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SUPPLEMENTARY INFORMATION

***Table S1**:* Swelling (%) and weight loss (%) of the polymer films over the 16-day study period, calculated based on initial weight (W_i), swelled-up weight (W_s) and final weight (W_f) (Experiment I).

Day	W_i (g)	W_s (g)	W_f (g)	S %	L %
			PP CF1		
Day 2	0.820	0.885	0.818	7.927	0.244
Day 4	0.820	0.850	0.816	3.659	0.488
Day 8	0.820	0.865	0.813	5.488	0.854
Day 16	0.820	0.895	0.806	9.146	1.707
			PLA CF1		
Day 2	0.505	0.515	0.498	1.980	1.386
Day 4	0.505	0.533	0.487	5.545	3.564
Day 8	0.505	0.575	0.370	13.861	26.733
Day 16	0.505	0.514	0.340	1.782	32.673
			PCL CF1		
Day 2	0.612	0.680	0.608	11.057	0.702
Day 4	0.612	0.690	0.580	12.690	5.275
Day 8	0.612	0.635	0.570	3.707	6.908
Day 16	0.612	0.660	0.569	7.790	7.072
			PVOH CF1		
Day 2	0.330	0.385	0.326	16.667	1.212
Day 4	0.330	0.430	0.313	30.303	5.152
Day 8	0.330	0.595	0.310	80.303	6.061
Day 16	0.330	0.800	0.280	142.424	15.152
			PP CF2		
Day 2	0.874	0.875	0.871	0.114	0.343
Day 4	0.874	0.940	0.869	7.551	0.572
Day 8	0.874	0.965	0.850	10.412	2.746
Day 16	0.874	1.000	0.830	14.416	5.034
			PLA CF2		
Day 2	0.497	0.512	0.490	2.977	1.448
Day 4	0.497	0.510	0.488	2.574	1.850
Day 8	0.497	0.535	0.430	7.603	13.516
Day 16	0.497	0.505	0.350	1.569	29.606
			PCL CF2		
Day 2	0.677	0.685	0.610	1.254	9.832
Day 4	0.677	0.715	0.607	5.689	10.275
Day 8	0.677	0.695	0.610	2.732	9.832
Day 16	0.677	0.698	0.620	3.176	8.354
			PVOH CF2		
Day 2	0.370	0.430	0.364	16.252	1.591

Day 4	0.370	0.420	0.342	13.549	7.539
Day 8	0.370	0.685	0.320	85.192	13.487
Day 16	0.370	0.870	0.270	135.208	27.004

Table S2. Measured weight of the polymer films in alkalised urine after heating at different temperatures, and corresponding weight loss (%) (Experiment I).

PP (Concentration Factor 1)								
	Measured weight (g)				Weight loss (%)			
Temp	Day 2	Day 4	Day 8	Day 16	Day 2	Day 4	Day 8	Day 16
20	0.885	0.85	0.865	0.895				
100	0.818	0.816	0.813	0.806	7.57	4.00	6.01	9.94
200	0.442	0.415	0.403	0.408	50.11	51.18	53.47	54.47
300	0.397	0.373	0.379	0.401	55.11	56.18	56.16	55.22
400	0.040	0.037	0.039	0.040	95.50	95.62	95.51	95.51
550	0.015	0.014	0.015	0.015	98.33	98.33	98.22	98.30

PLA (Concentration Factor 1)								
	Measured weight (g)				Weight loss (%)			
Temp	Day 2	Day 4	Day 8	Day 16	Day 2	Day 4	Day 8	Day 16
20	0.515	0.533	0.575	0.514				
100	0.498	0.487	0.370	0.340	3.30	8.63	35.65	33.85
200	0.308	0.318	0.300	0.285	40.29	40.34	47.83	44.55
300	0.215	0.223	0.210	0.200	58.20	58.24	63.48	61.19
400	0.062	0.053	0.075	0.048	88.06	90.06	86.96	90.76
550	0.010	0.010	0.007	0.007	97.98	98.12	98.71	98.68

PCL (Concentration Factor 1)								
	Measured weight (g)				Weight loss (%)			
Temp	Day 2	Day 4	Day 8	Day 16	Day 2	Day 4	Day 8	Day 16
20	0.68	0.69	0.635	0.66				
100	0.608	0.580	0.570	0.590	10.59	15.94	10.24	10.61
200	0.204	0.193	0.162	0.127	70.00	72.00	74.54	80.73
300	0.020	0.019	0.016	0.013	97.00	97.20	97.45	98.07
400	0.009	0.009	0.007	0.006	98.65	98.74	98.85	99.13
550	0.005	0.004	0.004	0.003	99.33	99.37	99.43	99.57

PVOH (Concentration Factor 1)

	Measured weight (g)				Weight loss (%)			
Temp	Day 2	Day 4	Day 8	Day 16	Day 2	Day 4	Day 8	Day 16
20	0.385	0.43	0.595	0.8				
100	0.326	0.313	0.310	0.280	15.32	27.21	47.90	65.00
200	0.180	0.165	0.155	0.140	53.25	61.63	73.95	82.50
300	0.072	0.066	0.062	0.056	81.30	84.65	89.58	93.00
400	0.014	0.013	0.012	0.011	96.26	96.93	97.92	98.60
550	0.007	0.007	0.006	0.006	98.13	98.47	98.96	99.30

PP (Concentration Factor 2)

	Measured weight (g)				Weight loss (%)			
Temp	Day 2	Day 4	Day 8	Day 16	Day 2	Day 4	Day 8	Day 16
20	0.875	0.94	0.965	1				
100	0.871	0.869	0.850	0.830	0.46	7.55	11.92	17.00
200	0.435	0.440	0.482	0.490	50.29	53.19	50.10	51.00
300	0.392	0.413	0.433	0.420	55.26	56.06	55.10	58.00
400	0.039	0.042	0.043	0.042	95.53	95.50	95.51	95.80
550	0.016	0.018	0.017	0.017	98.15	98.11	98.24	98.34

PLA (Concentration Factor 2)

	Measured weight (g)				Weight loss (%)			
Temp	Day 2	Day 4	Day 8	Day 16	Day 2	Day 4	Day 8	Day 16
20	0.512	0.51	0.535	0.505				
100	0.490	0.490	0.430	0.350	4.30	3.92	19.63	30.69
200	0.285	0.366	0.282	0.302	44.34	28.24	47.29	40.30
300	0.200	0.256	0.197	0.211	61.04	49.76	63.10	58.21
400	0.057	0.061	0.071	0.050	88.87	88.04	86.82	90.05
550	0.010	0.010	0.009	0.007	98.09	98.08	98.39	98.61

PCL (Concentration Factor 2)

	Measured weight (g)				Weight loss (%)			
Temp	Day 2	Day 4	Day 8	Day 16	Day 2	Day 4	Day 8	Day 16
20	0.685	0.715	0.695	0.698				
100	0.610	0.570	0.610	0.620	10.95	20.28	12.23	11.17
200	0.230	0.248	0.184	0.118	66.50	65.34	73.57	83.15
300	0.023	0.025	0.018	0.012	96.65	96.53	97.36	98.32
400	0.010	0.011	0.008	0.005	98.49	98.44	98.81	99.24
550	0.005	0.006	0.004	0.003	99.25	99.22	99.41	99.62

PVOH (Concentration Factor 2)								
	Measured weight (g)				Weight loss (%)			
Temp	Day 2	Day 4	Day 8	Day 16	Day 2	Day 4	Day 8	Day 16
20	0.43	0.42	0.685	0.87				
100	0.364	0.342	0.320	0.270	15.35	18.57	53.28	68.97
200	0.185	0.185	0.160	0.135	56.98	55.95	76.64	84.48
300	0.074	0.074	0.064	0.054	82.79	82.38	90.66	93.79
400	0.015	0.015	0.013	0.011	96.56	96.48	98.13	98.76
550	0.007	0.007	0.006	0.005	98.28	98.24	99.07	99.38

Table S3: Degree of crystallinity (X_c) of various PLLA films obtained by PXRD, calculated by dividing area under peaks (A_c) by total area under the curve (A_t) of the PXRD spectra (Experiment II).

Sample	**Number of peaks**	**Area under peaks (A_c)**	**Total area under the curve (A_t)**	**Degree of crystallinity (X_c) $X_c = A_c / A_t \times 100\%$**
Virgin 0.05 mm	5	122209.3	274127.2	44.5
0.05 mm at 20 °C in urine (Day 2)	4	80730.6	241524.9	33.4
0.05 mm at 45 °C in urine (Day 2)	3	52872.7	155897.3	33.9
0.1 mm at 20 °C in urine (Day 2)	7	200869.4	338559.8	59.3
0.1 mm at 45 °C in urine (Day 2)	6	60047.5	154066.6	38.9
0.25 mm at 20 °C in urine (Day 2)	7	168681.7	368789.7	45.7
0.23 mm at 45 °C in urine (Day 2)	7	159667.4	368789.7	43.2
0.05 mm at 20 °C in Milli-Q water (Day 8)	6	98255.1	220931.3	44.4
0.05 mm at 45 °C in Milli-Q water (Day 8)	2	157230.2	244086.8	47.7

Table S4: *Change in pH of NaOH stabilized urine over thirty-two days due to the release of KOH pellets from the polymer pouches in Concentration Factor 1 and Concentration Factor 10 urine (Experiment III).*

DAY	pH						
	0	2	4	8	16	24	32
CF 1/PH 11/1 LAYER	11.29	11.21	12.43	12.22	12.24	12.19	12.17
CF 1/PH 14/1 LAYER	14.03	14.13	14.1	14.12	14.08	14.04	13.99
CF 10/PH 11/1 LAYER	11.22	12.55	12.42	12.33	12.18	12.16	12.17
CF 10/ PH 14/1 LAYER	14.37	14.41	14.33	14.3	14.24	14.22	14.26
CF 1/PH 11/2 LAYER	11.29	11.21	11.19	11.15	12.23	12.14	12.04
CF 1/PH 14/2 LAYER	14.03	13.84	14.14	14.04	14.02	13.96	13.88
CF 10/PH 11/2 LAYER	11.22	11.19	11.14	12.29	12.22	12.12	12.05
CF 10/ PH 14/2 LAYER	14.37	14.22	14.4	14.3	14.25	14.2	14.2
CF 1/PH 11/3 LAYER	11.29	11.19	11.16	11.11	11.07	12.09	12.03
CF 1/PH 14/3 LAYER	14.03	14.02	13.87	14.13	13.98	13.81	13.69
CF 10/PH 11/3 LAYER	11.22	11.25	11.14	11.09	12.16	12.01	11.99
CF 10/ PH 14/3 LAYER	14.37	14.21	14.11	14.28	14.21	14.13	14.02

Table S5: *Change in K conc. in NaOH stabilized urine over thirty-two days due to the release of KOH pellets from the polymer pouches in Concentration Factor 1 and Concentration Factor 10 urine. The green colour denotes the days when there was a rise in K conc. due to the breakage of the pouches (Experiment III).*

K-Test (mg/L)							
DAY	0	2	4	8	16	24	32
CF 1/PH 11/1 LAYER	1671.10	1619.57	2997.14	2878.26	2878.03	2854.39	2799.56
CF 1/PH 14/1 LAYER	1671.10	3048.01	2969.63	2885.98	2872.09	2861.86	2812.43
CF 10/PH 11/1 LAYER	3172.53	5303.60	5284.16	5296.64	5194.17	5211.39	5144.67
CF 10/ PH 14/1 LAYER	3172.53	5397.09	5266.76	5106.57	5133.18	5128.43	5120.56
CF 1/PH 11/2 LAYER	1671.10	1609.13	1662.75	1697.99	2995.55	2887.70	2867.78
CF 1/PH 14/2 LAYER	1671.10	1657.33	3027.30	2897.34	2844.97	2877.49	2872.54
CF 10/PH 11/2 LAYER	3172.53	3108.00	3158.06	5270.39	5092.35	5098.77	5056.66
CF 10/ PH 14/2 LAYER	3172.53	3123.54	5308.92	5167.14	5082.64	4997.47	5011.34
CF 1/PH 11/3 LAYER	1671.10	1659.54	1677.84	1616.45	1613.98	2902.90	2945.45
CF 1/PH 14/3 LAYER	1671.10	1691.68	1623.90	3003.04	2806.32	2818.02	2809.65
CF 10/PH 11/3 LAYER	3172.53	3107.77	3108.22	3149.99	5257.76	5153.82	5153.65
CF 10/ PH 14/3 LAYER	3172.53	3152.31	3174.20	5273.57	5065.31	4995.30	5056.89

Table S6: *Calculated Potassium concentration (K conc). Conc. of K (dosed) is the concentration of K in urine after 0.2 g of KOH is mixed in urine and conc. of K (treated) is the reduced concentration of K in urine due to the formation of KLa (Experiment III).*

K CONC (mg/L) [DOSED -TREATED]							
DAY	0	2	4	8	16	24	32
CF 1/PH 11/1 LAYER	0.00	1434.82	57.25	176.13	176.36	200.00	254.83
CF 1/PH 14/1 LAYER	0.00	6.38	84.76	168.41	182.30	192.53	241.96
CF 10/PH 11/1 LAYER	0.00	300.00	319.44	306.96	409.42	392.20	458.93
CF 10/ PH 14/1 LAYER	0.00	206.50	336.84	497.03	470.41	475.17	483.04
CF 1/PH 11/2 LAYER	0.00	1445.26	1391.64	1356.40	58.84	166.69	186.61
CF 1/PH 14/2 LAYER	0.00	1397.06	27.09	157.05	209.42	176.90	181.85
CF 10/PH 11/2 LAYER	0.00	2495.60	2445.54	333.21	511.25	504.83	546.94
CF 10/ PH 14/2 LAYER	0.00	2480.05	294.68	436.46	520.96	606.13	592.26
CF 1/PH 11/3 LAYER	0.00	1394.85	1376.55	1437.94	1440.41	151.49	224.94
CF 1/PH 14/3 LAYER	0.00	1362.71	1430.49	51.35	248.07	236.38	244.74
CF 10/PH 11/3 LAYER	0.00	2495.83	2495.38	2453.60	345.84	449.77	449.95
CF 10/ PH 14/3 LAYER	0.00	2451.28	2429.39	330.03	538.29	608.30	546.71

Table S7: *Amount of KLa formed calculated (Experiment III).*

Amount of KLA2 formed (mg/L) [(DOSED - TREATED) / 0.3]							
DAY	0	2	4	8	16	24	32
CF 1/PH 11/1 LAYER	0.00	0.00	17.75	54.60	54.67	62.00	79.00
CF 1/PH 14/1 LAYER	0.00	1.98	26.27	52.21	56.51	59.68	75.01
CF 10/PH 11/1 LAYER	0.00	93.00	99.03	95.16	126.92	121.58	142.27
CF 10/ PH 14/1 LAYER	0.00	64.02	104.42	154.08	145.83	147.30	149.74
CF 1/PH 11/2 LAYER	0.00	0.00	0.00	0.00	18.24	51.67	57.85
CF 1/PH 14/2 LAYER	0.00	0.00	8.40	48.69	64.92	54.84	56.37
CF 10/PH 11/2 LAYER	0.00	0.00	0.00	103.29	158.49	156.50	169.55
CF 10/ PH 14/2 LAYER	0.00	0.00	91.35	135.30	161.50	187.90	183.60
CF 1/PH 11/3 LAYER	0.00	0.00	0.00	0.00	0.00	46.96	69.73
CF 1/PH 14/3 LAYER	0.00	0.00	0.00	15.92	76.90	73.28	75.87
CF 10/PH 11/3 LAYER	0.00	0.00	0.00	0.00	107.21	139.43	139.48
CF 10/ PH 14/3 LAYER	0.00	0.00	0.00	102.31	166.87	188.57	169.48

Table S8: *pH of urine dehydrated in* circular *(airtight) and* linear *alkaline urine dehydration setups using Potassium Polyacrylate (KPAc) and Sodium Polyacrylate (NaPAc) Super Absorbent Polymers. 50 g alkaline urine with 11.95 pH was dehydrated to concentration factors 1.25, 2, 2.5 and 5 in a* circular *and* linear *setup and the pH was measured (Experiment IV).*

	circular			linear		
CF			**pH (KPAc)**			
1	11.95	11.95	11.95	11.95	11.95	11.95
1.25	11.92	11.93	11.91	11.52	11.61	11.55
2	11.89	11.87	11.88	11.01	10.98	11.05
2.5	11.85	11.82	11.81	10.67	10.57	10.53
5	11.62	11.67	11.65	9.67	9.72	9.81
			pH (NaPAc)			
1	11.95	11.95	11.95	11.95	11.95	11.95
1.25	11.91	11.89	11.93	11.58	11.63	11.51
2	11.85	11.85	11.86	11.12	11.02	10.93
2.5	11.88	11.79	11.77	10.56	10.64	10.45
5	11.73	11.69	11.63	9.56	9.78	9.61

Table S9: *Time taken for urine to dehydrate (min) and drying rate (kg/day/m2) of* circular *(airtight) and* linear *alkaline urine dehydration setups using Polyacrylate (KPAc) and Sodium Polyacrylate (NaPAc) Super Absorbent Polymers. 50 g alkaline urine was dehydrated to concentration factors 1.25, 2, 2.5 and 5 in a* circular *and* linear *setup and the time taken was measured (Experiment IV).*

CF	**Weight (g)**	**Time taken (min)**		**Drying rate (kg/day/m^2)**	
		KPAc			
		circular	linear	circular	linear
1	50	0	0	0	0
1.25	40	105	45	0.001117709	0.001564792
2	25	360	225	0.000814996	0.001029469
2.5	20	465	330	0.000757158	0.000938875
5	10	585	420	0.000802458	0.001043195
		NaPAc			
1	50	0	0	0	0
1.25	40	120	45	0.000977995	0.001564792
2	25	375	225	0.000782396	0.001029469
2.5	20	510	330	0.000690349	0.000938875
5	10	615	420	0.000763313	0.001043195

Table S10: *Moisture absorbed and water recycled from Potassium Polyacrylate (KPAc) and Sodium Polyacrylate (NaPAc) Super Absorbent Polymers during alkaline urine dehydration in a* circular *(airtight) setup. 50 g alkaline urine was dehydrated in 12-hour cycles eight times and the amount of moisture absorbed by the SAPs were weighed. Water was extracted from the SAPs using a rotary evaporator (Experiment IV).*

			Moisture absorbed				Water extracted		
Cycle no	**Drying time (h)**	**Total urine dehydrated (g)**	**1**	**2**	**Average**	**Absorption rate (kg/day/m2)**	**1**	**2**	**Average**
KPAc									
1	12	46	45.2	45.6	45.4	0.004486	44.8	45.1	44.95
2	12	46	44.8	44.7	44.75	0.004421	44.6	44.4	44.5
3	12	46	44.9	44.3	44.6	0.004406	44.1	43.3	43.7
4	12	46	43	44.1	43.55	0.004303	42.6	42.1	42.35
5	12	46	36	38.2	37.1	0.003665	35.6	36.9	36.25
6	12	46	33.3	36.2	34.75	0.003433	33.1	34.7	33.9
7	12	46	31.7	33.6	32.65	0.003226	31.2	31.6	31.4
8	12	46	31.9	32.5	32.2	0.003181	31.6	31.1	31.35
NaPAc									
1	12	46	44.6	44.3	44.45	0.004392	43.2	43.1	43.15
2	12	46	43.3	43.8	43.55	0.004303	42.1	42.6	42.35
3	12	46	40.9	42.4	41.65	0.004115	39.8	41.1	40.45
4	12	46	38.7	40.1	39.4	0.003893	37.6	38.2	37.9
5	12	46	38.1	37.7	37.9	0.003745	36.6	35.9	36.25
6	12	46	35.5	33.5	34.5	0.003409	32.4	30.6	31.5
7	12	46	33.8	34.1	33.95	0.003354	30.1	30.3	30.2
8	12	46	31.8	32.2	32	0.003162	27.8	29.4	28.6
1:1 (KPAc+NaPAc)									
1	12	46	44.6	43.9	44.25	0.004372	44.1	42.9	43.5
2	12	46	43.6	44.2	43.9	0.004337	42.9	42.4	42.65
3	12	46	43.4	42.9	43.15	0.004263	42.7	40.9	41.8
4	12	46	42.3	41.8	42.05	0.004155	41.1	40.8	40.95
5	12	46	40.8	41.2	41	0.004051	38.9	40.2	39.55
6	12	46	37	37.8	37.4	0.003695	35.7	36.1	35.9
7	12	46	31.8	34.3	33.05	0.003265	28.9	30.3	29.6
8	12	46	27.8	32.1	29.95	0.002959	24.7	29.1	26.9

Table S10: *Complete list of Organic Metabolites tested for in urine and water extracted (Experiment IV).*

Superclass	Class	Sub-class	Metabolites
Benzenoids	Phenols	Methoxyphenols	3-Methoxytyramine
Benzenoids	phenols	benzenediols	Dopamine
Benzenoids	phenols	benzenediols	Epinephrine
Benzenoids	Phenols	Benzenediols	Norepinephrine
Benzenoids	Benzene and substituted derivatives	Phenethylamines	Phenylethylamine
benzenoids	Benzene and substituted derivatives	Phenethylamines	Tyramine
Benzenoids	Benzene and substituted derivatives	Phenylacetic acids	2-Hydroxyphenylacetic acid
Benzenoids	Phenols	1-hydroxy-4-unsubstituted benzenoids	3-Hydroxyphenylacetic acid
Benzenoids	Benzene and substituted derivatives	Benzoic acids and derivatives	4-Hydroxybenzoic acid
Benzenoids	Phenols	1-hydroxy-2-unsubstituted benzenoids	4-Hydroxyphenylacetic acid
Benzenoids	Benzene and substituted derivatives	phenylpyruvic acid derivatives	4-Hydroxyphenylpyruvic acid
Benzenoids	Benzene and substituted derivatives	Benzoic acids and derivatives	Benzoic acid
Benzenoids	Benzene and substituted derivatives	Benzoic acids and derivatives	Hippuric acid

Benzenoids	Phenols	Methoxyphenols	Homovanillic acid
Benzenoids	Benzene and substituted derivatives	N/A	Phenylacetic acid
Benzenoids	Benzene and substituted derivatives	Benzoic acids and derivatives	p-Hydroxyhippuric acid
lipids and lipid-like molecules	Glycerophospholipids	Glycerophosphocholines	LysoPC a C14:0
lipids and lipid-like molecules	Glycerophospholipids	Glycerophosphocholines	LysoPC a C16:1
lipids and lipid-like molecules	Glycerophospholipids	Glycerophosphocholines	LysoPC a C16:0
lipids and lipid-like molecules	Glycerophospholipids	Glycerophosphocholines	LysoPC a C17:0
lipids and lipid-like molecules	Glycerophospholipids	Glycerophosphocholines	LysoPC a C18:2
lipids and lipid-like molecules	Glycerophospholipids	Glycerophosphocholines	LysoPC a C18:1
lipids and lipid-like molecules	Glycerophospholipids	Glycerophosphocholines	LysoPC a C18:0
lipids and lipid-like molecules	Glycerophospholipids	Glycerophosphocholines	LysoPC a C20:4
lipids and lipid-like molecules	Glycerophospholipids	Glycerophosphocholines	LysoPC a C20:3
lipids and lipid-like molecules	Glycerophospholipids	Glycerophosphocholines	LysoPC a C24:0
lipids and lipid-like molecules	Glycerophospholipids	Glycerophosphocholines	LysoPC a C26:1
lipids and lipid-like molecules	Glycerophospholipids	Glycerophosphocholines	LysoPC a C26:0
lipids and lipid-like molecules	Glycerophospholipids	Glycerophosphocholines	LysoPC a C28:1

lipids and lipid-like molecules	Glycerophospholipids	Glycerophosphocholines	LysoPC a C28:0
lipids and lipid-like molecules	Sphingolipids	Phosphosphingolipids	SM(OH) C14:1
lipids and lipid-like molecules	Sphingolipids	Phosphosphingolipids	SM C16:1
lipids and lipid-like molecules	Sphingolipids	Phosphosphingolipids	SM C16:0
lipids and lipid-like molecules	Sphingolipids	Phosphosphingolipids	SM(OH) C16:1
lipids and lipid-like molecules	Sphingolipids	Phosphosphingolipids	SM C18:1
lipids and lipid-like molecules	Glycerophospholipids	Glycerophosphocholines	PC aa C32:2
lipids and lipid-like molecules	Sphingolipids	Phosphosphingolipids	SM C18:0
lipids and lipid-like molecules	Sphingolipids	Phosphosphingolipids	SM C20:2
lipids and lipid-like molecules	Glycerophospholipids	Glycerophosphocholines	PC ae C36:0
lipids and lipid-like molecules	Glycerophospholipids	Glycerophosphocholines	PC aa C36:6
lipids and lipid-like molecules	Glycerophospholipids	Glycerophosphocholines	PC aa C36:0
lipids and lipid-like molecules	Sphingolipids	Phosphosphingolipids	SM(OH) C22:2
lipids and lipid-like molecules	Sphingolipids	Phosphosphingolipids	SM(OH) C22:1
lipids and lipid-like molecules	Glycerophospholipids	Glycerophosphocholines	PC aa C38:6
lipids and lipid-like molecules	Glycerophospholipids	Glycerophosphocholines	Pc aa C38:0
lipids and lipid-like molecules	Glycerophospholipids	Glycerophosphocholines	Pc ae C40:6

lipids and lipid-like molecules	Sphingolipids	Phosphosphingolipids	SM(OH) C24:1
lipids and lipid-like molecules	Glycerophospholipids	Glycerophosphocholines	PC aa C40:6
lipids and lipid-like molecules	Glycerophospholipids	Glycerophosphocholines	PC aa C40:2
lipids and lipid-like molecules	Glycerophospholipids	Glycerophosphocholines	PC aa C40:1
Lipids and lipid-like molecules	Fatty acyls	Fatty acid esters	C2 L-Acetylcarnitine
Lipids and lipid-like molecules	Fatty acyls	Fatty acid esters	C3:1 Propenoylcarnitine
Lipids and lipid-like molecules	Fatty acyls	Fatty acid esters	C3 Propionylcarnitine
Lipids and lipid-like molecules	Fatty acyls	Fatty acid esters	C4:1 Butenylcarnitine
Lipids and lipid-like molecules	Fatty acyls	Fatty acid esters	C4 Butyrylcarnitine
Lipids and lipid-like molecules	Fatty acyls	Fatty acid esters	C3OH Hydroxypropionylcarnitine
Lipids and lipid-like molecules	Fatty acyls	Fatty acid esters	C5:1 Tiglylcarnitine
Lipids and lipid-like molecules	Fatty acyls	Fatty acid esters	C5 Valerylcarnitine
Lipids and lipid-like molecules	Fatty acyls	Fatty acid esters	C4OH 3-Hydroxybutyrylcarnitine
Lipids and lipid-like molecules	Fatty acyls	Fatty acid esters	C6:1 2-Hexenoylcarnitine
Lipids and lipid-like molecules	Fatty acyls	Fatty acid esters	C6 Hexanoylcarnitine
Lipids and lipid-like molecules	Fatty acyls	Fatty acid esters	C5:1DC Glutaconylcarnitine

Lipids and lipid-like molecules	Fatty acyls	Fatty acid esters	C5DC Glutarylcarnitine
Lipids and lipid-like molecules	Fatty acyls	Fatty acid esters	C8 Octanoylcarnitine
Lipids and lipid-like molecules	Fatty acyls	Fatty acid esters	C5MDC 3-Methylglutarylcarnitine
Lipids and lipid-like molecules	Fatty acyls	Fatty acid esters	C9 2,6 Dimethylheptanoyl carnitine
Lipids and lipid-like molecules	Fatty acyls	Fatty acid esters	C7DC Pimelylcarnitine
Lipids and lipid-like molecules	Fatty acyls	Fatty acid esters	C10:2 (3,8)-Decadienoylcarnitine & (2,7)-Decadienoylcarnitine
Lipids and lipid-like molecules	Fatty acyls	Fatty acid esters	C10:1 9-Decenoylcarnitine
Lipids and lipid-like molecules	Fatty acyls	Fatty acid esters	C10 Decanoylcarnitine
Lipids and lipid-like molecules	Fatty acyls	Fatty acid esters	C12:1 trans-2-Dodecenoylcarnitine
Lipids and lipid-like molecules	Fatty acyls	Fatty acid esters	C12 Dodecanoylcarnitine
Lipids and lipid-like molecules	Fatty acyls	Fatty acid esters	C14:2 3, 5-Tetradecadiencarnitine
Lipids and lipid-like molecules	Fatty acyls	Fatty acid esters	C14:1 cis-5-Tetradecenoylcarnitine
Lipids and lipid-like molecules	Fatty acyls	Fatty acid esters	C14 Tetradecanoylcarnitine
Lipids and lipid-like molecules	Fatty acyls	Fatty acid esters	C14:2OH 3-Hydroxy-5,8-tetradecadienoylcarnitine

Lipids and lipid-like molecules	Fatty acyls	Fatty acid esters	C14:1OH 3-Hydroxy-cis-5-tetradecenoylcarnitine
Lipids and lipid-like molecules	Fatty acyls	Fatty acid esters	C16:2 9,12-Hexadecadienoylcarnitine
Lipids and lipid-like molecules	Fatty acyls	Fatty acid esters	C16:1 9-Hexadecenoylcarnitine
Lipids and lipid-like molecules	Fatty acyls	Fatty acid esters	C16 Palmitoylcarnitine
Lipids and lipid-like molecules	Fatty acyls	Fatty acid esters	C16:2OH 3-Hydroxyhexadecadienoylcarnitine
Lipids and lipid-like molecules	Fatty acyls	Fatty acid esters	C16:1OH 3-Hydroxy-9-hexadecenoylcarnitine
Lipids and lipid-like molecules	Fatty acyls	Fatty acid esters	C16OH 3-Hydroxyhexadecanoyl carnitine
Lipids and lipid-like molecules	Fatty acyls	Fatty acid esters	C18:2 Linoleyl carnitine
Lipids and lipid-like molecules	Fatty acyls	Fatty acid esters	C18:1 Elaidic carnitine
Lipids and lipid-like molecules	Fatty acyls	Fatty acid esters	C18 Stearoylcarnitine
Lipids and lipid-like molecules	Fatty acyls	Fatty acid esters	C18:1OH 3-Hydroxy-9Z-octadecenoylcarnitine
Lipids and lipid-like molecules	Fatty acyls	Fatty acid esters	2-Hydroxy-2-methylbutyric acid
Lipids and lipid-like molecules	Fatty acyls	Fatty acid esters	2-Hydroxy-3-methylvaleric acid
Lipids and lipid-like molecules	Fatty acyls	Fatty acid esters	2-Hydroxyisovaleric acid

Lipids and lipid-like molecules	Fatty acyls	Fatty alcohols	3-Deoxyglucosone
Lipids and lipid-like molecules	Fatty acyls	Fatty acids and conjugates	3-Hydroxyisovaleric acid
Lipids and lipid-like molecules	Fatty acyls	Fatty acids and conjugates	3-Methyladipic acid
Lipids and lipid-like molecules	Fatty Acyls	Fatty acids and conjugates	Caproic acid
Lipids and lipid-like molecules	Fatty Acyls	Fatty acids and conjugates	Caprylic acid
Lipids and lipid-like molecules	Fatty Acyls	Fatty acids and conjugates	CMPF
Lipids and lipid-like molecules	Fatty Acyls	Fatty acids and conjugates	Ethylmalonic acid
Lipids and lipid-like molecules	Fatty Acyls	Fatty acids and conjugates	Isovaleric acid
Lipids and lipid-like molecules + organic acids and derivatives	Fatty Acyls + Carboxylic acids and derivatives	Fatty acids and conjugates + Carboxylic Acids	Butyric acid + Isobutyric acid
N/A	N/A	N/A	C5OH Hydroxyvalerylcarnitine
Nucleosides, nucleotides, and analogues	pyrimidine nucleosides	N/A	5-Methyluridine
nucleosides, nucleotides, and analogues	purine nucleosides	N/A	Adenosine
Nucleosides, nucleotides, and analogues	Purine nucleosides	Purine 2′-deoxyribonucleosides	Cytosine
Nucleosides, nucleotides, and analogues	Pyrimidine nucleosides	pyrimidine 2′-deoxyribonucleosides	Deoxyadenosine

Nucleosides, nucleotides, and analogues	Purine nucleosides	Purine 2′-deoxyribonucleosides	Deoxyguanosine
Nucleosides, nucleotides, and analogues	Purine nucleosides	Purine 2′-deoxyribonucleosides	Deoxyinosine
Nucleosides, nucleotides, and analogues	Pyrimidine nucleosides	pyrimidine 2′-deoxyribonucleosides	Deoxyuridine
Nucleosides, nucleotides, and analogues	Purine nucleosides	N/A	Guanosine
Nucleosides, nucleotides, and analogues	Purine nucleosides	N/A	Inosine
nucleosides, nucleotides, and analogues	Pyridine nucleotides	Nicotinamide nucleotides	Nicotinamide ribotide
Nucleosides, nucleotides, and analogues	Pyrimidine nucleosides	pyrimidine 2′-deoxyribonucleosides	Thymidine
Nucleosides, nucleotides, and analogues	Pyrimidine nucleosides	N/A	Uridine
Nucleosides, nucleotides, and analogues	Purine nucleotides	Cyclic purine nucleotides	cAMP
Organic Acids and derivatives	Carboxylic acids and derivatives	Amino acids, peptides, and analogues	5-Hydroxylysine
Organic acids and derivatives	carboxylic acids and derivatives	Amino acids, peptides, and analogues	α-Aminobutyric acid
organic acids and derivatives	carboxylic acids and derivatives	amino acids, peptides, and analogues	Asymmetric dimethylarginine

organic acids and derivatives	carboxylic acids and derivatives	Amino acids, peptides, and analogues	Alanine
organic acids and derivatives	carboxylic acids and derivatives	Amino acids, peptides, and analogues	alpha-Aminoadipic acid
organic acids and derivatives	carboxylic acids and derivatives	Amino acids, peptides, and analogues	Arginine
organic acids and derivatives	carboxylic acids and derivatives	Amino acids, peptides, and analogues	Asparagine
organic acids and derivatives	carboxylic acids and derivatives	Amino acids, peptides, and analogues	Aspartic acid
organic acids and derivatives	carboxylic acids and derivatives	Amino acids, peptides, and analogues	β-Alanine
organic acids and derivatives	carboxylic acids and derivatives	Amino acids, peptides, and analogues	Betaine
organic acids and derivatives	peptidomimetics	hybrid peptides	Carnosine
organic acids and derivatives	carboxylic acids and derivatives	Amino acids, peptides, and analogues	cis-4-Hydroxyproline
organic acids and derivatives	carboxylic acids and derivatives	Amino acids, peptides, and analogues	Citrulline
organic acids and derivatives	carboxylic acids and derivatives	Amino acids, peptides, and analogues	Creatine
organic acids and derivatives	carboxylic acids and derivatives	Amino acids, peptides, and analogues	Creatinine

organic acids and derivatives	carboxylic acids and derivatives	Amino acids, peptides, and analogues	Cystathionine
organic acids and derivatives	carboximidic acids and derivatives	carboximidic acids	Diacetylspermine
organic acids and derivatives	carboxylic acids and derivatives	Amino acids, peptides, and analogues	DOPA
organic acids and derivatives	carboxylic acids and derivatives	Amino acids, peptides, and analogues	γ-Aminobutyric acid
organic acids and derivatives	carboxylic acids and derivatives	Amino acids, peptides, and analogues	Glutamine
organic acids and derivatives	carboxylic acids and derivatives	Amino acids, peptides, and analogues	Glutamic acid
organic acids and derivatives	carboxylic acids and derivatives	Amino acids, peptides, and analogues	Glycine
organic acids and derivatives	carboxylic acids and derivatives	Amino acids, peptides, and analogues	Histidine
organic acids and derivatives	carboxylic acids and derivatives	Amino acids, peptides, and analogues	Homocitrulline
organic acids and derivatives	carboxylic acids and derivatives	Amino acids, peptides, and analogues	Isoleucine
organic acids and derivatives	carboxylic acids and derivatives	Amino acids, peptides, and analogues	Leucine
organic acids and derivatives	carboxylic acids and derivatives	Amino acids, peptides, and analogues	Lysine

organic acids and derivatives	carboxylic acids and derivatives	Amino acids, peptides, and analogues	Methionine
organic acids and derivatives	carboxylic acids and derivatives	Amino acids, peptides, and analogues	Methionine Sulfoxide
organic acids and derivatives	carboxylic acids and derivatives	Amino acids, peptides, and analogues	Methylhistidine
organic acids and derivatives	Carboximidic acids and derivatives	Carboximidic acids	N1-Acetylspermidine
organic acids and derivatives	carboxylic acids and derivatives	Amino acids, peptides, and analogues	N2-Acetyl-Ornithine
organic acids and derivatives	Carboximidic acids and derivatives	Carboximidic acids	N-Acetylputrescine
organic acids and derivatives	carboxylic acids and derivatives	Amino acids, peptides, and analogues	Nitro-Tyrosine
organic acids and derivatives	carboxylic acids and derivatives	Amino acids, peptides, and analogues	Ornithine
organic acids and derivatives	carboxylic acids and derivatives	Amino acids, peptides, and analogues	Phenylalanine
organic acids and derivatives	carboxylic acids and derivatives	Amino acids, peptides, and analogues	Proline
organic acids and derivatives	carboxylic acids and derivatives	Amino acids, peptides, and analogues	Sarcosine
organic acids and derivatives	carboxylic acids and derivatives	Amino acids, peptides, and analogues	Serine

Organic Acids and derivatives	Organic sulfonic acids and derivatives	Organosulfonic acids and derivatives	Taurine
organic acids and derivatives	carboxylic acids and derivatives	Amino acids, peptides, and analogues	Threonine
organic acids and derivatives	carboxylic acids and derivatives	Amino acids, peptides, and analogues	Total Dimethylarginine
organic acids and derivatives	carboxylic acids and derivatives	Amino acids, peptides, and analogues	trans-4-Hydroxyproline
organic acids and derivatives	carboxylic acids and derivatives	Amino acids, peptides, and analogues	Tyrosine
organic acids and derivatives	carboxylic acids and derivatives	Amino acids, peptides, and analogues	Valine
Organic acids and derivatives	Carboxylic acids and derivatives	Tricarboxylic acids and derivatives	C12DC Dodecanedioylcarnitine
Organic acids and derivatives	Hydroxy acids and derivatives	Alpha hydroxy acids and derivatives	2-Hydroxybutyric acid
Organic acids and derivatives	Hydroxy acids and derivatives	short-chain hydroxy acids and derivatives	2-hydroxyglutaric acid
Organic acids and derivatives	Hydroxy acids and derivatives	Alpha hydroxy acids and derivatives	2-Hydroxyisobutyric acid
Organic acids and derivatives	Keto acids and derivatives	Medium-chain keto acids and derivatives	2-oxoadipic acid
Organic acids and derivatives	Keto acids and derivatives	short-chain keto acids and derivatives	2-oxoisocaproic acid

Organic acids and derivatives	Hydroxy acids and derivatives	Beta hydroxy acids and derivatives	3,4-Dihydroxybutyric acid
organic acids and derivatives	carboxylic acids and derivatives	Amino acids, peptides, and analogues	3-Aminoisobutyric acid
Organic acids and derivatives	Hydroxy acids and derivatives	Beta hydroxy acids and derivatives	3-Hydroxybutyric acid
Organic acids and derivatives	Hydroxy acids and derivatives	Beta hydroxy acids and derivatives	3-Hydroxyisobutyric acid
organic acids and derivatives	organic sulfuric acids and derivatives	Arylsulfates	4-Ethylphenyl sulfate
organic acids and derivatives	carboxylic acids and derivatives	Amino acids, peptides, and analogues	5-Oxoproline
organic acids and derivatives	Keto acids and derivatives	Short-chain keto acids and derivatives	Acetoacetic acid
organic acids and derivatives	Keto acids and derivatives	Gamma-keto acids and derivatives	alpha-Ketoglutaric acid
organic acids and derivatives	Keto acids and derivatives	Short-chain keto acids and derivatives	alpha-Ketoisovaleric acid
organic acids and derivatives	carboxylic acids and derivatives	Amino acids, peptides, and analogues	Argininic acid
Organic acids and derivatives	Carboxylic acids and derivatives	Tricarboxylic acids and derivatives	cis-Aconitic acid
Organic acids and derivatives	Carboxylic acids and derivatives	Tricarboxylic acids and derivatives	Citric acid

Organic acids and derivatives	Carboxylic acids and derivatives	Amino acids, peptides, and analogues	Dimethylglycine
Organic acids and derivatives	Carboxylic acids and derivatives	Dicarboxylic acids and derivatives	Fumaric acid
Organic acids and derivatives	Carboxylic acids and derivatives	Dicarboxylic acids and derivatives	Glutaric acid
Organic acids and derivatives	Carboxylic acids and derivatives	Amino acids, peptides, and analogues	Guanidoacetic acid
organic acids and derivatives	Organic sulfuric acids and derivatives	Arylsulfates	Indoxyl sulfate
Organic acids and derivatives	Carboxylic acids and derivatives	Tricarboxylic acids and derivatives	Isocitric acid
Organic acids and derivatives	Hydroxy acids and derivatives	Alpha hydroxy acids and derivatives	Lactic acid
Organic acids and derivatives	Carboxylic acids and derivatives	Dicarboxylic acids and derivatives	Maleic acid
Organic acids and derivatives	Hydroxy acids and derivatives	Beta hydroxy acids and derivatives	Malic acid
Organic acids and derivatives	Carboxylic acids and derivatives	Dicarboxylic acids and derivatives	Malonic acid
Organic acids and derivatives	Carboxylic acids and derivatives	Dicarboxylic acids and derivatives	Methylmalonic acid
Organic Acids and derivatives	Carboxylic acids and derivatives	Amino acids, peptides, and analogues	N1-Acetyl-Lysine

Organic Acids and derivatives	Carboxylic acids and derivatives	Amino acids, peptides, and analogues	N6-Acetyl-Lysine
Organic Acids and derivatives	Carboxylic acids and derivatives	Amino acids, peptides, and analogues	N-Acetyl-Alanine
Organic Acids and derivatives	Carboxylic acids and derivatives	Amino acids, peptides, and analogues	N-Acetyl-Arginine
Organic Acids and derivatives	Carboxylic acids and derivatives	Amino acids, peptides, and analogues	N-Acetyl-Asparagine
Organic Acids and derivatives	Carboxylic acids and derivatives	Amino acids, peptides, and analogues	N-Acetyl-Aspartic acid
Organic Acids and derivatives	Carboxylic acids and derivatives	Amino acids, peptides, and analogues	N-Acetyl-Glutamine
Organic Acids and derivatives	Carboxylic acids and derivatives	Amino acids, peptides, and analogues	N-Acetyl-Glutamic acid
Organic Acids and derivatives	Carboxylic acids and derivatives	Amino acids, peptides, and analogues	N-Acetyl-Glycine
Organic Acids and derivatives	Carboxylic acids and derivatives	Amino acids, peptides, and analogues	N-Acetyl-Histidine
Organic Acids and derivatives	Carboxylic acids and derivatives	Amino acids, peptides, and analogues	N-Acetyl-Isoleucine
Organic Acids and derivatives	Carboxylic acids and derivatives	Amino acids, peptides, and analogues	N-Acetyl-Leucine
Organic Acids and derivatives	Carboxylic acids and derivatives	Amino acids, peptides, and analogues	N-Acetyl-Methionine

Organic Acids and derivatives	Carboxylic acids and derivatives	Amino acids, peptides, and analogues	N-Acetyl-Proline
Organic Acids and derivatives	Carboxylic acids and derivatives	Amino acids, peptides, and analogues	N-Acetyl-Serine
Organic Acids and derivatives	Carboxylic acids and derivatives	Amino acids, peptides, and analogues	N-Acetyl-Tryptophan
Organic Acids and derivatives	Carboxylic acids and derivatives	Amino acids, peptides, and analogues	N-Acetyl-Tyrosine
Organic Acids and derivatives	Carboxylic acids and derivatives	Amino acids, peptides, and analogues	N-Acetyl-Valine
organic acids and derivatives	organic sulfuric acids and derivatives	Arylsulfates	p-Cresol sulfate
Organic Acids and derivatives	Carboxylic acids and derivatives	Amino acids, peptides, and analogues	Phenylacetylglutamine
Organic Acids and derivatives	Carboxylic acids and derivatives	Amino acids, peptides, and analogues	Pipecolic acid
Organic Acids and derivatives	Carboxylic acids and derivatives	Carboxylic Acids	Propionic acid
Organic acids and derivatives	Keto acids and derivatives	Alpha-keto acids and derivatives	Pyruvic acid
organic nitrogen compounds	Organonitrogen compounds	Amines	1,3-Diaminopropane
organic nitrogen compounds	organonitrogen compounds	guanidines	Agmatine
organic nitrogen compounds	organonitrogen compounds	quaternary ammonium salts	Choline

organic nitrogen compounds	organonitrogen compounds	Amines	Dimethylamine
organic nitrogen compounds	organonitrogen compounds	Amines	Ethanolamine
Organic nitrogen compounds	Organonitrogen compounds	Amines	Histamine
Organic nitrogen compounds	Organonitrogen compounds	Amines	Methylamine
organic nitrogen compounds	organonitrogen compounds	Amines	Putrescine
organic nitrogen compounds	organonitrogen compounds	Amines	Spermidine
organic nitrogen compounds	organonitrogen compounds	Amines	Spermine
organic nitrogen compounds	Organonitrogen compounds	Aminoxides	Trimethylamine N-oxide
organic nitrogen compounds	organonitrogen compounds	Amines	Trimethylamine
organic nitrogen compounds	organonitrogen compounds	quaternary ammonium salts	C0 L-Carnitine
Organic nitrogen compounds	Organonitrogen compounds	Guanidines	Guanidinopropionic acid
organic oxygen compounds	Organooxygen compounds	Carbonyl compounds	Kynurenine
Organic oxygen compounds	organooxygen compounds	Carbohydrates and carbohydrate conjugates	Glucose
organic oxygen compounds	Organooxygen compounds	Carbohydrates and carbohydrate conjugates	Glyceric acid
organic oxygen compounds	Organooxygen compounds	Carbohydrates and	Indoxyl glucuronide

		carbohydrate conjugates	
organic oxygen compounds	Organooxygen compounds	Carbohydrates and carbohydrate conjugates	Indoxyl glucoside
Organoheterocyclic compounds	Pyridines and derivatives	Pyridinecarboxylix Acids and derivatives	1-Methylnicotinamide
organoheterocyclic compounds	Indoles and derivatives	tryptamines and derivatives	5-Methoxytryptamine
organoheterocyclic compounds	imidazopyrimidines	Purines and purine derivatives	7-Methylguanine
organoheterocyclic compounds	imidazopyrimidines	Purines and purine derivatives	Adenine
organoheterocyclic compounds	Azoles	imidazoles	Allantoin
organoheterocyclic compounds	Diazines	pyrimidines and pyrimidine derivatives	Cytidine
organoheterocyclic compounds	Imidazopyrimidines	Purines and purine derivatives	Guanine
organoheterocyclic compounds	imidazopyrimidines	Purines and purine derivatives	Hypoxanthine
organoheterocyclic compounds	Indoles and derivatives	Indoles	Indole
organoheterocyclic compounds	Indoles and derivatives	Indoles	Indole-3-acetamide
organoheterocyclic compounds	Pyridines and derivatives	Pyridinecarboxylic acids and derivatives	Nudifloramide

organoheterocyclic compounds	Indoles and derivatives	Tryptamines and derivatives	Serotonin
Organoheterocyclic compounds	Diazines	Pyrimidines and pyrimidine derivatives	Thymine
Organoheterocyclic compounds	Indoles and derivatives	Indolyl carboxylic acids and derivatives	Tryptophan
organoheterocyclic compounds	indoles and derivatives	Tryptamines and derivatives	Tryptamine
Organoheterocyclic compounds	Diazines	Pyrimidines and pyrimidine derivatives	Uracil
Organoheterocyclic compounds	Indoles and derivatives	Indolyl carboxylic acids and derivatives	3-Indoleacetic acid
Organoheterocyclic compounds	Indoles and derivatives	Indolyl carboxylic acids and derivatives	5-Hydroxyindoleacetic acid
Organoheterocyclic compounds	Furans	Furoic acid and derivatives	2,5-Furandicarboxylic acid
Organoheterocyclic compounds	Indoles and derivatives	Indolecarboxylic acids and derivatives	Indole-3-carboxylic acid
Organoheterocyclic compounds	Indoles and derivatives	Indolyl carboxylic acids and derivatives	Indole-3-propionic acid
Organoheterocyclic compounds	Indoles and derivatives	Indolyl carboxylic acids and derivatives	Indolelactic acid
Organoheterocyclic compounds	quinolines and derivatives	Quinoline carboxylic acids	Kynurenic acid
organoheterocyclic compounds	Diazines	pyrimidines and pyrimidine derivatives	Orotic acid

Phenylpropanoids and polyketides	Cinnamic acids and derivatives	Hydroxycinnamic acids and derivatives	Caffeic acid
Phenylpropanoids and polyketides	Phenylpropanoic acids	N/A	HPHPA

Figure S1: *(a) Dry potassium polyacrylate (top) and potassium polyacrylate after moisture absorption (bottom), (b) dry sodium polyacrylate (top) and sodium polyacrylate after moisture absorption (bottom) (Experiment IV).*

S1. Energy demand calculation of the circular urine dehydrating setup

The primary objective of the setup was to evaporate 45 g of urine in a 12-hour drying cycle. The heat of vaporization of urine (ΔHv) is approximately 2360 kJ kg^{-1}. The energy required to evaporate 45 g (0.045 kg) of urine is = Heat of vaporization × mass of urine

$$=2360 \text{ kJ kg-1} \times 0.0045 \text{ kg} = 106.2 \text{ kJ}$$

The pump, operating at 200 W over 12 hours, consumes = 200 W × (12 × 3600)s

$$= 200 \text{ W} \times 43{,}200 \text{ s} = 8640 \text{ kJ}$$

The energy efficiency of the system is then calculated as the ratio of the useful energy (used for evaporation) to the total energy input, ɳ = used energy/ input energy

$$= 106.2 \text{ kJ}/ 8640 = 0.012$$

This low efficiency indicates significant energy losses within the system.

S1.1. Energy loss analysis of lab scale circular urine dehydrating setup

Energy loss in the system occurs primarily through heat transfer via conduction and convection. The temperatures inside and outside the drying chamber, as well as the temperature of the pump, contribute to these losses. The following formulas are used to calculate the heat loss:

$Q = Q_{conduction} + Q_{convection}$

$Q_{conduction} = \frac{k \times A \times (Tin - Tout) \times t}{d}$

$Q_{convection} = h \times A \times (Tpump - Tout) \times t$

Where:

Q is the rate of heat transfer.

k is the thermal conductivity of the glass = 0.8 W/(m.K) (approx.)

h is the specific convection coefficient of urine = 15 W/(m^2·K) (approx.)

From the data collected from the experiment, we know that

Temperature inside the drying chamber (T_{in}) = 27°C = 300 K

Temperature outside the drying chamber (T_{out}) = 20°C = 293 K

Temperature of the pump (T_{pump})= 46°C = 319K

Diameter of the drying chamber = 12.5 cm, radius (r) = 6.25 cm

Height of the drying chamber = 16 cm

Curved surface area of the drying chamber (A) = $2\pi rh = 1408cm^2 = 0.14m^2$

Wall thickness of the glass chamber (d) = 0.5 cm =0.005 m

Power of the pump (P) = 200 W

Amount of urine to be dried = 0.0045 kg

Time taken to dry, t = 12 hours = 43200 seconds

Latent heat of vaporization of urine $\Delta Hv \sim 2360\ kJ\ kg^{-1}$

$$Q_{conduction} = \frac{[0.8 \times 0.14 \times (300-293) \times 43200]}{0.005}$$

$$= 6.78 \times 10^6\ J$$

$$Q_{convection} = 15 \times 0.14 \times (319-293) \times 43200$$

$$= 2.5 \times 10^6\ J$$

Thus, total heat loss, Q = $(6.78 + 2.5) \times 10^6$ J = 9280 kJ.

Heat loss factor = $\frac{Q}{A \times \Delta T}$,

where Q is heat loss, A is the surface area of the drying chamber and ΔT is the temperature difference

Heat loss factor = $\frac{9280\ kJ}{0.14\ m2 \times 7K}$

= 9359.2 kJ m^{-2} K

This is significant heat loss and indicates potential areas for improvement to enhance system efficiency.

S1.2. Scaling up the circular urine dehydrating setup

Urine dehydrating chamber to dehydrate 6 L of urine in 12 hours.

Volume of urine: 6 liters,

Assuming the chamber to be a cylindrical drying reactor. The volume V of a cylinder is given by: V = πr2h

where r is the radius and h is the height.

If we set a practical height for easy handling, for example, 50 cm (0.5 m):

V = 6 liters = 0.006 m^3

$\pi r^2 \times 0.5 = 0.006$

$r^2 = 0.006 / 0.5\pi$

r ≈ 6.2 cm

So, the drying reactor could have:

Height, h = 50 cm

Radius, r = 6.2 cm

Absorbent chambers with SAPs to absorb 90% of the moisture generated.

90% of the evaporated urine = 5.4 kg

We will assume each absorption chamber to be also cylindrical for consistency and ease of design.

To maximize the area of interaction, let's assume a height of 50 cm (similar to the drying reactor).

Using a similar volume calculation, let's determine a suitable radius for each SAP reactor.

For practical design, assume we use 2 SAP reactors, each handling half of the moisture:

Moisture per SAP reactor = 5.4 kg/ 2 = 2.7 kg

Given that SAPs can absorb many times their weight in water, we need to account for the total volume they will occupy when absorbing moisture.

Assuming SAPs absorb 30 times their weight in water: Volume occupied by absorbed moisture in each SAP reactor = 2.7 kg × 30 = 81 kg or 81L.

$\pi r^2 \times 0.5 = 0.081$

$r^2 = 0.081/ 0.5\pi$

$r \approx 22.7$ cm

So, each SAP reactor could have:

Height, h = 50 cm

Radius, r = 22.7 cm

Connecting Pipes

For efficient airflow, the diameter of the connecting pipes should allow for smooth flow without significant pressure drop.

We will assume a pipe diameter of 5 cm to balance flow rate and system size.

To evaporate 6 kg of urine and ensure 90% moisture absorption by SAPs.

Using psychrometric principles (detailed usage and calculation in the next section) and ensuring sufficient air exchange, we estimate:

Airflow rate =Volume of air required to remove moisture

Assuming an air exchange rate that effectively removes 5.4 kg of water vapour, estimated air flow rate per reactor = 500 m^3/h

Total system air flow rate = 3 reactors × 500 m^3/h = 1500 m^3/h.

Typical power ratings for such pumps range from 500 W to 1 kW depending on the efficiency and design of the system.

S1.3. Calculation of The Optimum Airflow using Psychrometric Principles

Psychrometric principles involve the study of the thermodynamic properties of moist air and the use of these properties to analyze conditions and processes involving moist air. To evaluate the airflow rate required for a urine-dehydrating system, we need to understand the relationship between air temperature, humidity, and the evaporation process.

1. **Dry Bulb Temperature (DBT):** The temperature of air measured by a regular thermometer.
2. **Wet Bulb Temperature (WBT):** The temperature of air measured by a thermometer covered with a water-soaked cloth over its bulb.
3. **Relative Humidity (RH):** The ratio of the current amount of water vapour in the air to the maximum amount of water vapour the air can hold at the same temperature.
4. **Dew Point Temperature:** The temperature at which air becomes saturated with moisture and water vapour starts to condense.
5. **Specific Humidity (or Humidity Ratio):** The mass of water vapour per unit mass of dry air.
6. **Enthalpy:** The total heat content of the air, including both sensible and latent heat.

Steps to Evaluate Airflow Rate Using Psychrometric Principles

1. **Determination of the amount of moisture to be evaporated:**
    - Total urine to evaporate: 6 kg in 12 hours.
    - Moisture to be absorbed by SAPs: 90% of 6 kg = 5.4 kg.
    - Moisture to be handled by the air: 6 kg (since we are interested in the total evaporation).
2. **Calculation of the evaporation rate:**
    - Evaporation rate = Total urine / Time = 6 kg/ 12 hours = 0.5 kg/ hour
3. **Determination of the initial and final conditions of air:**
    - Initial conditions (e.g., inside the drying chamber): Dry Bulb Temperature (DBT) = 27°C, Relative Humidity (RH) = 50%.
    - Final conditions (e.g., outside the drying chamber): Dry Bulb Temperature (DBT) = 20°C, Relative Humidity (RH) = varies based on the design.
4. **Using the psychrometric chart:**

- Plot the initial conditions on the psychrometric chart (DBT and RH).
- Determine the specific humidity (or humidity ratio) and enthalpy at the initial conditions.
- Plot the final conditions on the psychrometric chart. This will help to find the final specific humidity and enthalpy.

5. **Calculation of the change in humidity ratio:**
   - $\Delta W = W_{final} - W_{initial}$

     Where W is the specific humidity.

6. **Calculation of the required airflow rate:**
   - Use the mass balance equation for the water vapour:
   - Evaporation rate = Airflow rate × ΔW
   - Airflow rate = Evaporation rate/ ΔW

S1.4. Calculation for the Scaled Up Circular Urine Dehydrating Setup

- Initial conditions: DBT = 27°C, RH = 50%.
- Final conditions: DBT = 20°C, RH = 90%.

From the psychrometric chart:

- Initial specific humidity ($W_{initial}$) at 27°C and 50% RH ≈ 0.010 kg/ kg dry air.
- Final specific humidity (W_{final}) at 20°C and 90% RH ≈ 0.013 kg/ kg dry air.

Change in humidity ratio (ΔW):

- $\Delta W = 0.013 - 0.010 = 0.003$ kg /kg dry air

Using the evaporation rate:

- Airflow rate = (0.5 kg/ hour)/ (0.003 kg/kg dry air) = 166.67 kg dry air/hour

Converting this to volumetric flow rate (using the density of air, 1.2 kg/m³ at standard conditions):

- Airflow rate (m³/hour) = (166.67 kg dry air/hour)/ (1.2 kg/m³)

  ≈138.89 m³/hour

To handle the moisture effectively, total system air flow rate = 138.89 m³/ hour × 3

≈ 416.67 m³/hour.

However, considering real conditions and ensuring effective evaporation and absorption, we typically oversize the airflow rate. So, a pump capacity of at least 500 m³/hour per reactor would be recommended.

LIST OF PUBLICATIONS AND CONFERENCE PRESENTATIONS

Research Papers

Deka, A., Simha, P., Nazarova, L., Kataki, R., & Vinnerås, B. (2023). Degradation of poly-L-lactic acid biopolymer films in Ca(OH)2-dosed fresh human urine collected in source-separating sanitation systems. Resources, Conservation and Recycling, 198, 107202. https://doi.org/10.1016/j.resconrec.2023.107202

Deka, A., Simha, P., Kataki, R., & Vinnerås, B. (2024). Degradation of polymers in unconcentrated and concentrated alkaline urine. Environmental Technology & Innovation, 36, 103880. https://doi.org/10.1016/j.eti.2024.103880

Book Chapter

Deka, A., Kataki, R., & Simha, P. (2021). Recycling source-separated human faeces. Novel Approaches Towards Wastewater Treatment and Resource Recovery Technologies, 341-352. https://doi.org/10.1016/B978-0-323-90627-2.00023-X

Conference Presentations

Presented a poster entitled *"Degradation and erosion of polymers in alkalised fresh human urine collected in source-separating sanitation systems"* at the *"6th IWA International Conference on eco-Technologies for Wastewater Treatment"* held in Girona, Catalonia, Spain on June 26-29, 2023.

Authors: Anuron Deka , Prithvi Simha , Rupam Kataki , Björn Vinnerås

Presented a presentation entitled *"Biopolymer-based passive chemical dosing system for buffering urine PH during Alkaline Urine Dehydration"* at the *"National Conference on Polymers and Advanced Functional Materials"* held in Institute of Advanced Study in Science and Technology, Guwahati, India on December 13-14, 2024.

Authors: Anuron Deka , Prithvi Simha , Rupam Kataki , Björn Vinnerås