Electronic Supplementary Material (ESI) for Journal of Materials Chemistry C.

Swelling of PDMS Networks in Solvent Vapours; Applications for Passive RFID Wireless Sensors

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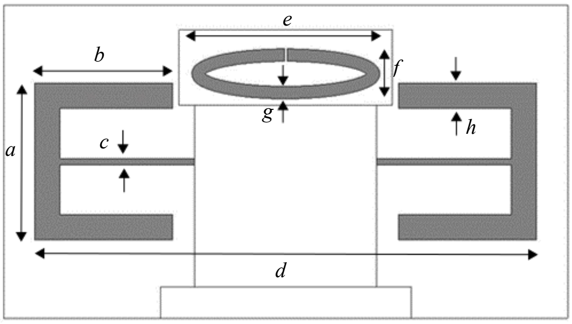


Figure S1: Displacement feed loop RFID tag antenna. Dimensions in Table S1

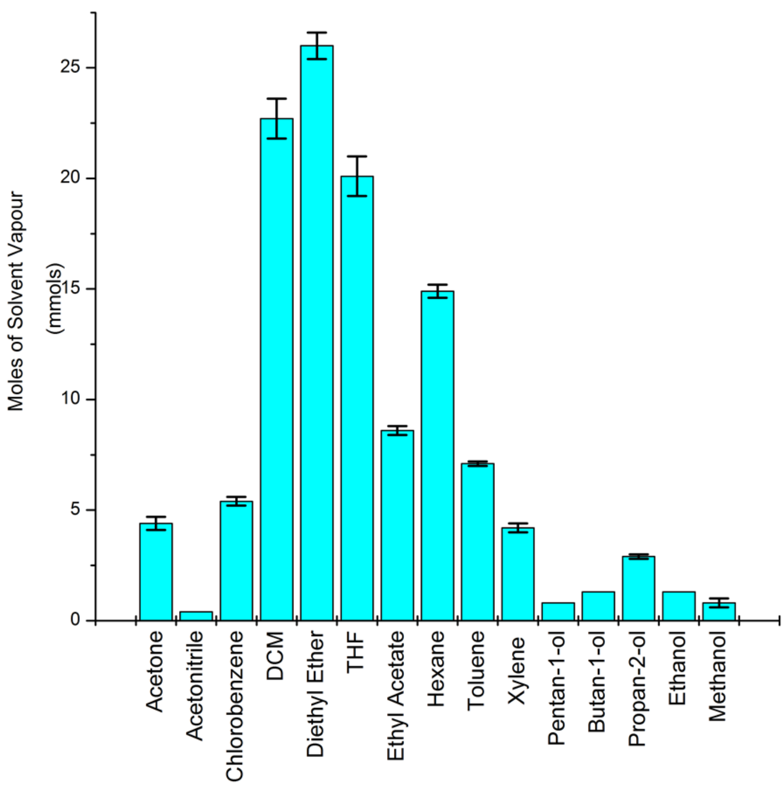
Table S1: Dimensions of feed loop RFID tag antenna.

Symbol	Length (mm)
a	25
b	22
c	1
d	80
e	14
f	3
g	2
h	4

Table S2: Volume and weight swelling ratios, Hansen solubility parameters, Ra and ranking for each solvent. Ranking refers to the order of the solvent swelling ability with rank 1 being the best swelling solvent.

Solvent	Q_V	Q_W	Solvent vapour (mmol)	Hansen Solubility Parameters ($MPa^{1/2}$)				Ra ($MPa^{1/2}$)	Rank (Q_V)	Rank (Q_W)	Rank (mmol)	P_{VP} (mmHg @ 20°C)
				δ_d	δ_p	δ_h	δ_t					
Acetone	1.32	1.33	4.4	15.5	10.4	7.0	19.9	10.6	9	9	8	181.0
Acetonitrile	1.06	1.02	0.4	15.3	18.0	6.1	24.2	18.0	14	15	15	74.0
Butan-1-ol	1.13	1.14	1.3	16.0	5.7	15.8	23.2	12.4	11	11	11	5.5
Chlorobenzene	1.52	1.75	5.4	19.0	4.3	2.0	19.6	8.0	7	7	7	11.7
Diethyl Ether	3.27	3.33	26.0	14.5	2.9	5.1	15.6	4.0	1	2	1	422.0
Ethanol	1.11	1.08	1.3	15.8	8.8	19.4	26.5	17.1	12	12	12	44.3
Ethyl Acetate	1.75	1.90	8.6	15.8	5.3	7.2	18.2	5.8	5	5	5	73.0
Hexane	2.76	2.74	14.9	14.9	0.0	0.0	14.9	5.1	2	3	4	124.0
Methanol	1.03	1.04	0.8	15.1	12.3	22.3	29.6	21.5	15	14	14	96.0
DCM	2.29	3.37	22.7	18.2	6.3	6.1	20.2	7.8	4	1	2	350.0
Pentan-1-ol	1.07	1.08	0.8	15.9	5.9	13.9	21.9	10.9	13	13	13	1.5
Propan-2-ol	1.26	1.22	2.9	15.8	6.1	16.4	23.6	13.2	10	10	10	33.0
Tetrahydrofuran	2.43	2.74	20.1	16.8	5.7	8.0	19.5	6.7	3	4	3	143.0
Toluene	1.72	1.81	7.1	18.0	1.4	2.0	18.2	5.2	6	6	6	22.0
Xylene	1.51	1.53	4.2	17.8	0.9	1.8	17.9	4.8	8	8	9	4.8
PDMS	-	-	-	15.9	0.1	4.7	16.6	-	-	-	-	-

Figure S2: Moles of solvent vapour absorbed into elastomer after 72 hours exposure.



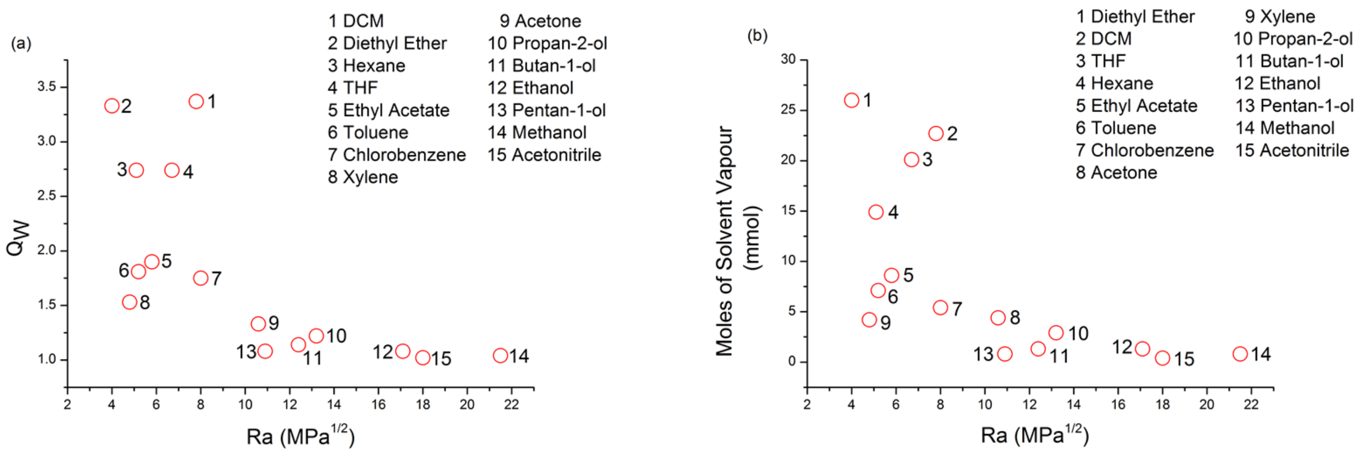


Figure S3: (a) Weight swelling ratio versus Ra for each solvent and (b) moles of solvent vapour absorbed by elastomer versus Ra for each solvent. The numbers relate to the ranking of the solvents swelling ability.

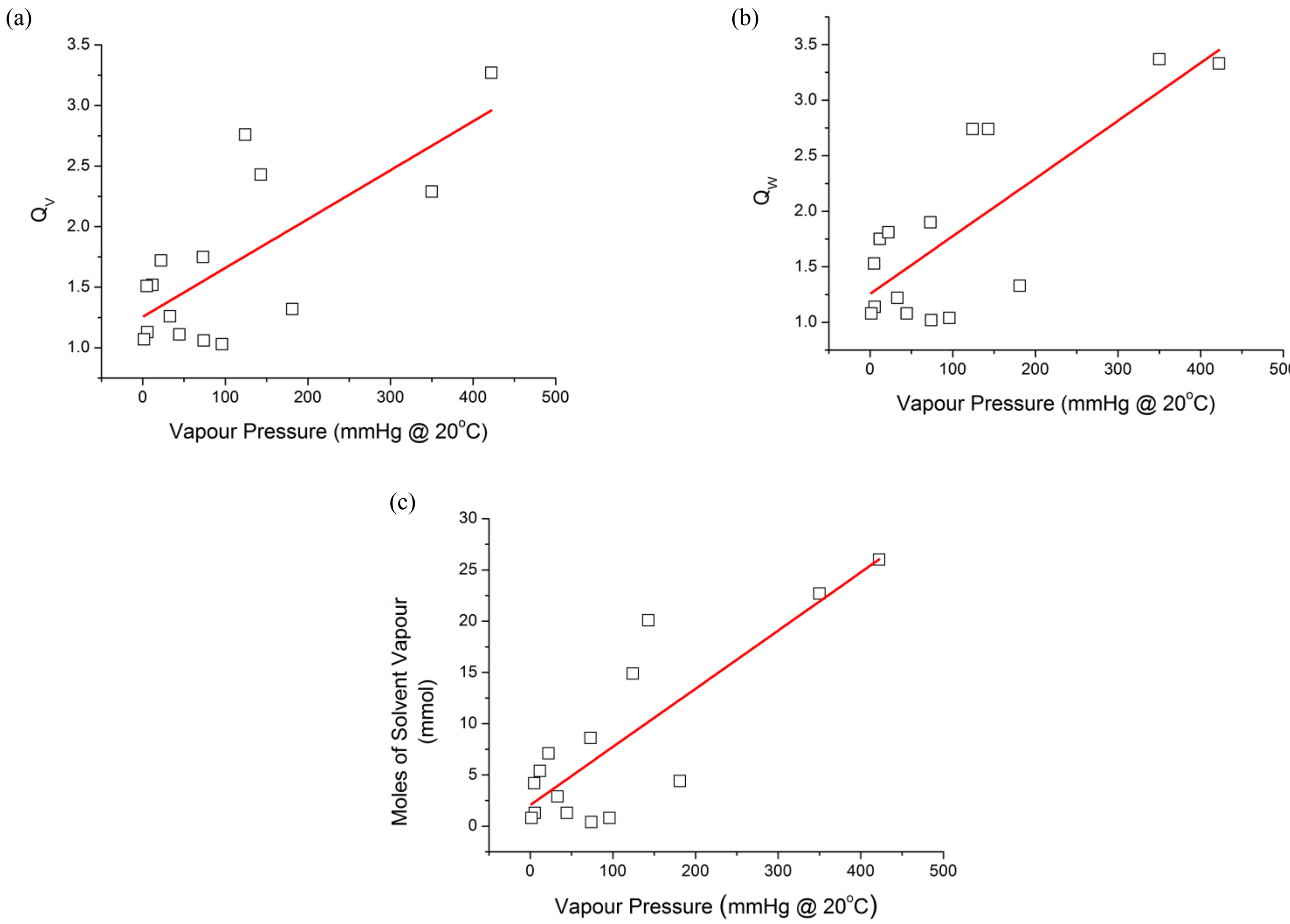


Figure S4: (a) Q_V versus vapour pressure (b) Q_W versus vapour pressure and (c) moles of solvent vapour in swollen elastomer versus vapour pressure.

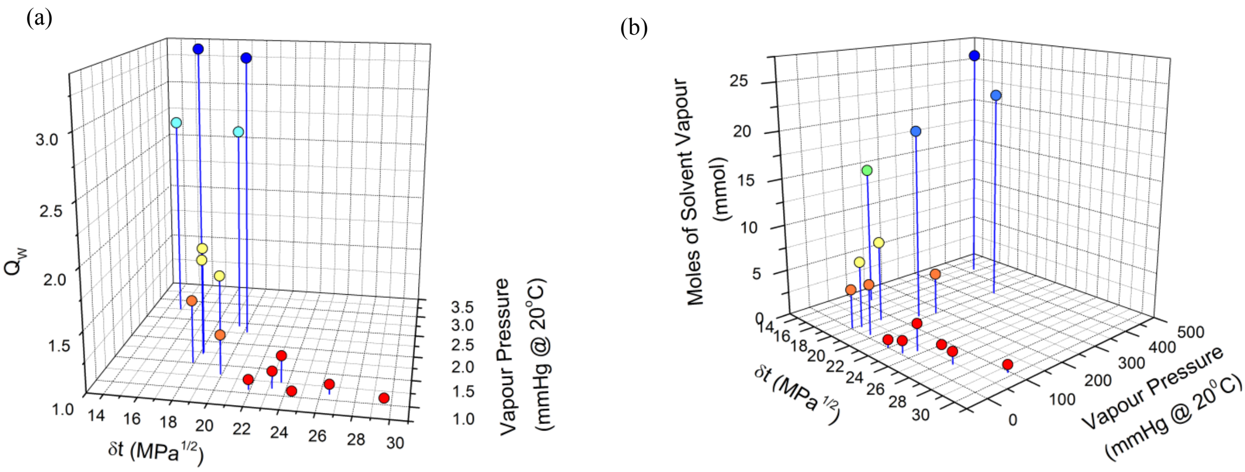


Figure S5: (a) Q_W versus the total Hansen solubility parameter and vapour pressure of each solvent (b) moles of solvent in swollen elastomer versus the total Hansen solubility parameter and vapour pressure of each solvent.

Table S3: Results from the linear regression analysis. The intercept and variables were used in equations 7 and 8 to predict swelling for Q_V.

	Q_V		**Q_W**		**Moles of Solvent Vapour**	
	Eq 7	**Eq 8**	**Eq7**	**Eq 8**	**Eq 7**	**Eq 8**
R^2	0.820032972	0.8870684	0.851629341	0.879732317	-	-
Significance f	3.39749×10^{-5}	9.98399×10^{-5}	1.06681×10^{-5}	1.35841×10^{-4}	4.65×10^{-6}	0.000192
Intercept (a)	2.061165316	3.733022915	2.1428168	0.758810704	10.00094586	-0.383922955
b_{Ra}	-0.071008207	-	-0.078272575	-	-0.700582178	
$b\delta_d$	-	-0.105318594	-	0.06699796	-	0.459577803
$b\delta_p$	-	-0.069508359	-	-0.063754836	-	-0.606956017
$b\delta_h$	-	-0.029037386	-	-0.020349323	-	-0.128322476
b_{VP}	0.00317938	0.00338831	0.004261646	0.005060529	0.048357022	0.055789896

$$Q_V = a + b_{Ra} * Ra + b_{PVP} * Pvp \quad (7)$$

$$Q_V = a + (b_{\delta d} * \delta_d) + (b_{\delta p} * \delta_p) + (b_{\delta h} * \delta_h) + (b_{PVP} * Pvp) \quad (8)$$

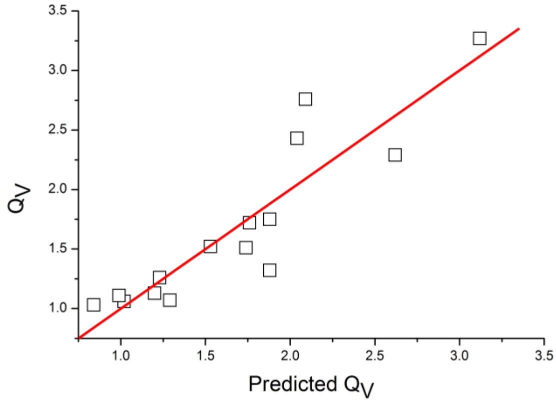


Figure S6: Measured volume swelling ratio versus predicted swelling ratio calculated using results from linear regression analysis. Ra and vapour pressure variables used (equation 7).

(a) (b)

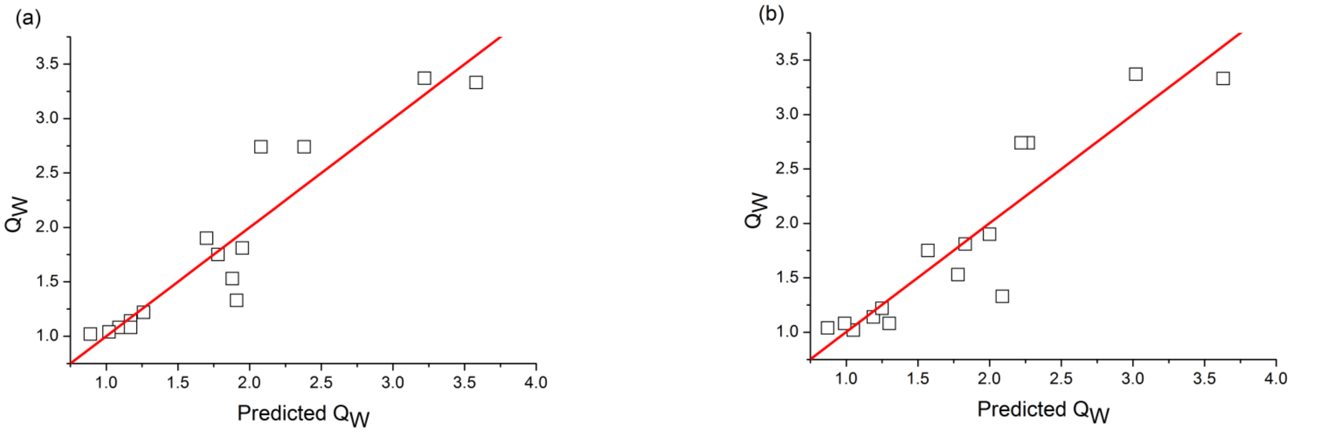


Figure S7: (a) Measured weight swelling ratio versus predicted weight swelling ratio using results from linear regression analysis. δ_d, δ_p, δ_h and vapour pressure variables used (equation 8) (b) Measured weight swelling ratio versus predicted weight swelling ratio using results from linear regression analysis. Ra and vapour pressure variables used (equation 7).

(a) (b)

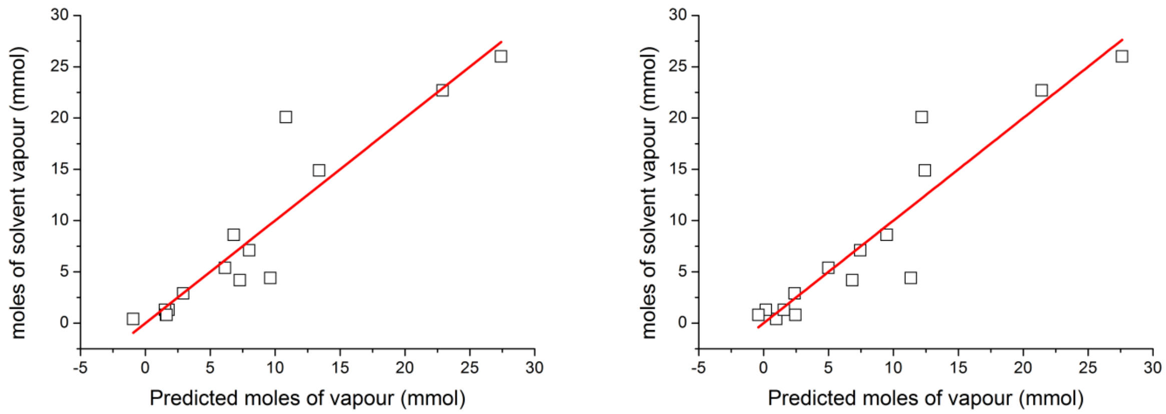


Figure S8 : (a) Measured moles of solvent vapour in swollen elastomer versus predicted moles of vapour using results from linear regression analysis. δ_d, δ_p, δ_h and vapour pressure variables used (equation 8) (b) Measured moles of solvent vapour in swollen elastomer versus predicted moles of vapour using results from linear regression analysis. Ra and vapour pressure variables used (equation 7).

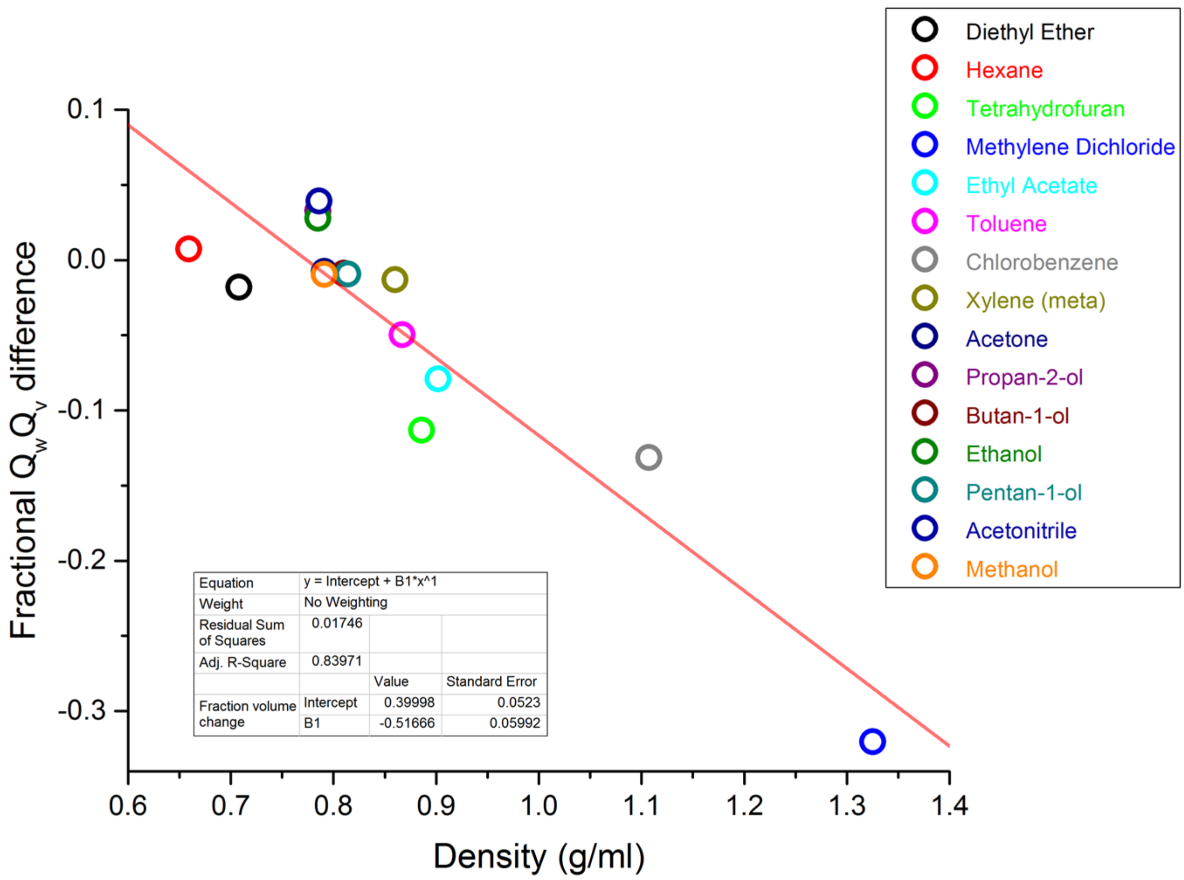


Figure S9 : Variation in fractional difference, (Q_v/Q_W)-1, between Qv and Qw with solvent density.