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Amphiphilic silicones to mitigate lens epithelial cell growth on intraocular lenses

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Electronic Supplementary Information:

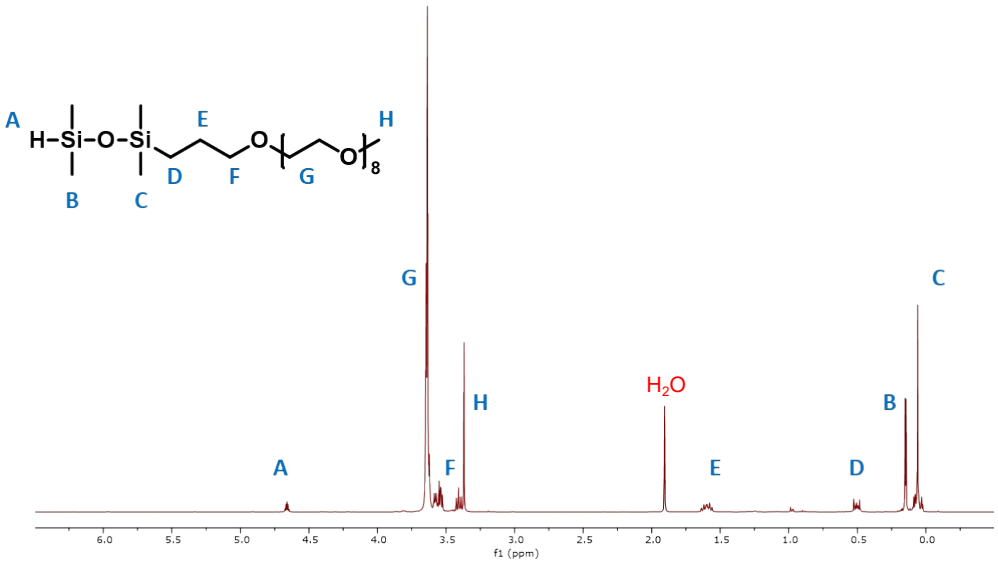

Figure S1. ^{1}H NMR of $HDMS_0$ ($CDCl_3$; δ, ppm): 0.05-0.10 (m, 6H, $SiCH_3$), 0.19 (d, J = 2.8 Hz, 6H, $OSi[CH_3]_2H$), 0.47-0.55 (m, 2H, $SiCH_2CH_2CH_2$), 1.56-1.64 (m, 2H, $SiCH_2CH_2CH_2$), 3.38 (s, 3H, OCH_3), 3.39-3.44 (t, J = 6.9 Hz, 2H, $SiCH_2CH_2CH_2$), 3.52-3.70 (m, 34H, CH_2CH_2O), 4.65-4.75 (m, 1H, SiH).

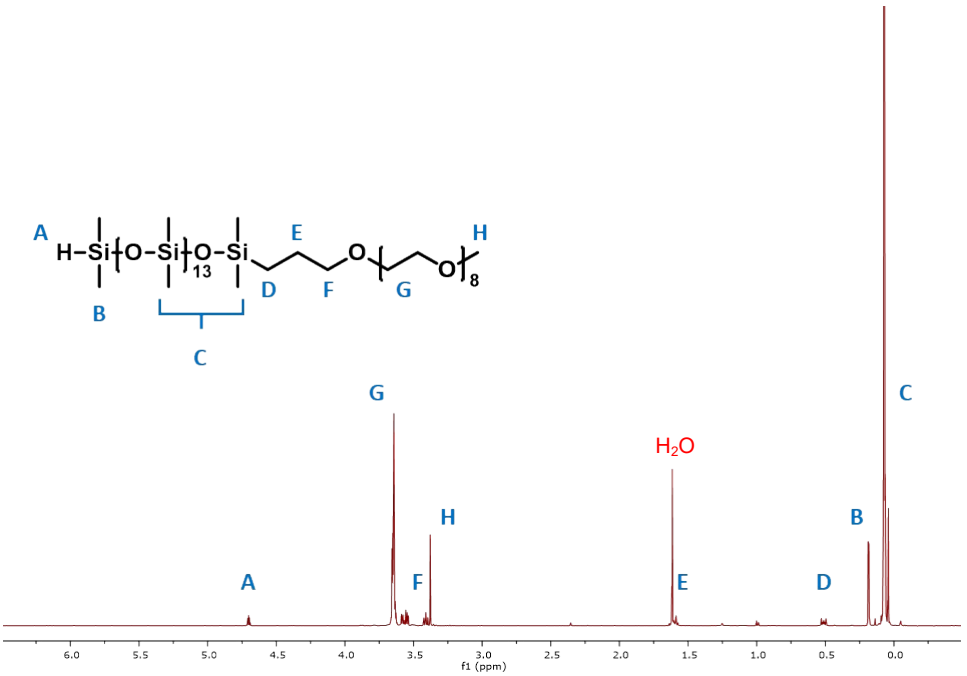

Figure S2. ^{1}H NMR of $HDMS_{13}$ ($CDCl_3$; δ, ppm): 0.05-0.10 (m, 84H, $SiCH_3$), 0.19 (d, J = 2.8 Hz, 6H, $OSi[CH_3]_2H$), 0.47-0.55 (m, 2H, $SiCH_2CH_2CH_2$), 1.56-1.64 (m, 2H, $SiCH_2CH_2CH_2$), 3.38 (s, 3H, OCH_3), 3.39-3.44 (t, J = 6.9 Hz, 2H, $SiCH_2CH_2CH_2$), 3.52-3.70 (m, 34H, CH_2CH_2O), 4.65-4.75 (m, 1H, SiH).

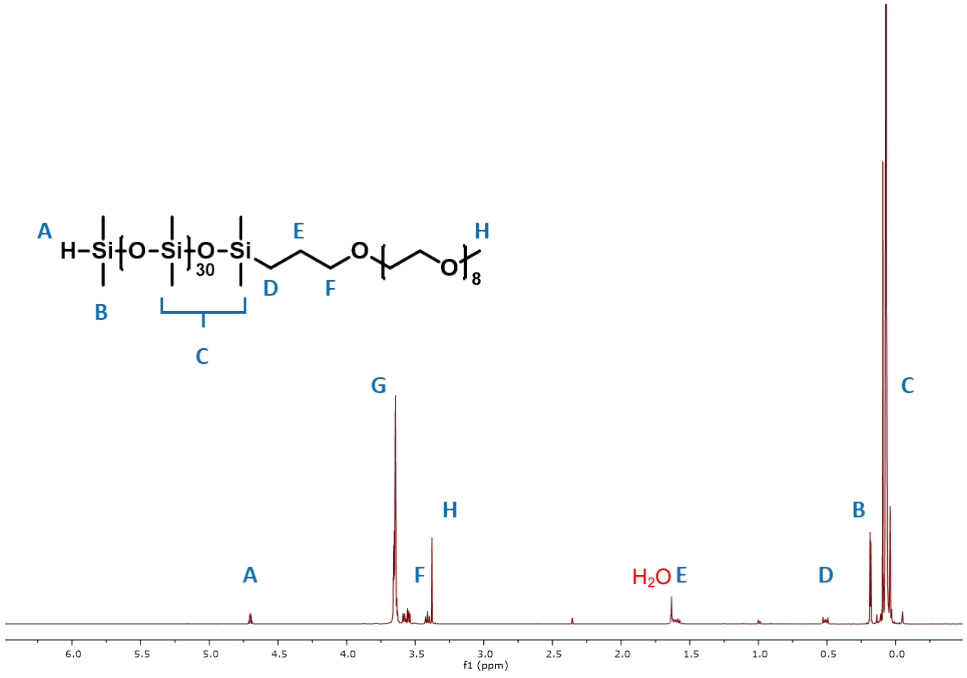

Figure S3. ^{1}H NMR of $HDMS_{30}$ ($CDCl3$; δ, ppm): 0.05-0.10 (m, 186H, $SiCH_3$), 0.19 (d, J = 2.8 Hz, 6H, $OSi[CH_3]_2H$), 0.47-0.55 (m, 2H, $SiCH_2CH_2CH_2$), 1.56-1.64 (m, 2H, $SiCH_2CH_2CH_2$), 3.38 (s, 3H, OCH_3), 3.39-3.44 (t, J = 6.9 Hz, 2H, $SiCH_2CH_2CH_2$), 3.52-3.70 (m, 34H, CH_2CH_2O), 4.65-4.75 (m, 1H, SiH).

Table S1. Sol contents of unmodified silicone (MED-6020) and silicones modified with SMAs.

	Concentration (μmol/g)	Sol Content (Wt. %)
MED-6020	**---**	**3.85 ± 0.69**
$HDMS_0$		
	5	**3.75 ± 1.60**
	10	**3.65 ± 1.13**
	15	**4.03 ± 0.50**
	20	**4.21 ± 0.92**
	25	**3.88 ± 1.85**
$HDMS_{13}$		
	5	**4.34 ± 1.21**
	10	**5.15 ± 0.63**
	15	**4.22 ± 1.19**
	20	**4.76 ± 0.62**
	25	**4.31 ± 0.53**
$HDMS_{30}$		
	5	**4.09 ± 0.60**
	10	**4.67 ± 0.53**
	15	**5.39 ± 0.69**
	20	**5.02 ± 0.62**
	25	**5.18 ± 0.13**

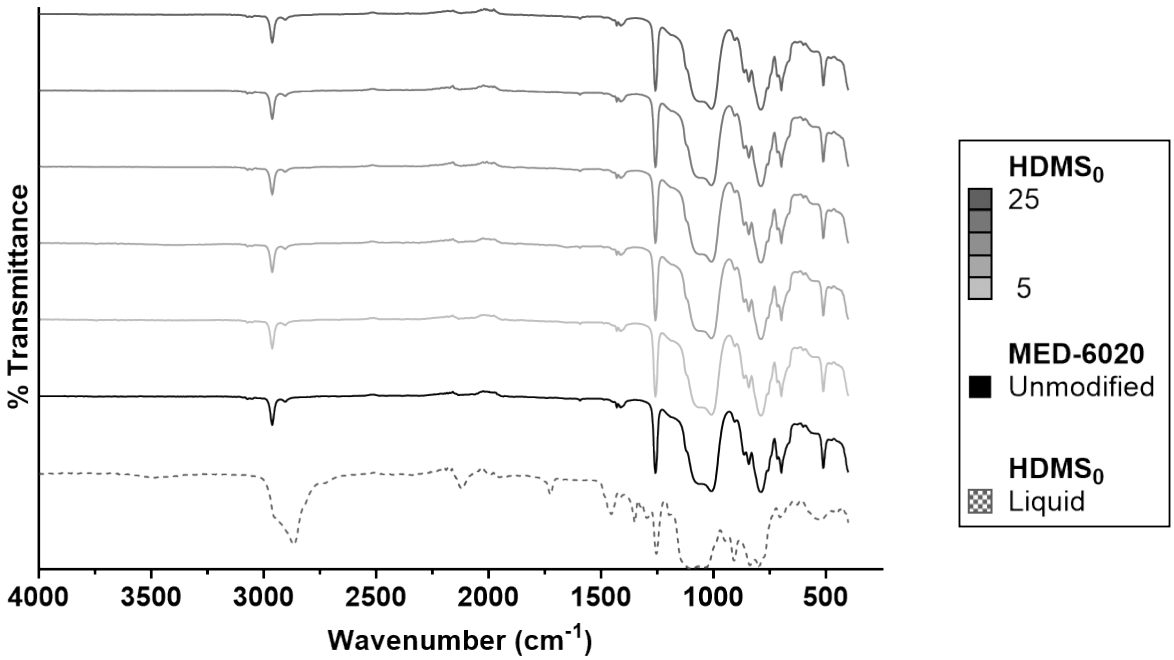

Figure S4. ATR-FTIR spectra of unmodified silicone (MED-6020) and silicones modified with $HDMS_0$ at all concentrations. Color gradient (top of legend) refers to concentration of $HDMS_0$ (µmol/g) added to silicone.

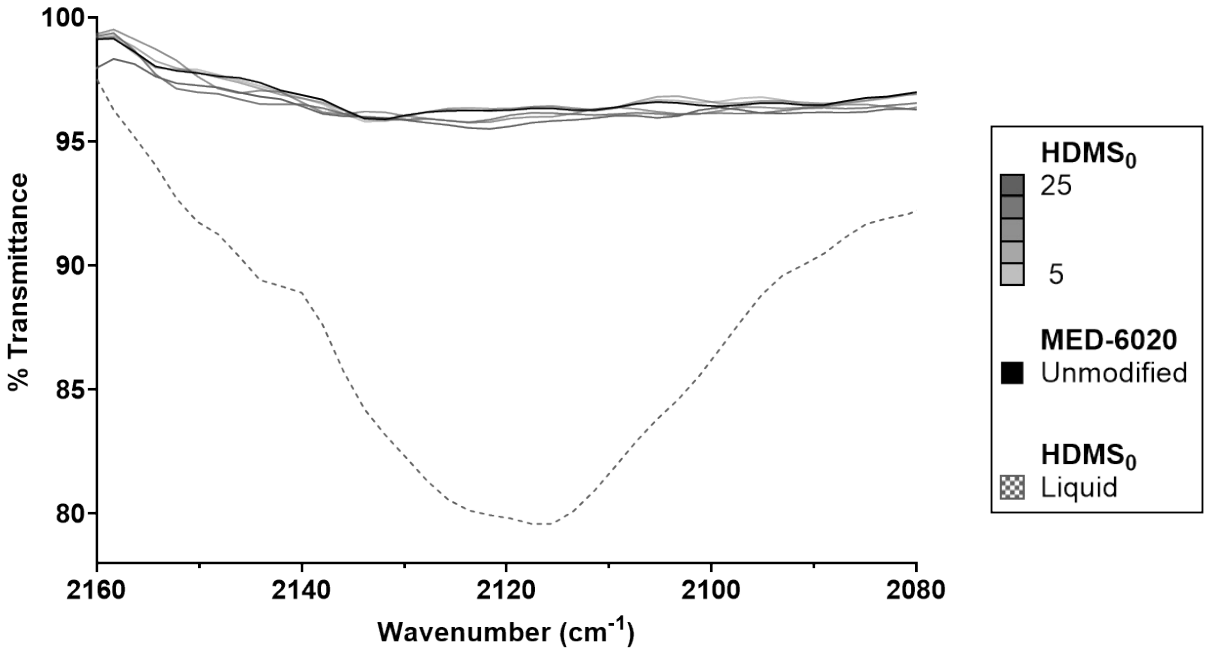

Figure S5. ATR-FTIR spectra of unmodified silicone (MED-6020) and silicones modified with $HDMS_0$ at all concentrations. Color gradient (top of legend) refers to concentration of $HDMS_0$ (µmol/g) added to silicone. The modified silicone spectra lacked the characteristic Si-H peak at 2280-2080 cm^{-1}, indicating complete hydrosilylation.

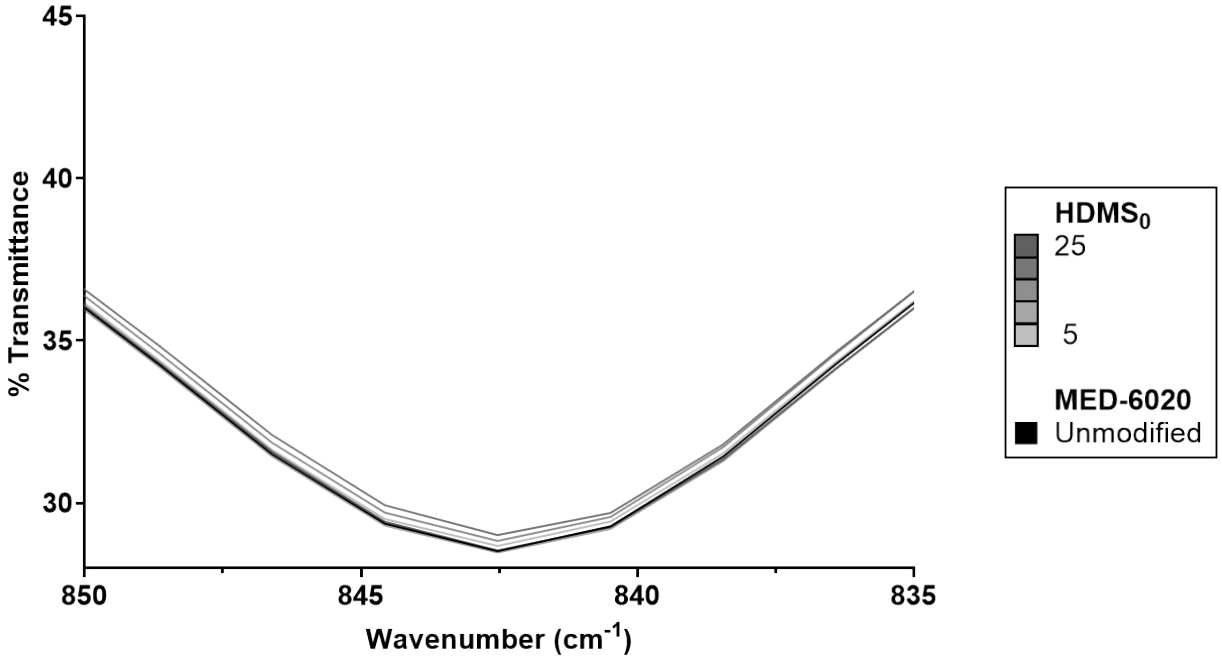

Figure S6. ATR-FTIR spectra of unmodified silicone (MED-6020) and silicones modified with $HDMS_0$ at all concentrations. Color gradient (top of legend) refers to concentration $HDMS_0$ (μmol/g) added to silicone. Characteristic Si-CH_3 stretching peak at 842 cm^{-1} decreased with increasing concentration of $HDMS_0$.

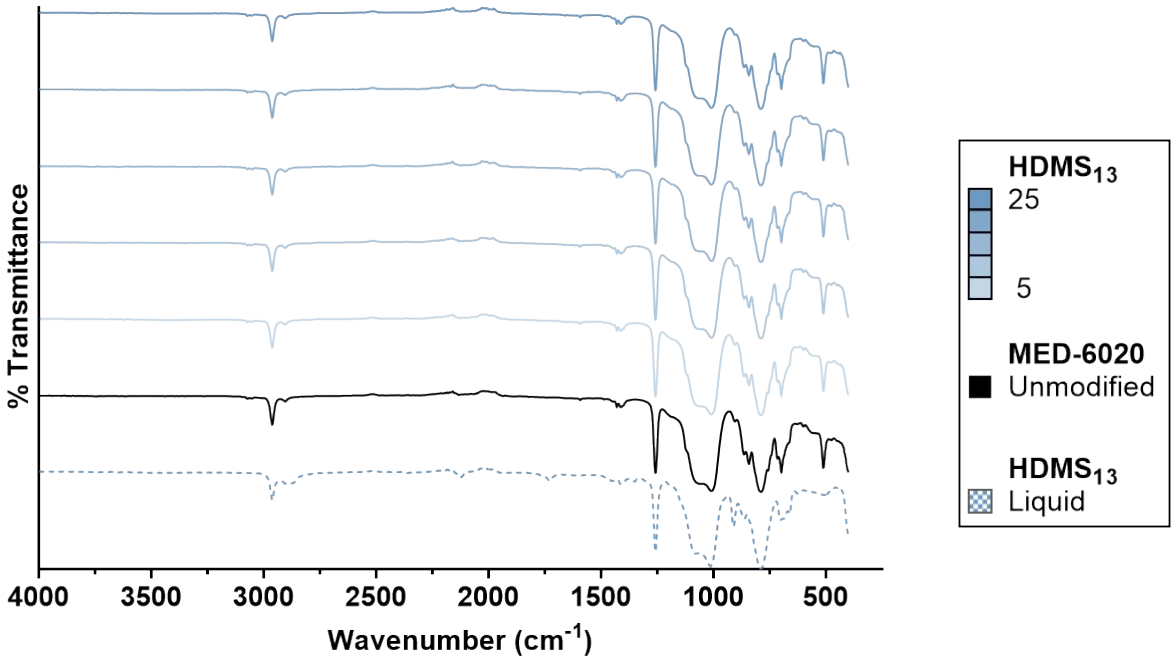

Figure S7. ATR-FTIR spectra of unmodified silicone (MED-6020) and silicones modified with $HDMS_{13}$ at all concentrations. Color gradient (top of legend) refers to concentration of $HDMS_{13}$ (µmol/g) added to silicone.

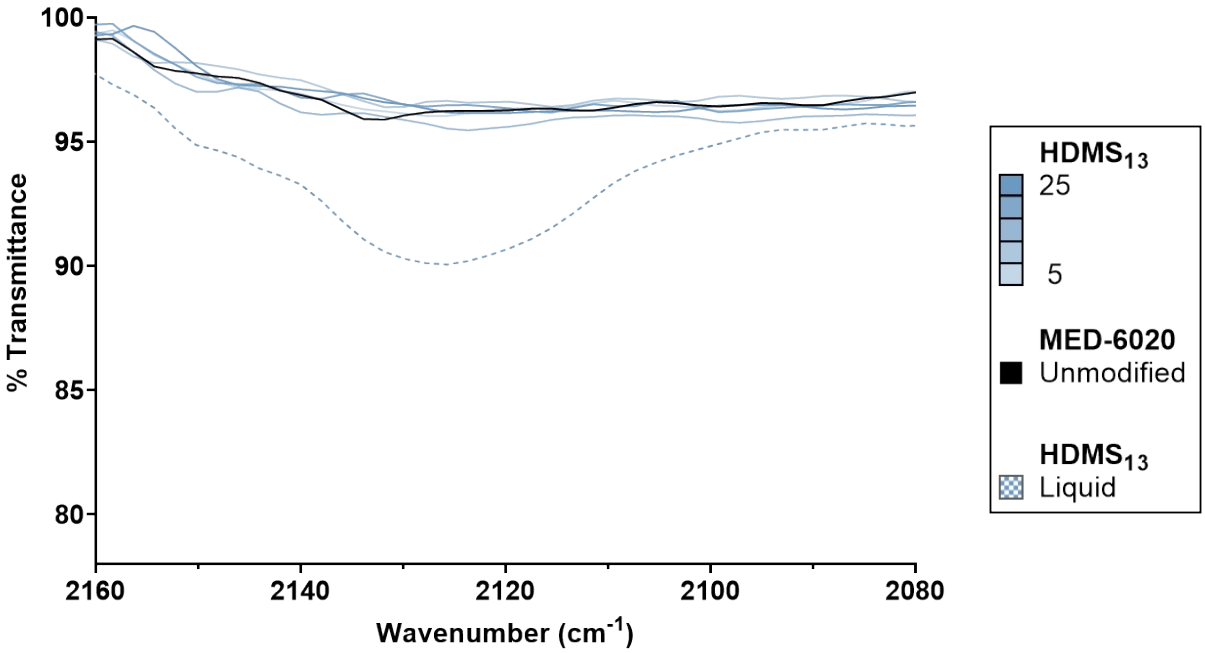

Figure S8. ATR-FTIR spectra of unmodified silicone (MED-6020) and silicones modified with $HDMS_{13}$ at all concentrations. Color gradient (top of legend) refers to concentration (µmol/g) added to silicone. The modified silicone spectra lacked the characteristic Si-H peak at 2280-2080 cm^{-1}, indicating complete hydrosilylation.

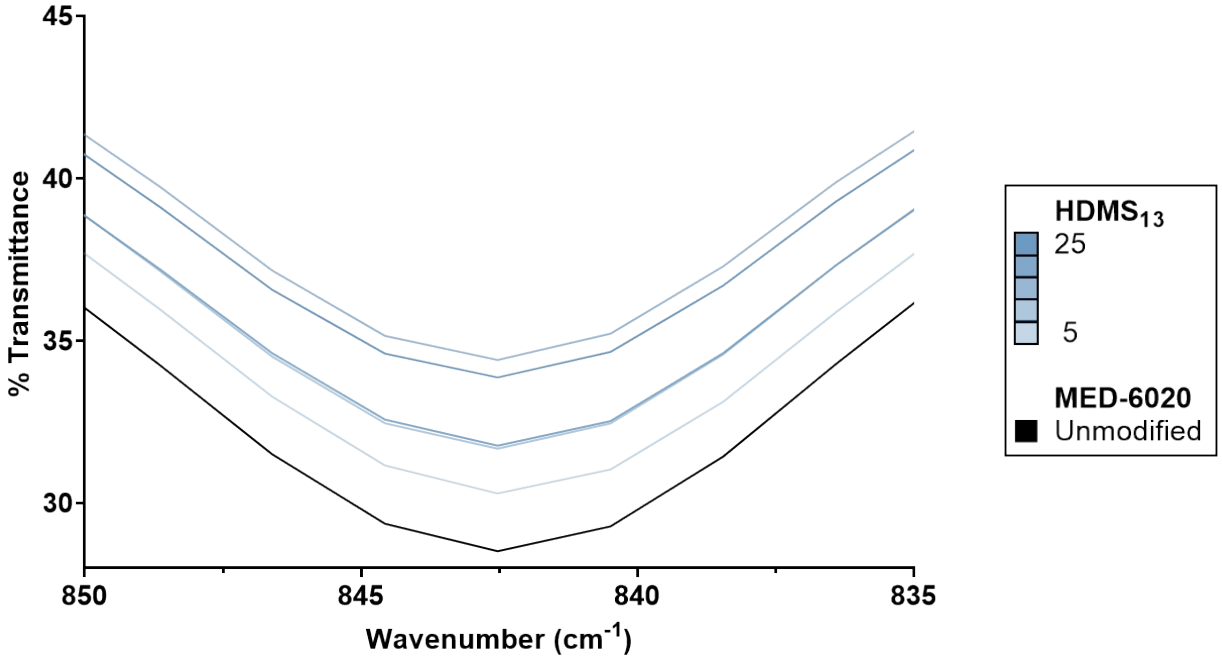

Figure S9. ATR-FTIR spectra of unmodified silicone (MED-6020) and silicones modified with $HDMS_{13}$ at all concentrations. Color gradient (top of legend) refers to concentration $HDMS_{13}$ (µmol/g) added to silicone. Characteristic Si-CH_3 stretching peak at 842 cm^{-1} decreased with increasing concentration of $HDMS_{13}$.

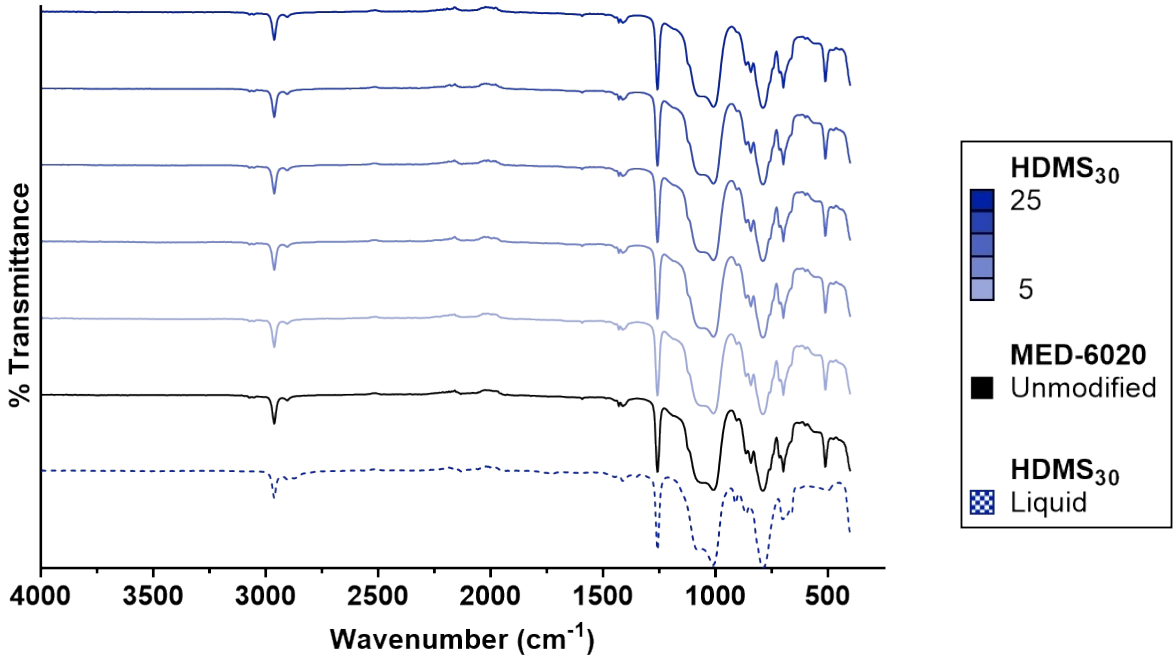

Figure S10. ATR-FTIR spectra of unmodified silicone (MED-6020) and silicones modified with $HDMS_{30}$ at all concentrations. Color gradient (top of legend) refers to concentration of $HDMS_{30}$ (µmol/g) added to silicone.

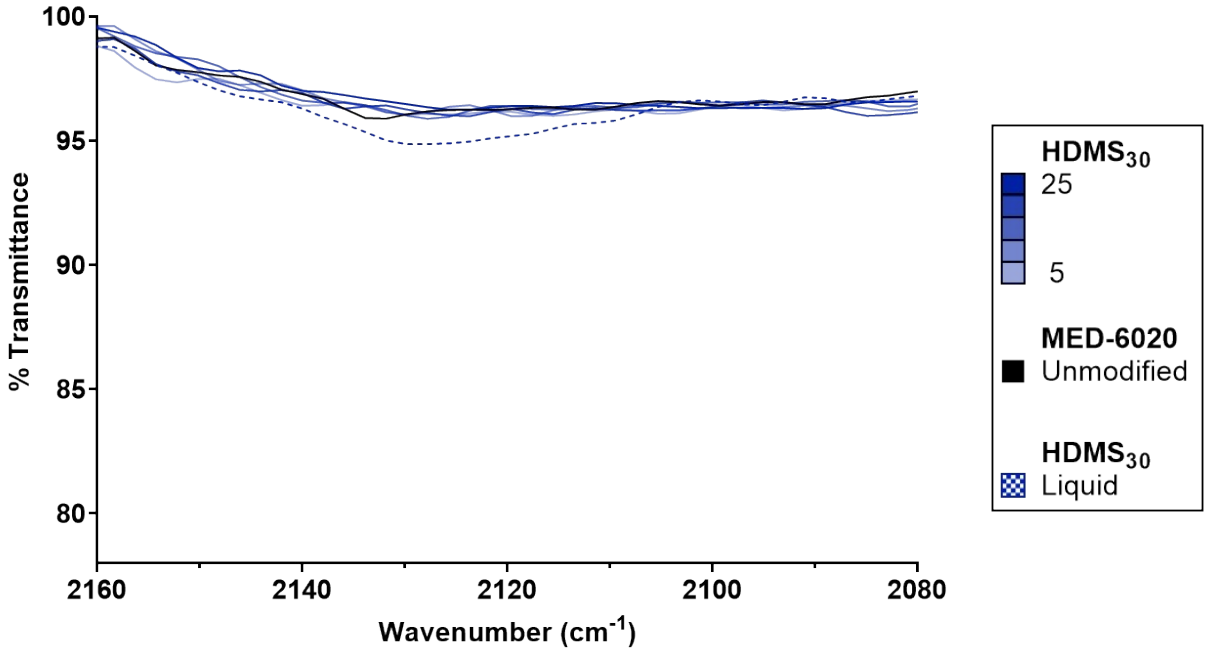

Figure S11. ATR-FTIR spectra of unmodified silicone (MED-6020) and silicones modified with $HDMS_{30}$ at all concentrations. Color gradient (top of legend) refers to concentration of $HDMS_{30}$ (µmol/g) added to silicone. The modified silicone spectra lacked the characteristic Si-H peak at 2280-2080 cm^{-1}, indicating complete hydrosilylation.

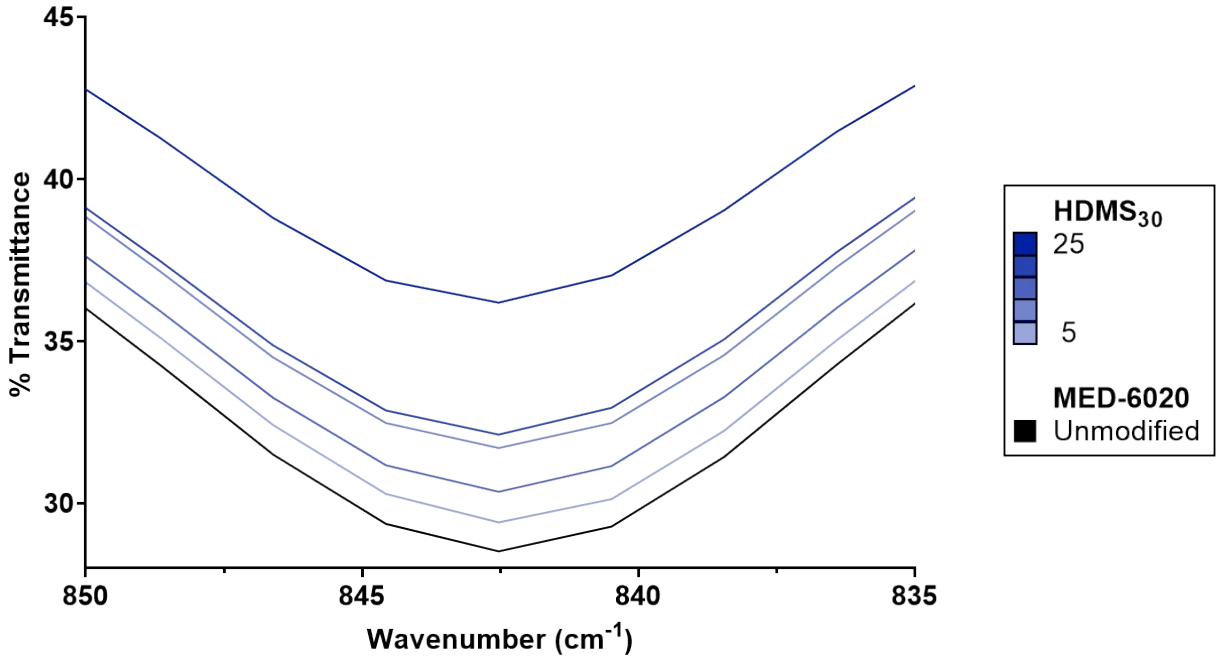

Figure S12. ATR-FTIR spectra of unmodified silicone (MED-6020) and silicones modified with $HDMS_{30}$ at all concentrations. Color gradient (top of legend) refers to concentration $HDMS_{30}$ (μmol/g) added to silicone. Characteristic Si-CH_3 stretching peak at 842 cm^{-1} decreased with increasing concentration of $HDMS_{30}$.

Table S2. Mass loss following aqueous equilibration for unmodified silicone (MED-6020) and silicones modified with SMAs.

	Concentration (μmol/g)	Mass Loss (Wt. %)
MED-6020	---	0.02 ± 0.08
$HDMS_0$		
	5	0.03 ± 0.08
	10	0.19 ± 0.18
	15	0.15 ± 0.13
	20	0.14 ± 0.15
	25	0.00 ± 0.15
$HDMS_{13}$		
	5	0.04 ± 0.08
	10	0.10 ± 0.09
	15	0.13 ± 0.15
	20	0.02 ± 0.09
	25	0.09 ± 0.11
$HDMS_{30}$		
	5	0.03 ± 0.10
	10	0.14 ± 0.14
	15	0.20 ± 0.13
	20	0.28 ± 0.16
	25	0.41 ± 0.19

Table S3. Water uptake following aqueous equilibration for unmodified silicone (MED-6020) and silicones modified with SMAs.

	Concentration (μmol/g)	Water Uptake (Wt. %)
MED-6020	---	0.02 ± 0.02
$HDMS_0$		
	5	0.07 ± 0.01
	10	0.02 ± 0.01
	15	0.02 ± 0.02
	20	0.05 ± 0.03
	25	0.05 ± 0.07
$HDMS_{13}$		
	5	0.06 ± 0.03
	10	0.03 ± 0.04
	15	0.01 ± 0.01
	20	0.01 ± 0.01
	25	0.01 ± 0.01
$HDMS_{30}$		
	5	0.01 ± 0.01
	10	0.02 ± 0.02
	15	0.00 ± 0.00
	20	0.00 ± 0.00
	25	0.01 ± 0.01

Table S4. Per **Figure 2a**, following air equilibration, static contact angle (DI water) (θ_{static}) values for unmodified silicone (MED-6020) and silicones modified with SMAs.

	Concentration (μmol/g)	t = 0 min	t = 1 min	t = 2 min	t = 3 min
MED-6020	---	119.1° ± 7.8°	117.1° ± 7.8°	116.3° ± 6.8°	115.5° ± 6.9°
$HDMS_0$					
	5	103.8° ± 6.9°	100.4° ± 5.2°	96.3° ± 5.5°	92.7° ± 5.0°
	10	96.5° ± 10.6°	88.8° ± 4.6°	84.7° ± 4.4°	81.4° ± 4.5°
	15	89.4° ± 6.3°	78.7° ± 5.8°	76.4° ± 5.3°	74.4° ± 5.3°
	20	66.6° ± 5.5°	57.0° ± 5.8°	54.7° ± 5.9°	51.6° ± 6.6°
	25	67.0° ± 1.9°	57.2° ± 2.4°	55.8° ± 3.1°	54.9° ± 2.1°
$HDMS_{13}$					
	5	115.5° ± 4.2°	114.5° ± 4.2°	113.5° ± 4.2°	108.3° ± 7.3°
	10	115.1° ± 5.7°	108.6° ± 10.4°	78.9° ± 14.3°	62.7° ± 13.3°
	15	112.9° ± 9.5°	97.4° ± 10.4°	65.2° ± 9.3°	51.1° ± 6.5°
	20	75.3° ± 14.9°	25.2° ± 10.8°	18.1° ± 7.0°	13.9° ± 4.5°
	25	72.6° ± 26.3°	25.8° ± 11.4°	20.9° ± 8.9°	18.7° ± 7.3°
$HDMS_{30}$					
	5	111.9° ± 5.4°	100.0° ± 18.2°	70.7° ± 21.2°	52.3° ± 17.2°
	10	109.2° ± 5.1°	51.8° ± 22.0°	30.5° ± 12.2°	22.4° ± 8.1°
	15	112.6° ± 6.9°	56.5° ± 6.6°	33.6° ± 4.6°	22.8° ± 5.0°
	20	115.6° ± 5.9°	30.6° ± 8.9°	16.5° ± 3.9°	12.2° ± 2.7°
	25	72.9° ± 28.1°	14.2° ± 4.0°	12.6° ± 3.1°	11.8° ± 2.6°

Table S5. Per **Figure 2b**, following aqueous equilibration, static contact angle (DI water) values for unmodified silicone (MED-6020) and silicones modified with SMAs.

	Concentration (μmol/g)	t = 0 min	t = 1 min	t = 2 min	t = 3 min
MED-6020	---	118.4° ± 8.7°	116.5° ± 5.4°	115.3° ± 5.4°	114.2° ± 5.6°
$HDMS_0$					
	5	119.0° ± 6.0°	113.6° ± 3.1°	112.5° ± 3.1°	111.7° ± 3.2°
	10	121.6° ± 3.0°	113.3° ± 1.7°	112.3° ± 1.7°	111.4° ± 1.8°
	15	118.3° ± 3.8°	111.8° ± 1.4°	110.9° ± 1.5°	110.1° ± 1.5°
	20	116.3° ± 3.1°	110.3° ± 2.2°	109.3° ± 2.2°	108.4° ± 2.1°
	25	116.4° ± 4.3°	110.2° ± 1.8°	109.4° ± 1.8°	108.6° ± 1.8°
$HDMS_{13}$					
	5	123.9° ± 4.9°	115.0° ± 1.3°	112.1° ± 1.9°	102.7° ± 1.9°
	10	126.9° ± 4.3°	113.0° ± 3.3°	97.0° ± 6.2°	79.5° ± 9.4°
	15	117.9° ± 3.4°	97.1° ± 19.6°	73.2° ± 22.0°	55.8° ± 19.2°
	20	107.7° ± 21.3°	73.1° ± 32.8°	43.5° ± 21.0°	33.0° ± 15.5°
	25	108.6° ± 15.9°	46.9° ± 24.2°	27.3° ± 9.9°	23.4° ± 6.9°
$HDMS_{30}$					
	5	118.2° ± 5.5°	109.7° ± 4.5°	101.7° ± 4.0°	97.2° ± 4.7°
	10	111.0° ± 7.0°	96.7° ± 9.1°	84.4° ± 9.5°	70.3° ± 10.5°
	15	99.1° ± 12.5°	77.8° ± 10.3°	66.1° ± 12.5°	56.3° ± 13.3°
	20	98.8° ± 11.7°	81.5° ± 4.3°	68.6° ± 6.8°	58.4° ± 9.3°
	25	95.2° ± 8.9°	70.1° ± 20.6°	59.3° ± 16.8°	50.2° ± 15.0°

Table S6. Comparison of static contact angle (DI water) (t = 3 min) values for air and aqueous equilibrated unmodified silicone (MED-6020) and silicones modified with SMAs.

	Concentration (μmol/g)	t = 3 min Air Equilibration	t = 3 min Aq. Equilibration
MED-6020	---	115.5° ± 6.9°	114.2° ± 5.6°
$HDMS_0$			
	5	92.7° ± 5.0°	111.7° ± 3.2°
	10	81.4° ± 4.5°	111.4° ± 1.8°
	15	74.4° ± 5.3°	110.1° ± 1.5°
	20	51.6° ± 6.6°	108.4° ± 2.1°
	25	54.9° ± 2.1°	108.6° ± 1.8°
$HDMS_{13}$			
	5	108.3° ± 7.3°	102.7° ± 1.9°
	10	62.7° ± 13.3°	79.5° ± 9.4°
	15	51.1° ± 6.5°	55.8° ± 19.2°
	20	13.9° ± 4.5°	33.0° ± 15.5°
	25	18.7° ± 7.3°	23.4° ± 6.9°
$HDMS_{30}$			
	5	52.3° ± 17.2°	97.2° ± 4.7°
	10	22.4° ± 8.1°	70.3° ± 10.5°
	15	22.8° ± 5.0°	56.3° ± 13.3°
	20	12.2° ± 2.7°	58.4° ± 9.3°
	25	11.8° ± 2.6°	50.2° ± 15.0°

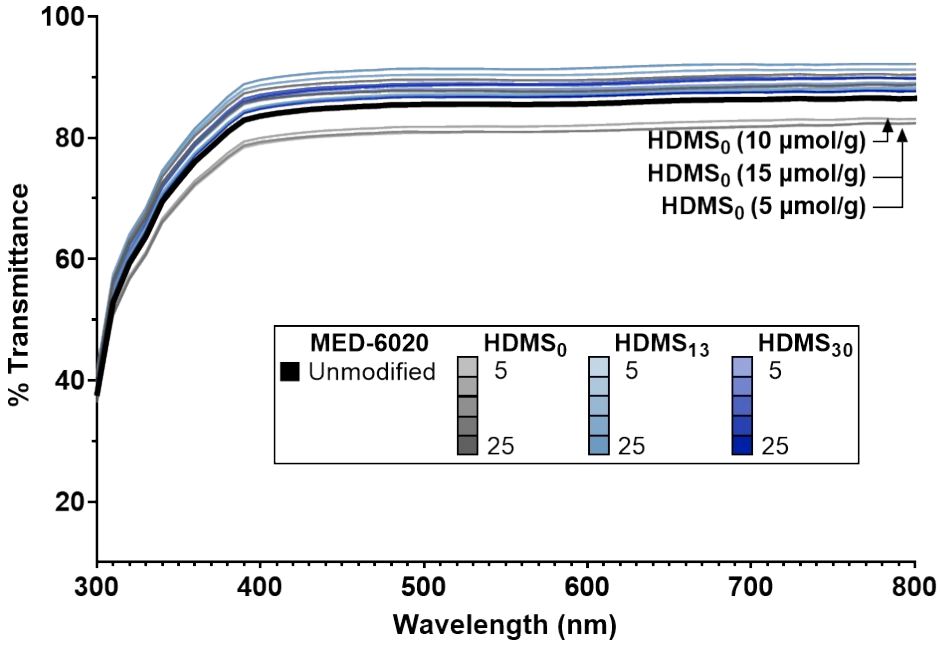

Figure S13. % Transmittance of unmodified silicone (MED-6020) and silicones modified with SMAs after air equilibration. Color gradients refer to concentration of $HDMS_0$, $HDMS_{13}$, or $HDMS_{30}$ (µmol/g) added to silicone. All formulations except for those modified with $HDMS_0$ exhibited greater % transmittance versus MED-6020.

Table S7. Per **Figures 3** and **S13**, % transmittance (at 550 nm) of unmodified silicone (MED-6020) and silicones modified with SMAs after air and aqueous equilibration.

	Concentration (µmol/g)	Air Equilibration (% Transmittance)	Aq. Equilibration (%Transmittance)
MED-6020	---	85.5 ± 0.4	90.4 ± 1.4
$HDMS_0$			
	5	80.9 ± 4.6	88.4 ± 0.9
	10	81.8 ± 6.0	86.5 ± 3.5
	15	81.0 ± 11.0	71.6 ± 3.2
	20	89.5 ± 1.7	74.3 ± 3.3
	25	87.6 ± 1.3	40.1 ± 5.7
$HDMS_{13}$			
	5	88.0 ± 3.6	91.3 ± 0.3
	10	87.2 ± 2.4	90.8 ± 0.2
	15	87.1 ± 1.9	90.3 ± 0.9
	20	90.4 ± 2.3	89.1 ± 1.1
	25	91.3 ± 0.7	89.0 ± 0.3
$HDMS_{30}$			
	5	88.0 ± 2.9	90.9 ± 0.3
	10	86.7 ± 2.8	90.7 ± 0.3
	15	88.9 ± 3.5	90.4 ± 0.4
	20	88.7 ± 3.6	89.7 ± 0.2
	25	86.7 ± 5.3	88.2 ± 1.1

Table S8. Per **Figure 4**, modulus of unmodified silicone (MED-6020) and silicones modified with SMAs after air and aqueous equilibration.

	Concentration (μmol/g)	Air Equilibration (MPa)	Aq. Equilibration (MPa)
MED-6020	---	0.94 ± 0.06	1.02 ± 0.10
$HDMS_0$			
	5	0.89 ± 0.04	0.97 ± 0.08
	10	0.95 ± 0.10	0.86 ± 0.06
	15	0.95 ± 0.07	0.95 ± 0.08
	20	0.93 ± 0.05	0.94 ± 0.07
	25	0.90 ± 0.04	0.79 ± 0.03
$HDMS_{13}$			
	5	1.08 ± 0.12	0.95 ± 0.04
	10	1.12 ± 0.05	0.86 ± 0.09
	15	1.04 ± 0.06	0.89 ± 0.04
	20	0.97 ± 0.04	0.95 ± 0.07
	25	1.07 ± 0.04	0.82 ± 0.08
$HDMS_{30}$			
	5	0.90 ± 0.06	0.84 ± 0.09
	10	1.03 ± 0.04	0.80 ± 0.12
	15	0.94 ± 0.04	0.88 ± 0.11
	20	0.84 ± 0.06	0.88 ± 0.06
	25	0.89 ± 0.16	0.81 ± 0.06

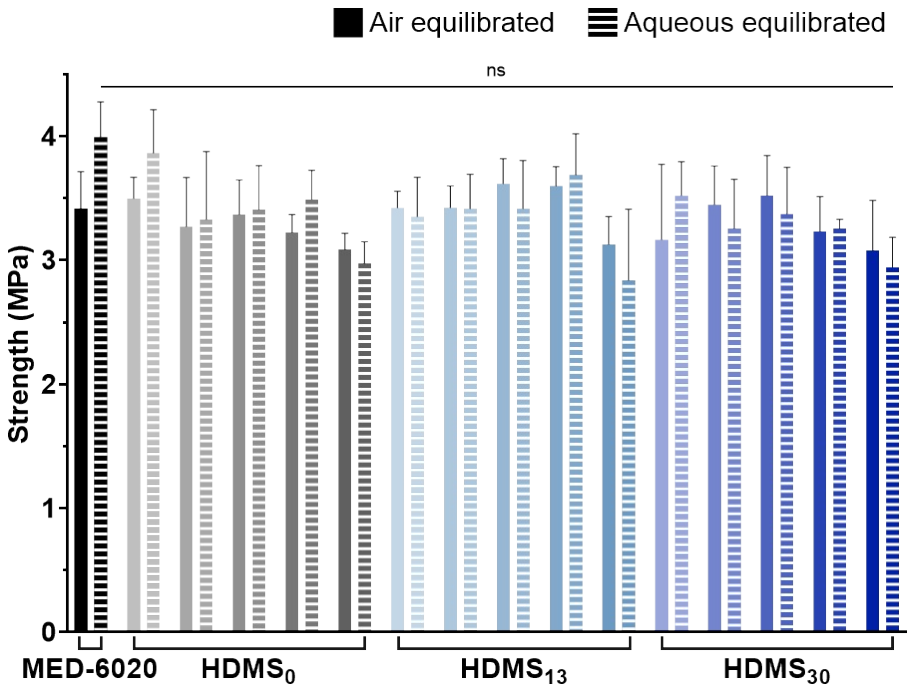

Figure S14. Strength of unmodified silicone (MED-6020) and silicones modified with SMAs after air and aqueous equilibration. Statistical analysis ($p < 0.05$); "ns": not significant.

Table S9. Per **Figure S14**, strength of unmodified silicone (MED-6020) and silicones modified with SMAs after air and aqueous equilibration.

	Concentration (μmol/g)	Air Equilibration (MPa)	Aq. Equilibration (MPa)
MED-6020	---	3.42 ± 0.30	3.99 ± 0.28
$HDMS_0$			
	5	3.50 ± 0.17	3.86 ± 0.35
	10	3.27 ± 0.40	3.33 ± 0.55
	15	3.37 ± 0.28	3.41 ± 0.35
	20	3.22 ± 0.14	3.49 ± 0.23
	25	3.09 ± 0.13	2.98 ± 0.17
$HDMS_{13}$			
	5	3.42 ± 0.13	3.35 ± 0.32
	10	3.42 ± 0.18	3.42 ± 0.28
	15	3.62 ± 0.20	3.42 ± 0.39
	20	3.60 ± 0.15	3.69 ± 0.33
	25	3.13 ± 0.22	2.84 ± 0.57
$HDMS_{30}$			
	5	3.17 ± 0.61	3.52 ± 0.27
	10	3.45 ± 0.31	3.26 ± 0.40
	15	3.52 ± 0.32	3.37 ± 0.38
	20	3.23 ± 0.28	3.26 ± 0.07
	25	3.08 ± 0.40	2.94 ± 0.24

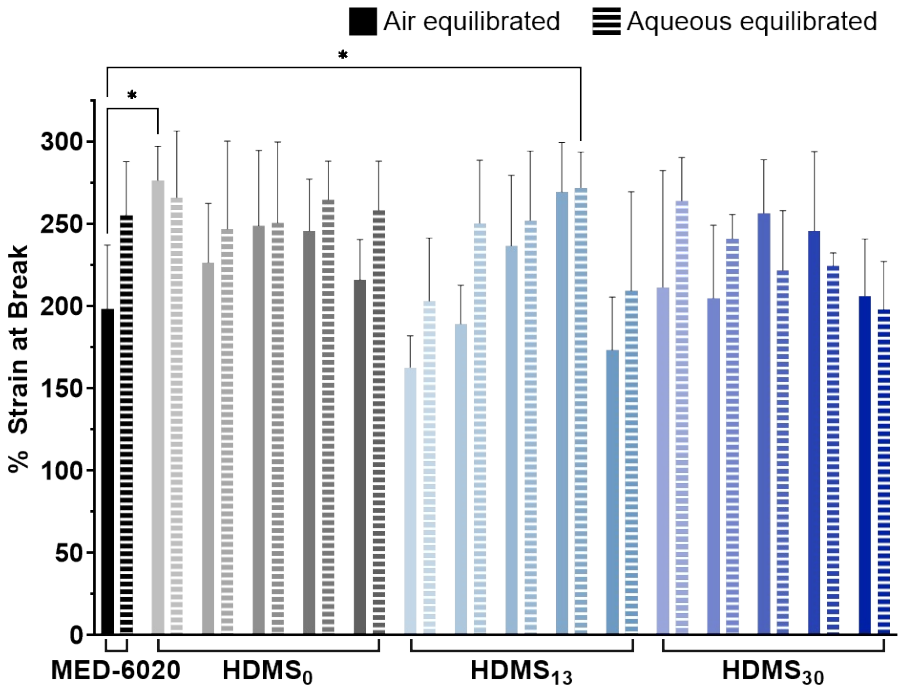

Figure S15. % Strain at break of unmodified silicone (MED-6020) and silicones modified with SMAs after air and aqueous equilibration. *$p < 0.05$: MED-6020 v. $HDMS_0$ @ 5 µmol/g after air equilibration; MED-6020 v. $HDMS_{13}$ @ 20 µmol/g after aqueous equilibration.

Table S10. Per **Figure S15**, % strain at break of unmodified silicone (MED-6020) and silicones modified with SMAs after air and aqueous equilibration

	Concentration (µmol/g)	Air Equilibration (% Strain)	Aq. Equilibration (% Strain)
MED-6020	---	198.3 ± 38.7	255.1 ± 32.7
$HDMS_0$			
	5	276.4 ± 20.6	266.0 ± 40.4
	10	226.6 ± 35.8	246.8 ± 53.4
	15	248.8 ± 45.8	250.6 ± 49.1
	20	245.7 ± 31.4	264.8 ± 23.3
	25	216.0 ± 24.5	258.2 ± 29.8
$HDMS_{13}$			
	5	162.8 ± 19.2	203.1 ± 38.1
	10	189.2 ± 23.6	250.5 ± 38.2
	15	236.6 ± 42.8	252.1 ± 42.0
	20	269.5 ± 29.9	272.0 ± 21.5
	25	173.4 ± 32.0	209.4 ± 60.1
$HDMS_{30}$			
	5	211.5 ± 70.9	264.0 ± 26.3
	10	204.7 ± 44.4	241.0 ± 14.7
	15	256.5 ± 32.5	221.8 ± 36.2
	20	245.8 ± 48.0	224.4 ± 7.8
	25	206.0 ± 34.6	198.1 ± 29.1

Table S11. Per **Figure 5a**, LDH release values.

		LDH Release (A.U.)
Glass	Positive control	1.72 ± 0.07
Laminin	Positive control	1.75 ± 0.04
X-100	Negative control	2.29 ± 0.16
MED-6020	Unmodified silicone	1.69 ± 0.04
$HDMS_0$	25 μmol/g	1.75 ± 0.05
$HDMS_{13}$	25 μmol/g	1.70 ± 0.06
$HDMS_{30}$	25 μmol/g	1.75 ± 0.02

Table S12. Per **Figure 5b** and **c**, cell count/field values.

		Cell Count/Field
Glass	Positive control	305 ± 52
Laminin	Positive control	315 ± 51
MED-6020	Unmodified silicone	458 ± 78
$HDMS_0$	25 μmol/g	353 ± 103
$HDMS_{13}$	25 μmol/g	263 ± 75
$HDMS_{30}$	25 μmol/g	132 ± 44