
		10	49.98	0.2001	8.76		
		10	49.88	0.2005	8.77		

Gas	P (psia)	vol. (ml)	time (sec)	Flow rate (ml/sec)	Permeance (GPU)	Average of Permeance (GPU)	STDEV of Permeance
CO ₂	100	10	49.89	0.2004	8.77		
		10	49.9	0.2004	8.77		
	125	10	38.54	0.2595	9.08	9.04	0.11
		10	38.49	0.2598	9.10		
		10	38.52	0.2596	9.09		
		10	38.44	0.2601	9.11		
		10	39.59	0.2526	8.84		
	150	10	31.05	0.3221	9.40	9.38	0.01
		10	31.09	0.3216	9.38		
		10	31.12	0.3213	9.38		
		10	31.1	0.3215	9.38		
		10	31.08	0.3218	9.39		
	175	10	25.93	0.3857	9.64	9.66	0.01
		10	25.88	0.3864	9.66		
		10	25.94	0.3855	9.64		
		10	25.89	0.3862	9.66		
		10	25.86	0.3867	9.67		
	200	10	22.23	0.4498	9.84	9.85	0.03
		10	22.33	0.4478	9.80		
		10	22.18	0.4509	9.87		
10		22.21	0.4502	9.85			
10		22.16	0.4513	9.87			
225	10	18.92	0.5285	10.28	10.25	0.02	
	10	19.02	0.5258	10.23			
	10	18.97	0.5271	10.25			
	10	18.98	0.5269	10.25			
	10	19.03	0.5255	10.22			
250	10	16.89	0.5921	10.36	10.41	0.03	
	10	16.74	0.5974	10.46			
	10	16.82	0.5945	10.41			
	10	16.79	0.5956	10.43			
	10	16.83	0.5942	10.40			

Table B31 CA powder

Gas	P (psia)	vol. (ml)	time (sec)	Flow rate (ml/sec)	Permeance (GPU)	Average of Permeance (GPU)	STDEV of Permeance
CO ₂	25	0.25	123.32	0.0020	0.35	0.35	0.00
		0.25	124.11	0.0020	0.35		
		0.25	123.95	0.0020	0.35		
		0.25	124.32	0.0020	0.35		
		0.25	123.78	0.0020	0.35		
	50	0.25	34.61	0.0072	0.63	0.63	0.00
		0.25	34.56	0.0072	0.63		
		0.25	34.97	0.0071	0.63		
		0.25	34.99	0.0071	0.63		
		0.25	34.84	0.0072	0.63		
	75	0.5	36.52	0.0137	0.80	0.80	0.00
		0.5	36.82	0.0136	0.79		
		0.5	36.43	0.0137	0.80		

Gas	P (psia)	vol. (ml)	time (sec)	Flow rate (ml/sec)	Permeance (GPU)	Average of Permeance (GPU)	STDEV of Permeance	
CO ₂	75	0.5	36.48	0.0137	0.80			
		0.5	36.59	0.0137	0.80			
	100	0.5	23.32	0.0214	0.94	0.95	0.01	
		0.5	22.96	0.0218	0.95			
		0.5	22.94	0.0218	0.95			
		0.5	22.93	0.0218	0.95			
		0.5	22.89	0.0218	0.96			
	125	0.5	15.21	0.0329	1.15	1.16	0.00	
		0.5	15.14	0.0330	1.16			
		0.5	15.13	0.0330	1.16			
		0.5	15.1	0.0331	1.16			
		0.5	15.15	0.0330	1.16			
	150	1	21.65	0.0462	1.35	1.35	0.00	
		1	21.69	0.0461	1.35			
		1	21.61	0.0463	1.35			
		1	21.65	0.0462	1.35			
		1	21.66	0.0462	1.35			
		175	1	14.32	0.0698	1.75	1.75	0.00
			1	14.33	0.0698	1.75		
1			14.3	0.0699	1.75			
1			14.38	0.0695	1.74			
1			14.32	0.0698	1.75			

Table B32 CA powder: Treated at 170 °C

Gas	P (psia)	vol. (ml)	time (sec)	Flow rate (ml/sec)	Permeance (GPU)	Average of Permeance (GPU)	STDEV of Permeance
CO ₂	25	0.25	213.32	0.0012	0.21	0.21	0.00
		0.25	214.32	0.0012	0.20		
		0.25	211.23	0.0012	0.21		
		0.25	212.43	0.0012	0.21		
		0.25	211.21	0.0012	0.21		
	50	0.25	84.43	0.0030	0.26	0.26	0.00
		0.25	84.54	0.0030	0.26		
		0.25	84.53	0.0030	0.26		
		0.25	84.54	0.0030	0.26		
		0.25	84.53	0.0030	0.26		
	75	0.25	42.65	0.0059	0.34	0.34	0.00
		0.25	42.34	0.0059	0.34		
		0.25	42.56	0.0059	0.34		
		0.25	42.53	0.0059	0.34		
		0.25	42.39	0.0059	0.34		
	100	0.25	26.84	0.0093	0.41	0.41	0.00
		0.25	26.85	0.0093	0.41		
		0.25	26.93	0.0093	0.41		
		0.25	26.89	0.0093	0.41		
		0.25	26.99	0.0093	0.41		
	125	0.25	17.21	0.0145	0.51	0.51	0.00
		0.25	17.16	0.0146	0.51		
		0.25	17.15	0.0146	0.51		

Gas	P (psia)	vol. (ml)	time (sec)	Flow rate (ml/sec)	Permeance (GPU)	Average of Permeance (GPU)	STDEV of Permeance
CO ₂	125	0.25	17.23	0.0145	0.51		
		0.25	17.22	0.0145	0.51		
	150	0.25	11.84	0.0211	0.62	0.63	0.01
		0.25	11.65	0.0215	0.63		
		0.25	11.61	0.0215	0.63		
		0.25	11.6	0.0216	0.63		
		0.25	11.59	0.0216	0.63		
	175	0.25	8.43	0.0297	0.74	0.74	0.00
		0.25	8.41	0.0297	0.74		
		0.25	8.49	0.0294	0.74		
		0.25	8.39	0.0298	0.75		
		0.25	8.47	0.0295	0.74		

Table B33 CA powder: Treated at 190 °C

Gas	P (psia)	vol. (ml)	time (sec)	Flow rate (ml/sec)	Permeance (GPU)	Average of Permeance (GPU)	STDEV of Permeance
CO ₂	25	0.25	334.32	0.0007	0.13	0.13	0.00
		0.25	334.24	0.0007	0.13		
		0.25	335.32	0.0007	0.13		
		0.25	335.12	0.0007	0.13		
		0.25	334.95	0.0007	0.13		
	50	0.25	143.34	0.0017	0.15	0.15	0.00
		0.25	144.35	0.0017	0.15		
		0.25	143.85	0.0017	0.15		
		0.25	143.32	0.0017	0.15		
		0.25	145.34	0.0017	0.15		
	75	0.25	78.43	0.0032	0.19	0.19	0.00
		0.25	78.54	0.0032	0.19		
		0.25	78.83	0.0032	0.19		
		0.25	78.69	0.0032	0.19		
		0.25	78.53	0.0032	0.19		
	100	0.25	50.34	0.0050	0.22	0.22	0.00
		0.25	50.63	0.0049	0.22		
		0.25	50.21	0.0050	0.22		
		0.25	50.11	0.0050	0.22		
		0.25	50.27	0.0050	0.22		
	125	0.25	35.13	0.0071	0.25	0.25	0.00
		0.25	35.15	0.0071	0.25		
		0.25	35.24	0.0071	0.25		
		0.25	35.21	0.0071	0.25		
		0.25	35.1	0.0071	0.25		
150	0.25	24.53	0.0102	0.30	0.30	0.00	
	0.25	24.36	0.0103	0.30			
	0.25	24.49	0.0102	0.30			
	0.25	24.44	0.0102	0.30			
	0.25	24.41	0.0102	0.30			
175	0.25	19.18	0.0130	0.33	0.33	0.00	
	0.25	19.21	0.0130	0.33			
	0.25	19.25	0.0130	0.32			

Gas	P (psia)	vol. (ml)	time (sec)	Flow rate (ml/sec)	Permeance (GPU)	Average of Permeance (GPU)	STDEV of Permeance
CO ₂	175	0.25	19.14	0.0131	0.33		
		0.25	19.05	0.0131	0.33		

Table B34 10%NaX/CA powder

Gas	P (psia)	vol. (ml)	time (sec)	Flow rate (ml/sec)	Permeance (GPU)	Average of Permeance (GPU)	STDEV of Permeance
CO ₂	25	0.25	256.55	0.0010	0.17	0.17	0.00
		0.25	256.82	0.0010	0.17		
		0.25	256.31	0.0010	0.17		
		0.25	256.22	0.0010	0.17		
		0.25	256.47	0.0010	0.17		
	50	0.25	52.25	0.0048	0.42	0.42	0.00
		0.25	52.38	0.0048	0.42		
		0.25	52.25	0.0048	0.42		
		0.25	52.36	0.0048	0.42		
		0.25	52.31	0.0048	0.42		
	75	0.25	23.85	0.0105	0.61	0.61	0.00
		0.25	23.71	0.0105	0.62		
		0.25	23.62	0.0106	0.62		
		0.25	23.76	0.0105	0.61		
		0.25	23.85	0.0105	0.61		
	100	0.25	15.95	0.0157	0.69	0.69	0.00
		0.25	15.82	0.0158	0.69		
		0.25	15.78	0.0158	0.69		
		0.25	15.89	0.0157	0.69		
		0.25	15.99	0.0156	0.68		
125	0.25	11.62	0.0215	0.75	0.75	0.01	
	0.25	11.52	0.0217	0.76			
	0.25	11.54	0.0217	0.76			
	0.25	11.62	0.0215	0.75			
	0.25	11.73	0.0213	0.75			
150	0.25	8.68	0.0288	0.84	0.83	0.01	
	0.25	8.72	0.0287	0.84			
	0.25	8.75	0.0286	0.83			
	0.25	8.72	0.0287	0.84			
	0.25	8.93	0.0280	0.82			
175	0.25	7.23	0.0346	0.86	0.88	0.01	
	0.25	7.02	0.0356	0.89			
	0.25	7.03	0.0356	0.89			
	0.25	7.08	0.0353	0.88			
	0.25	7.01	0.0357	0.89			

Table B35 10%NaX/CA powder: Treated at 170 °C

Gas	P (psia)	vol. (ml)	time (sec)	Flow rate (ml/sec)	Permeance (GPU)	Average of Permeance (GPU)	STDEV of Permeance
CO ₂	25	0.25	287.76	0.0009	0.15	0.15	0.00
		0.25	285.54	0.0009	0.15		
		0.25	286.65	0.0009	0.15		
		0.25	286.57	0.0009	0.15		
		0.25	287.43	0.0009	0.15		
	50	0.25	95.54	0.0026	0.23	0.23	0.00
		0.25	95.43	0.0026	0.23		
		0.25	94.47	0.0026	0.23		
		0.25	96.22	0.0026	0.23		
		0.25	95.04	0.0026	0.23		
	75	0.25	43.43	0.0058	0.34	0.34	0.00
		0.25	42.65	0.0059	0.34		
		0.25	43.21	0.0058	0.34		
		0.25	43.21	0.0058	0.34		
		0.25	42.78	0.0058	0.34		
	100	0.25	27.96	0.0089	0.39	0.39	0.00
		0.25	27.86	0.0090	0.39		
		0.25	27.8	0.0090	0.39		
		0.25	27.84	0.0090	0.39		
		0.25	27.99	0.0089	0.39		
	125	0.25	19.21	0.0130	0.46	0.46	0.00
		0.25	19.23	0.0130	0.46		
		0.25	19.18	0.0130	0.46		
		0.25	19.16	0.0130	0.46		
		0.25	19.11	0.0131	0.46		
150	0.25	13.76	0.0182	0.53	0.53	0.00	
	0.25	13.72	0.0182	0.53			
	0.25	13.75	0.0182	0.53			
	0.25	13.7	0.0182	0.53			
	0.25	13.68	0.0183	0.53			
175	0.25	10.02	0.0250	0.62	0.62	0.00	
	0.25	9.96	0.0251	0.63			
	0.25	10.05	0.0249	0.62			
	0.25	10.09	0.0248	0.62			
	0.25	10.11	0.0247	0.62			

Table B36 10%NAX/CA powder: Treated at 190 °C

Gas	P (psia)	vol. (ml)	time (sec)	Flow rate (ml/sec)	Permeance (GPU)	Average of Permeance (GPU)	STDEV of Permeance
CO ₂	25	0.25	365.54	0.0007	0.12	0.12	0.00
		0.25	369.65	0.0007	0.12		
		0.25	369.21	0.0007	0.12		
		0.25	368.95	0.0007	0.12		
		0.25	368.95	0.0007	0.12		
	50	0.25	145.54	0.0017	0.15	0.15	0.00
		0.25	148.73	0.0017	0.15		

Gas	P (psia)	vol. (ml)	time (sec)	Flow rate (ml/sec)	Permeance (GPU)	Average of Permeance (GPU)	STDEV of Permeance
CO ₂	50	0.25	143.32	0.0017	0.15		
		0.25	144.64	0.0017	0.15		
		0.25	145.86	0.0017	0.15		
	75	0.25	78.65	0.0032	0.19	0.19	0.00
		0.25	77.54	0.0032	0.19		
		0.25	78.43	0.0032	0.19		
		0.25	77.59	0.0032	0.19		
		0.25	77.36	0.0032	0.19		
	100	0.25	51.43	0.0049	0.21	0.21	0.00
		0.25	51.59	0.0048	0.21		
		0.25	51.52	0.0049	0.21		
		0.25	51.44	0.0049	0.21		
		0.25	51.56	0.0048	0.21		
	125	0.25	36.11	0.0069	0.24	0.24	0.00
		0.25	35.98	0.0069	0.24		
		0.25	35.85	0.0070	0.24		
		0.25	35.95	0.0070	0.24		
		0.25	36.04	0.0069	0.24		
	150	0.25	26.65	0.0094	0.27	0.27	0.00
		0.25	26.61	0.0094	0.27		
0.25		26.74	0.0093	0.27			
0.25		26.71	0.0094	0.27			
0.25		26.75	0.0093	0.27			
175	0.25	20.21	0.0124	0.31	0.31	0.00	
	0.25	20.11	0.0124	0.31			
	0.25	20.15	0.0124	0.31			
	0.25	20.25	0.0123	0.31			
	0.25	20.18	0.0124	0.31			

Table B37 20%NaX/CA powder

Gas	P (psia)	vol. (ml)	time (sec)	Flow rate (ml/sec)	Permeance (GPU)	Average of Permeance (GPU)	STDEV of Permeance
CO ₂	25	0.25	81.74	0.0031	0.54	0.53	0.00
		0.25	81.82	0.0031	0.53		
		0.25	82.74	0.0030	0.53		
		0.25	83.11	0.0030	0.53		
		0.25	82.92	0.0030	0.53		
	50	0.25	26.54	0.0094	0.82	0.83	0.00
		0.25	26.47	0.0094	0.83		
		0.25	26.49	0.0094	0.83		
		0.25	26.51	0.0094	0.83		
		0.25	26.43	0.0095	0.83		
	75	0.25	16.52	0.0151	0.88	0.89	0.01
		0.25	16.35	0.0153	0.89		
		0.25	16.42	0.0152	0.89		
		0.25	16.22	0.0154	0.90		
		0.25	16.82	0.0149	0.87		

Gas	P (psia)	vol. (ml)	time (sec)	Flow rate (ml/sec)	Permeance (GPU)	Average of Permeance (GPU)	STDEV of Permeance
CO ₂	100	0.25	12.15	0.0206	0.90	0.89	0.02
		0.25	12.42	0.0201	0.88		
		0.25	12.75	0.0196	0.86		
		0.25	12.35	0.0202	0.89		
		0.25	12.11	0.0206	0.90		
	125	0.25	7.71	0.0324	1.14	1.13	0.01
		0.25	7.79	0.0321	1.12		
		0.25	7.76	0.0322	1.13		
		0.25	7.67	0.0326	* 1.14		
		0.25	7.74	0.0323	1.13		
	150	0.25	5.57	0.0449	1.31	1.32	0.01
		0.25	5.51	0.0454	1.32		
		0.25	5.54	0.0451	1.32		
		0.25	5.53	0.0452	1.32		
		0.25	5.56	0.0450	1.31		
	175	0.25	4.45	0.0562	1.40	1.40	0.01
		0.25	4.46	0.0561	1.40		
		0.25	4.43	0.0564	1.41		
		0.25	4.48	0.0558	1.40		
		0.25	4.46	0.0561	1.40		

Table B38 20%NaX/CA powder: Treated at 170 °C

Gas	P (psia)	vol. (ml)	time (sec)	Flow rate (ml/sec)	Permeance (GPU)	Average of Permeance (GPU)	STDEV of Permeance
CO ₂	25	0.25	195.54	0.0013	0.22	0.22	0.00
		0.25	196.76	0.0013	0.22		
		0.25	196.23	0.0013	0.22		
		0.25	197.4	0.0013	0.22		
		0.25	196.79	0.0013	0.22		
	50	0.25	110.21	0.0023	0.20	0.20	0.00
		0.25	109.84	0.0023	0.20		
		0.25	110.54	0.0023	0.20		
		0.25	111.43	0.0022	0.20		
		0.25	111.34	0.0022	0.20		
	75	0.25	40.43	0.0062	0.36	0.36	0.00
		0.25	40.93	0.0061	0.36		
		0.25	40.35	0.0062	0.36		
		0.25	40.56	0.0062	0.36		
		0.25	40.99	0.0061	0.36		
	100	0.25	25.86	0.0097	0.42	0.42	0.00
		0.25	25.76	0.0097	0.42		
		0.25	25.83	0.0097	0.42		
		0.25	25.49	0.0098	0.43		
		0.25	25.9	0.0097	0.42		
125	0.25	18.54	0.0135	0.47	0.47	0.00	
	0.25	18.65	0.0134	0.47			
	0.25	18.75	0.0133	0.47			

Gas	P (psia)	vol. (ml)	time (sec)	Flow rate (ml/sec)	Permeance (GPU)	Average of Permeance (GPU)	STDEV of Permeance
CO ₂		0.25	18.68	0.0134	0.47	0.50	0.00
		0.25	18.62	0.0134	0.47		
	150	0.25	14.65	0.0171	0.50		
		0.25	14.67	0.0170	0.50		
		0.25	14.58	0.0171	0.50		
		0.25	14.53	0.0172	0.50		
		0.25	14.66	0.0171	0.50		
	175	0.25	9.43	0.0265	0.66		
		0.25	9.48	0.0264	0.66		
		0.25	9.54	0.0262	0.66		
		0.25	9.47	0.0264	0.66		
		0.25	9.51	0.0263	0.66		

Table B39 20%NaX/CA powder: Treated at 190°C

Gas	P (psia)	vol. (ml)	time (sec)	Flow rate (ml/sec)	Permeance (GPU)	Average of Permeance (GPU)	STDEV of Permeance
CO ₂	25	0.25	312.21	0.0008	0.14	0.14	0.00
		0.25	310.32	0.0008	0.14		
		0.25	311.32	0.0008	0.14		
		0.25	309.32	0.0008	0.14		
		0.25	307.32	0.0008	0.14		
	50	0.25	138.54	0.0018	0.16	0.16	0.00
		0.25	139.43	0.0018	0.16		
		0.25	139.32	0.0018	0.16		
		0.25	140.43	0.0018	0.16		
		0.25	139.78	0.0018	0.16		
	75	0.25	68.65	0.0036	0.21	0.21	0.00
		0.25	69.54	0.0036	0.21		
		0.25	69.23	0.0036	0.21		
		0.25	69.54	0.0036	0.21		
		0.25	68.96	0.0036	0.21		
	100	0.25	49.32	0.0051	0.22	0.22	0.00
		0.25	50.21	0.0050	0.22		
		0.25	49.78	0.0050	0.22		
		0.25	49.83	0.0050	0.22		
		0.25	50.02	0.0050	0.22		
	125	0.25	32.94	0.0076	0.27	0.27	0.00
		0.25	32.85	0.0076	0.27		
		0.25	32.65	0.0077	0.27		
		0.25	32.46	0.0077	0.27		
		0.25	32.71	0.0076	0.27		
	150	0.25	23.43	0.0107	0.31	0.31	0.00
		0.25	23.54	0.0106	0.31		
		0.25	23.41	0.0107	0.31		
		0.25	23.49	0.0106	0.31		
		0.25	23.53	0.0106	0.31		

Gas	P (psia)	vol. (ml)	time (sec)	Flow rate (ml/sec)	Permeance (GPU)	Average of Permeance (GPU)	STDEV of Permeance
	175	0.25	18.11	0.0138	0.35	0.35	0.00
		0.25	18.05	0.0139	0.35		
		0.25	18.09	0.0138	0.35		
		0.25	18.03	0.0139	0.35		
		0.25	17.95	0.0139	0.35		

Table B40 30%NaX/CA powder

Gas	P (psia)	vol. (ml)	time (sec)	Flow rate (ml/sec)	Permeance (GPU)	Average of Permeance (GPU)	STDEV of Permeance
CO ₂	25	0.25	221.21	0.0011	0.20	0.20	0.00
		0.25	223.32	0.0011	0.20		
		0.25	222.54	0.0011	0.20		
		0.25	223.91	0.0011	0.20		
		0.25	220.89	0.0011	0.20		
	50	0.25	81.32	0.0031	0.27	0.27	0.00
		0.25	82.23	0.0030	0.27		
		0.25	80.65	0.0031	0.27		
		0.25	83.32	0.0030	0.26		
		0.25	81.12	0.0031	0.27		
	75	0.25	22.49	0.0111	0.65	0.64	0.00
		0.25	22.82	0.0110	0.64		
		0.25	22.56	0.0111	0.65		
		0.25	22.59	0.0111	0.65		
		0.25	22.76	0.0110	0.64		
	100	0.5	27.82	0.0180	0.79	0.79	0.01
		0.5	27.63	0.0181	0.79		
		0.5	27.74	0.0180	0.79		
		0.5	27.89	0.0179	0.78		
		0.5	27.43	0.0182	0.80		
125	0.5	17.69	0.0283	0.99	0.99	0.00	
	0.5	17.83	0.0280	0.98			
	0.5	17.67	0.0283	0.99			
	0.5	17.82	0.0281	0.98			
	0.5	17.74	0.0282	0.99			
150	0.5	12.64	0.0396	1.15	1.15	0.01	
	0.5	12.68	0.0394	1.15			
	0.5	12.73	0.0393	1.15			
	0.5	12.6	0.0397	1.16			
	0.5	12.78	0.0391	1.14			
CO ₂	175	0.5	10.27	0.0487	1.22	1.22	0.00
		0.5	10.31	0.0485	1.21		
		0.5	10.27	0.0487	1.22		
		0.5	10.23	0.0489	1.22		
		0.5	10.26	0.0487	1.22		

Table B41 30%NaX/CA powder: Treated at 170 °C

Gas	P (psia)	vol. (ml)	time (sec)	Flow rate (ml/sec)	Permeance (GPU)	Average of Permeance (GPU)	STDEV of Permeance
CO ₂	25	0.25	245.43	0.0010	0.18	0.18	0.00
		0.25	244.34	0.0010	0.18		
		0.25	246.96	0.0010	0.18		
		0.25	245.59	0.0010	0.18		
		0.25	245.18	0.0010	0.18		
	+50	0.25	104.34	0.0024	0.21	0.21	0.00
		0.25	105.43	0.0024	0.21		
		0.25	104.38	0.0024	0.21		
		0.25	104.25	0.0024	0.21		
		0.25	104.15	0.0024	0.21		
	75	0.25	43.32	0.0058	0.34	0.34	0.00
		0.25	43.78	0.0057	0.33		
		0.25	43.2	0.0058	0.34		
		0.25	43.29	0.0058	0.34		
		0.25	43.22	0.0058	0.34		
	100	0.25	25.84	0.0097	0.42	0.42	0.00
		0.25	25.77	0.0097	0.42		
		0.25	25.89	0.0097	0.42		
		0.25	25.74	0.0097	0.43		
		0.25	25.98	0.0096	0.42		
125	0.25	18.13	0.0138	0.48	0.48	0.00	
	0.25	18.15	0.0138	0.48			
	0.25	18.21	0.0137	0.48			
	0.25	18.17	0.0138	0.48			
	0.25	18.22	0.0137	0.48			
150	0.25	12.54	0.0199	0.58	0.58	0.00	
	0.25	12.58	0.0199	0.58			
	0.25	12.53	0.0200	0.58			
	0.25	12.59	0.0199	0.58			
	0.25	12.55	0.0199	0.58			
175	0.25	8.43	0.0297	0.74	0.74	0.00	
	0.25	8.47	0.0295	0.74			
	0.25	8.41	0.0297	0.74			
	0.25	8.49	0.0294	0.74			
	0.25	8.46	0.0296	0.74			

Table B42 30%NaX/CA powder: Treated at 190 °C

Gas	P (psia)	vol. (ml)	time (sec)	Flow rate (ml/sec)	Permeance (GPU)	Average of Permeance (GPU)	STDEV of Permeance
CO ₂	25	0.25	285.43	0.0009	0.15	0.15	0.00
		0.25	285.94	0.0009	0.15		
		0.25	285.47	0.0009	0.15		
		0.25	286.23	0.0009	0.15		
		0.25	286.11	0.0009	0.15		

Gas	P (psia)	vol. (ml)	time (sec)	Flow rate (ml/sec)	Permeance (GPU)	Average of Permeance (GPU)	STDEV of Permeance
CO ₂	50	0.25	122.43	0.0020	0.18	0.18	0.00
		0.25	122.84	0.0020	0.18		
		0.25	122.56	0.0020	0.18		
		0.25	123.14	0.0020	0.18		
		0.25	122.49	0.0020	0.18		
	75	0.25	63.34	0.0039	0.23	0.23	0.00
		0.25	63.92	0.0039	0.23		
		0.25	63.46	0.0039	0.23		
		0.25	63.48	0.0039	0.23		
		0.25	63.53	0.0039	0.23		
	100	0.25	44.43	0.0056	0.25	0.25	0.00
		0.25	44.63	0.0056	0.25		
		0.25	44.41	0.0056	0.25		
		0.25	44.38	0.0056	0.25		
		0.25	44.4	0.0056	0.25		
	125	0.25	32.32	0.0077	0.27	0.27	0.00
		0.25	32.84	0.0076	0.27		
		0.25	32.56	0.0077	0.27		
		0.25	32.64	0.0077	0.27		
		0.25	32.69	0.0076	0.27		
	150	0.25	20.86	0.0120	0.35	0.35	0.00
		0.25	21.13	0.0118	0.35		
		0.25	20.95	0.0119	0.35		
		0.25	20.96	0.0119	0.35		
		0.25	21.05	0.0119	0.35		
175	0.25	16.86	0.0148	0.37	0.37	0.00	
	0.25	16.91	0.0148	0.37			
	0.25	16.85	0.0148	0.37			
	0.25	16.93	0.0148	0.37			
	0.25	16.99	0.0147	0.37			

Table B43 40%NaX/CA powder

Gas	P (psia)	vol. (ml)	time (sec)	Flow rate (ml/sec)	Permeance (GPU)	Average of Permeance (GPU)	STDEV of Permeance
CO ₂	25	0.25	158.22	0.0016	0.28	0.28	0.00
		0.25	157.18	0.0016	0.28		
		0.25	159.34	0.0016	0.27		
		0.25	158.32	0.0016	0.28		
		0.25	157.93	0.0016	0.28		
	50	0.25	72.65	0.0034	0.30	0.30	0.00
		0.25	72.81	0.0034	0.30		
		0.25	72.35	0.0035	0.30		
		0.25	72.01	0.0035	0.30		
		0.25	71.32	0.0035	0.31		
	75	0.25	30.85	0.0081	0.47	0.47	0.00
		0.25	30.77	0.0081	0.47		
		0.25	30.72	0.0081	0.47		

Gas	P (psia)	vol. (ml)	time (sec)	Flow rate (ml/sec)	Permeance (GPU)	Average of Permeance (GPU)	STDEV of Permeance		
CO ₂	75	0.25	30.69	0.0081	0.48				
		0.25	30.82	0.0081	0.47				
	100	0.25	12.69	0.0197	0.86			0.86	0.00
		0.25	12.73	0.0196	0.86				
		0.25	12.74	0.0196	0.86				
		0.25	12.79	0.0195	0.86				
0.25		12.76	0.0196	0.86					
CO ₂	125	0.5	16.49	0.0303	1.06	1.06	0.01		
		0.5	16.54	0.0302	1.06				
		0.5	16.39	0.0305	1.07				
		0.5	16.45	0.0304	1.06				
		0.5	16.74	0.0299	1.05				
	150	0.5	12.75	0.0392	1.14	1.15	0.03		
		0.5	12.78	0.0391	1.14				
		0.5	12.85	0.0389	1.14				
		0.5	12.19	0.0410	1.20				
		0.5	12.76	0.0392	1.14				
	175	0.5	9.31	0.0537	1.34	1.35	0.00		
		0.5	9.28	0.0539	1.35				
		0.5	9.29	0.0538	1.35				
		0.5	9.26	0.0540	1.35				
		0.5	9.27	0.0539	1.35				

Table B44 40%NaX/CA powder: Treated at 170 °C

Gas	P (psia)	vol. (ml)	time (sec)	Flow rate (ml/sec)	Permeance (GPU)	Average of Permeance (GPU)	STDEV of Permeance
CO ₂	25	0.25	203.32	0.0012	0.22	0.22	0.00
		0.25	202.21	0.0012	0.22		
		0.25	202.65	0.0012	0.22		
		0.25	201.54	0.0012	0.22		
		0.25	201.85	0.0012	0.22		
	50	0.25	62.21	0.0040	0.35	0.35	0.00
		0.25	62.54	0.0040	0.35		
		0.25	62.73	0.0040	0.35		
		0.25	62.68	0.0040	0.35		
		0.25	62.83	0.0040	0.35		
	75	0.25	31.74	0.0079	0.46	0.46	0.00
		0.25	31.76	0.0079	0.46		
		0.25	31.82	0.0079	0.46		
		0.25	31.79	0.0079	0.46		
		0.25	31.84	0.0079	0.46		
	100	0.25	20.54	0.0122	0.53	0.53	0.00
		0.25	20.51	0.0122	0.53		
		0.25	20.49	0.0122	0.53		
		0.25	20.55	0.0122	0.53		
		0.25	20.58	0.0121	0.53		
125	0.25	13.75	0.0182	0.64	0.64	0.00	

Gas	P (psia)	vol. (ml)	time (sec)	Flow rate (ml/sec)	Permeance (GPU)	Average of Permeance (GPU)	STDEV of Permeance
CO ₂	125	0.25	13.77	0.0182	0.64		
		0.25	13.82	0.0181	0.63		
		0.25	13.68	0.0183	0.64		
		0.25	13.61	0.0184	0.64		
	150	0.25	9.23	0.0271	0.79	0.79	0.00
		0.25	9.25	0.0270	0.79		
		0.25	9.21	0.0271	0.79		
		0.25	9.29	0.0269	0.79		
		0.25	9.28	0.0269	0.79		
	175	0.25	7.21	0.0347	0.87	0.87	0.00
		0.25	7.23	0.0346	0.86		
		0.25	7.15	0.0350	0.87		
		0.25	7.14	0.0350	0.88		
		0.25	7.19	0.0348	0.87		

Table B45 40%NaX/CA powder: Treated at 190 °C

Gas	P (psia)	vol. (ml)	time (sec)	Flow rate (ml/sec)	Permeance (GPU)	Average of Permeance (GPU)	STDEV of Permeance
CO ₂	25	0.25	265.43	0.0009	0.16	0.16	0.00
		0.25	268.43	0.0009	0.16		
		0.25	266.84	0.0009	0.16		
		0.25	267.54	0.0009	0.16		
		0.25	268.35	0.0009	0.16		
	50	0.25	117.32	0.0021	0.19	0.19	0.00
		0.25	115.45	0.0022	0.19		
		0.25	116.34	0.0021	0.19		
		0.25	116.93	0.0021	0.19		
		0.25	115.94	0.0022	0.19		
	75	0.25	62.23	0.0040	0.23	0.23	0.00
		0.25	62.19	0.0040	0.23		
		0.25	62.84	0.0040	0.23		
		0.25	62.74	0.0040	0.23		
		0.25	62.16	0.0040	0.23		
	100	0.25	38.65	0.0065	0.28	0.28	0.00
		0.25	38.46	0.0065	0.28		
		0.25	38.79	0.0064	0.28		
		0.25	38.52	0.0065	0.28		
		0.25	38.41	0.0065	0.28		
	125	0.25	27.43	0.0091	0.32	0.32	0.00
		0.25	27.69	0.0090	0.32		
		0.25	27.54	0.0091	0.32		
		0.25	27.56	0.0091	0.32		
		0.25	27.94	0.0089	0.31		
150	0.25	19.8	0.0126	0.37	0.37	0.00	
	0.25	19.85	0.0126	0.37			
	0.25	19.83	0.0126	0.37			
	0.25	19.83	0.0126	0.37			
	0.25	19.91	0.0126	0.37			

Gas	P (psia)	vol. (ml)	time (sec)	Flow rate (ml/sec)	Permeance (GPU)	Average of Permeance (GPU)	STDEV of Permeance
CO ₂	150	0.25	19.88	0.0126	0.37		
	175	0.25	15.43	0.0162	0.41	0.41	0.01
		0.25	15.44	0.0162	0.40		
		0.25	15.03	0.0166	0.42		
		0.25	15.64	0.0160	0.40		
		0.25	15.38	0.0163	0.41		

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1. Sriwasut, K., Rirksomboon, T., and Kulprathipanja, S. (2005, October 30-November 4) Mixed Matrix Membranes for CO₂/CH₄ separation: Plasticization Study on Cellulose Acetate. Oral presented at AICHE Annual 2005 Meeting, Cincinnati, OHIO, USA.