

ESI

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Table S1. Calculated or known pK_a values for tetrazole and carboxylic acid species

Organic additive	pK _a 's
TzmebH (methyl 4-(1H-tetrazol-5-yl) benzoate)	3.76 [#]
TzacbH (4-(1H-tetrazol-5-yl) acetylbenzene)	3.70 [#]
TzPhH (Phenyl-1H-tetrazole)	4.30 ⁴
TzPhaH (4-(1H-tetrazol-5-yl) benzaldehyde)	3.78 [#]
TzPhCNH (4-(1H-tetrazol-5-yl) benzonitrile)	3.52 [#]
TzTzH₂ (1,4 bis(1H-tetrazol-5-yl) benzene)	1. 3.63 [#] 2. -
BaPhH (Benzoic acid)	4.20 ⁵
BaPhaH (4-formylbenzoic acid)	3.77 ⁶
BaPhCNH (4-cyanobenzoic acid)	3.55 ⁶
BaTzH₂ (4-(1H-tetrazol-5-yl) benzoic acid)	1. 3.64 [#] 2. -
BaBaH₂ (Terephthalic acid)	1. 3.54 ⁶ 2. 4.34 ⁶

References for Table S1

calculated using Advanced Chemistry Development (ACD/Labs) Software V11.02. SciFinder.

4. S. Govindaswamy, A. Tripathi, I. I. Suni, and Y. Li, *J. Electrochem. Soc.*, 2008, **155**, H459.
5. G. Aylward and T. Findlay, *SI Chemical Data 6th Edition*, John Wiley & Sons Australia, Ltd, 6th edn., 2008.
6. W. . Haynes, Ed., in *CRC Handbook of Chemistry and Physics 95th Edition*, CRC Press, 95th edn., 2014, pp. 94–103.

Table S2. Number of experiments performed for each additive and control.

Where,

Tet C = **TzPhH** (Phenyl-1H-tetrazole)

Tet D = **TzPhaH** (4-(1H-tetrazol-5-yl) benzaldehyde)

Tet E = **TzPhCNH** (4-(1H-tetrazol-5-yl) benzonitrile)

Tet F = **TzTzH₂** (1,4 bis(1H-tetrazol-5-yl) benzene)

Cc = **BaPhH** (Benzoic acid)

Dc = **BaPhaH** (4-formylbenzoic acid)

Ec = **BaPhCNH** (4-cyanobenzoic acid)

Fc = **BaTzH₂** (4-(1H-tetrazol-5-yl) benzoic acid)

Gc = **BaBaH₂** (Terephthalic acid)

Control	Tet C	Tet D	Tet E	Tet F	Cc	Dc	Ec	Fc	Gc	Supersaturation
3	3	3	3	3	0	0	0	0	0	~11 SS
37	37	6	8	9	31	3	6	3	3	~7 SS
1	3	0	0	0	0	0	0	0	0	~2 SS

Table S3. Dissolution experiment additive concentrations.

Additive species	Concentration of additives (mol/L)		
	0.1 g/L	1.0 g/L	5.0 g/L
TzPhH	6.84E-04	6.84E-03	3.42E-02
TzPhCNH	5.84E-04	5.84E-03	2.92E-02
TzTzH₂	4.67E-04	4.67E-03	2.33E-02
BaPhH	8.19E-04	8.19E-03	4.09E-02
BaPhCNH	6.80E-04	6.80E-03	3.40E-02
TzBaH₂	5.26E-04	5.26E-03	2.63E-02
BaBaH₂	6.02E-04	6.02E-03	3.01E-02

Table S4. Table of SEM images mean particle sizes, standard deviation (S.D), number of particles counted within SEM image and the conditions of each sample.

Sample	Additive	Super-Saturation ¹	Concentration (g/L)	Particle Length (μm) ²	S.D ³	Aspect Ratio ⁴	# of Particles Counted
Fig. 3f	BaPhH	7	1	11.82	1.44	2.6	55
Fig. 3b	BaPhaH	7	1	5.65	1.37	2.0	16
Fig. S6	BaPhCNH	7	1	9.37	1.81	2.4	55
Fig. 5b	BaPhCNH	7	5	20.33	5.24	1.6	55
Fig. S5	BaTzH ₂	7	1	41.21	10.02	2.0	55
Fig. 4	BaTzH ₂	7	5	5.61	1.44	2.0	38
Fig. 3d	BaBaH ₂	7	1	11.89	2.81	2.4	18
Fig. 2	Control	7	1	6.52	0.86	2.8	22
Fig. S17a	TzPhH	7	1	9.50	2.95	2.6	55
Fig. 19	TzPhH	7	1	10.35	1.70	2.9	55
Fig. S3e	TzPhH	7	1	22.15	5.67	2.7	55
Fig. S18	TzPhH	11	1	11.30	2.03	2.8	38
Fig. 3a	TzPhaH	7	1	11.20	4.11	1.9	55
Fig. S7	TzPhCNH	7	1	9.24	1.28	1.8	95
Fig. 5a	TzPhCNH	7	5	31.73	7.94	1.7	55
Fig. 3c	TzTzH ₂	7	1	5.90	1.40	1.7	34

¹ Note: Super-saturation, $S = C/C_{\text{eq}}$,

Where, C = Concentration of Ca^{2+} and $\text{C}_2\text{O}_4^{2-}$ and C_{eq} = Equilibrium concentration.

² Note: The particle size is the mean length along the [001] direction of each particle.

³ Note: S.D = Standard deviation

⁴ Note: Aspect Ratio = Length (along <001>) / Width (along <010>)

Samples with few particles to measure were removed from the table for clarity.

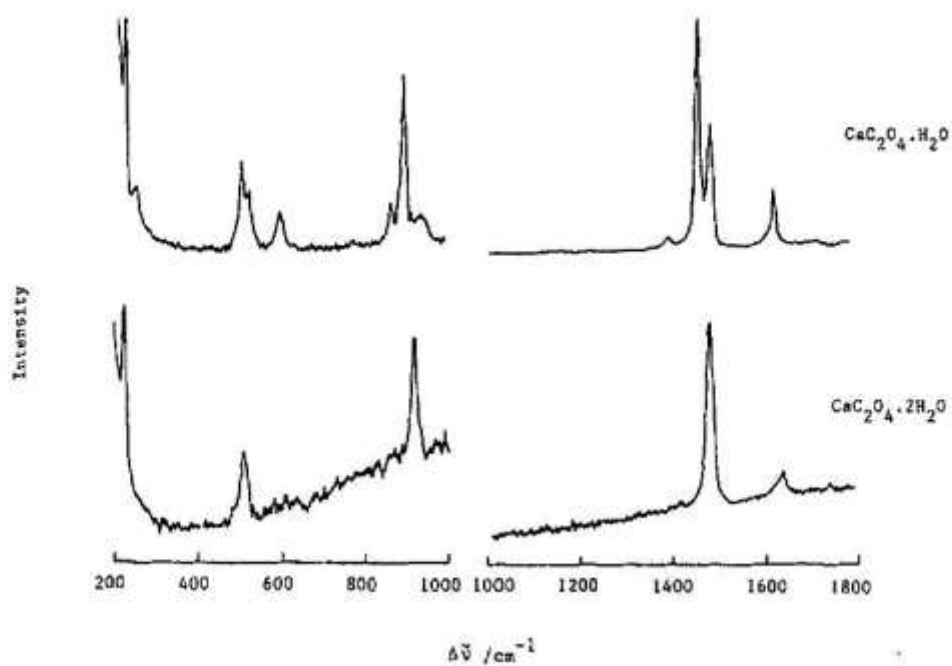


Figure S1. Literature Raman Spectra. H. G. M. Edwards, D. W. Farwell, R. Jenkins, *J. Raman Spectroscopy* (1992) **23**, 185-189. (with permission)

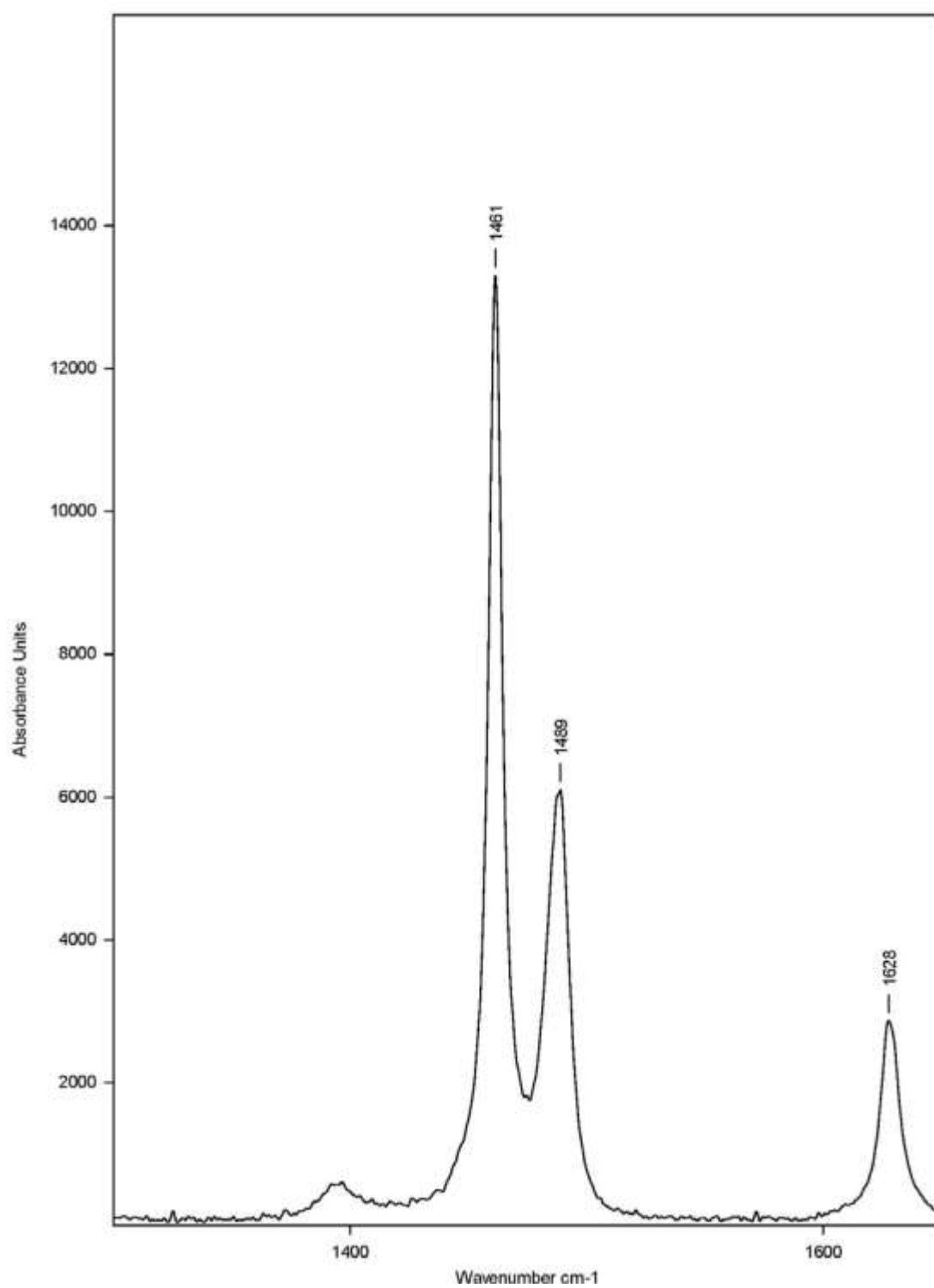


Figure S2. Control Raman Spectrum (sample shown in Fig. 2, calcium oxalate concentration 0.30 mM)

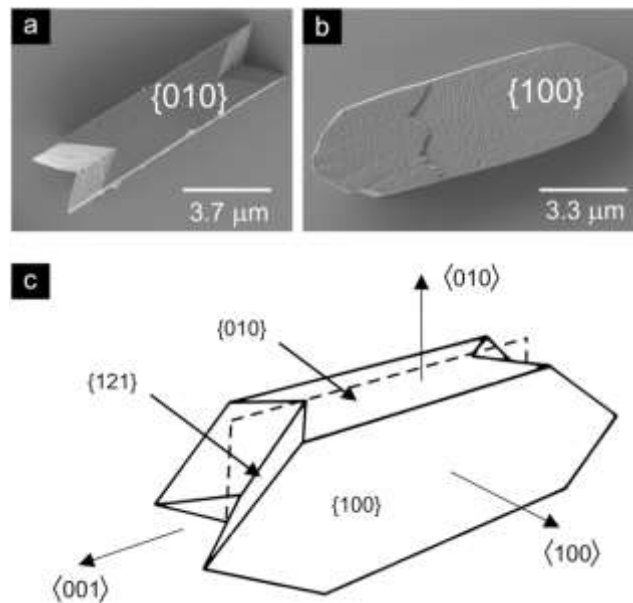


Figure S3. COM indexing of crystal faces. From A Taller, B. Grohe, K. A. Rogers, H. A. Goldberg, G. K. Hunter *Biophysical Journal*, (2007) **93**, 1768-1777.
(With permission)

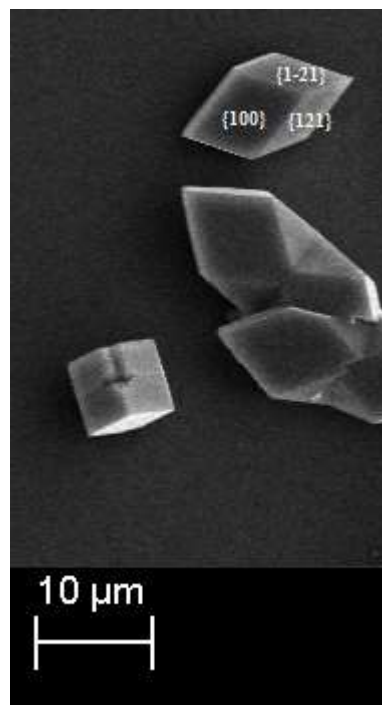


Figure S4. Magnified view of Figure 3a

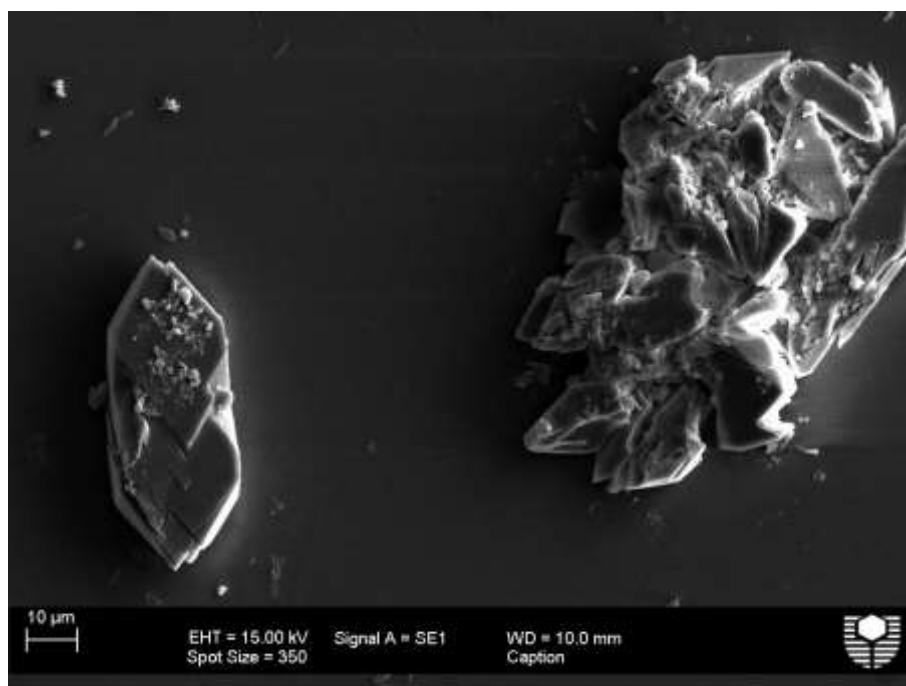


Figure S5. SEM image of calcium oxalate (0.30 mM) particles formed in the presence of 1 g/L **TzBa²⁺** (6.02 mM)

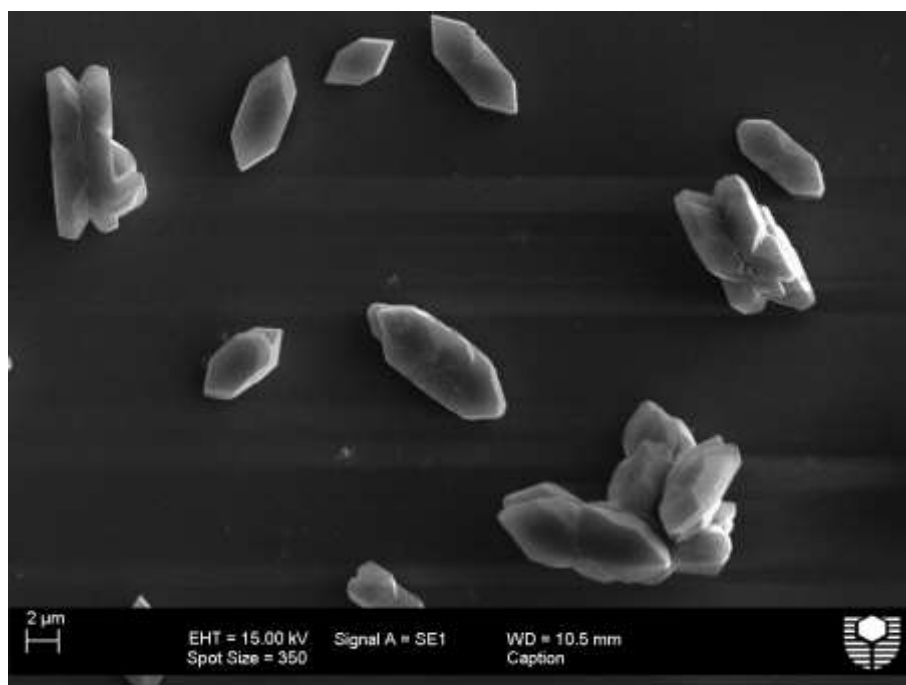


Figure S6. SEM image of calcium oxalate (0.30 mM) particles formed in the presence of 1 g/L **BaPhCN⁻** (6.80 mM)

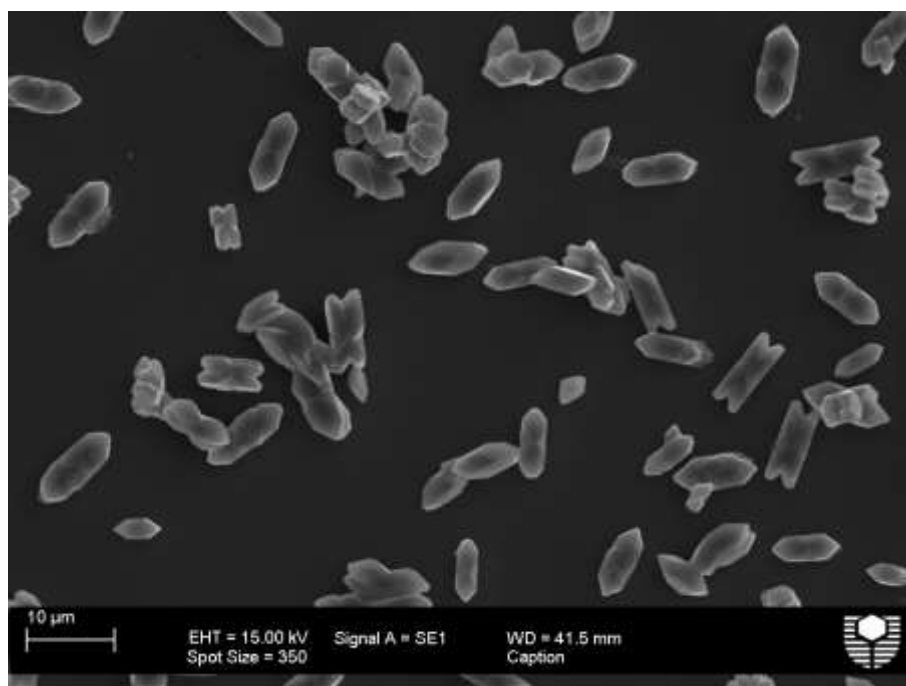


Figure S7. SEM image of calcium oxalate (0.30 mM) particles formed in the presence of 1 g/L **TzPhCN⁻** (5.48 mM)

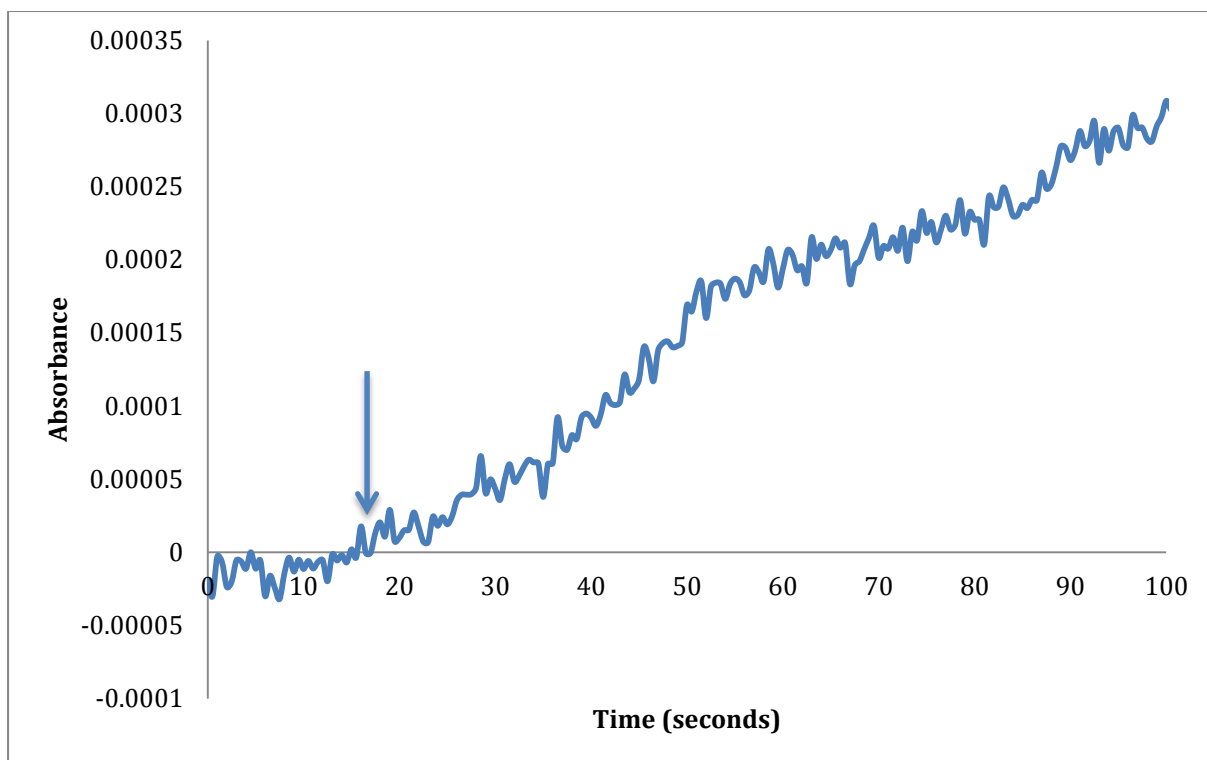


Figure S8. Turbidity experiment with calcium oxalate using the additive **TzPh⁻** (6.84 mM) (averaged from 6 plots)

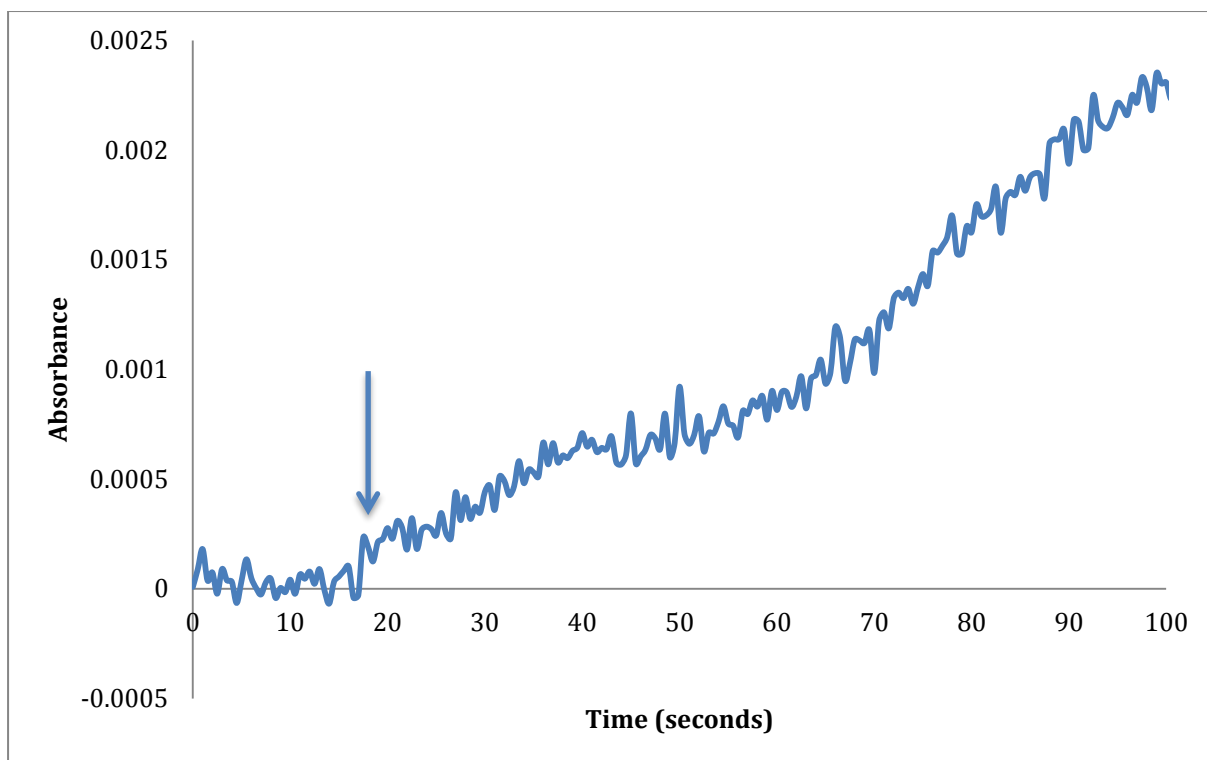


Figure S9. Turbidity experiment with calcium oxalate using the additive **TzPha⁻** (5.73 mM) (averaged from 5 plots)

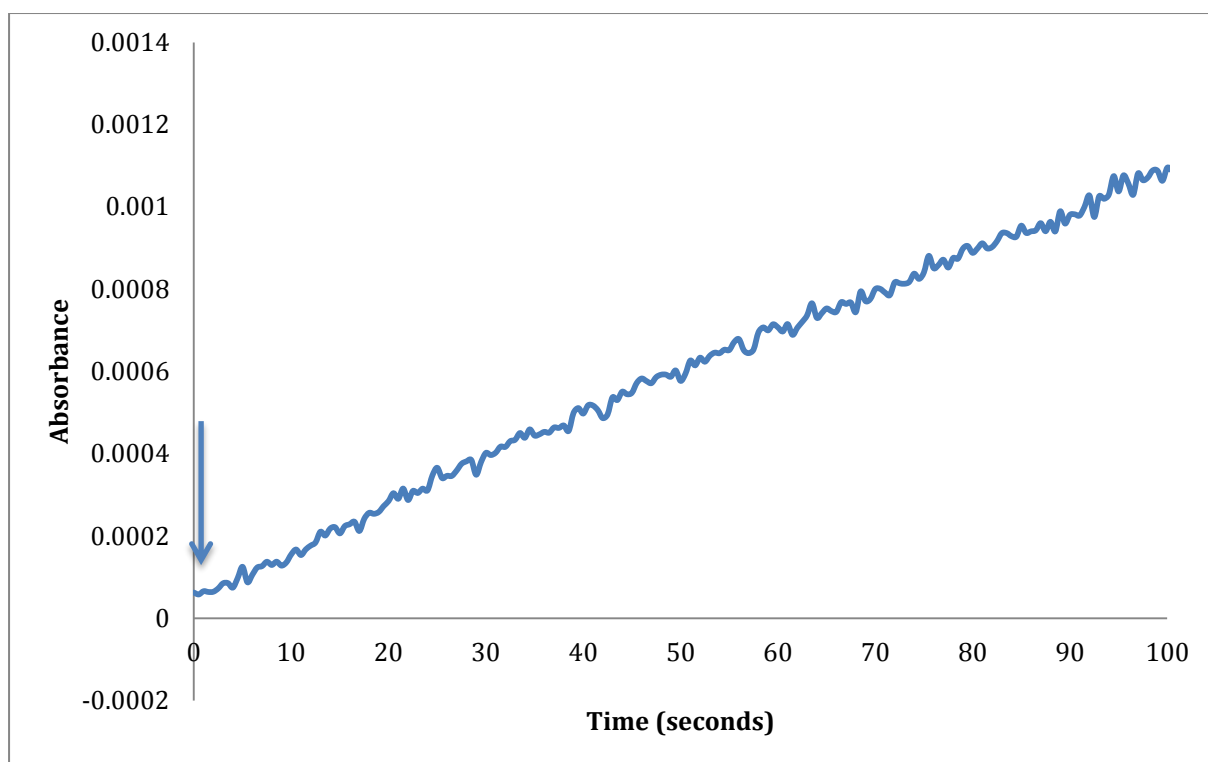


Figure S10. Turbidity experiment with calcium oxalate using the additive **TzPhCN⁻** (5.84 mM) (averaged from 4 plots)

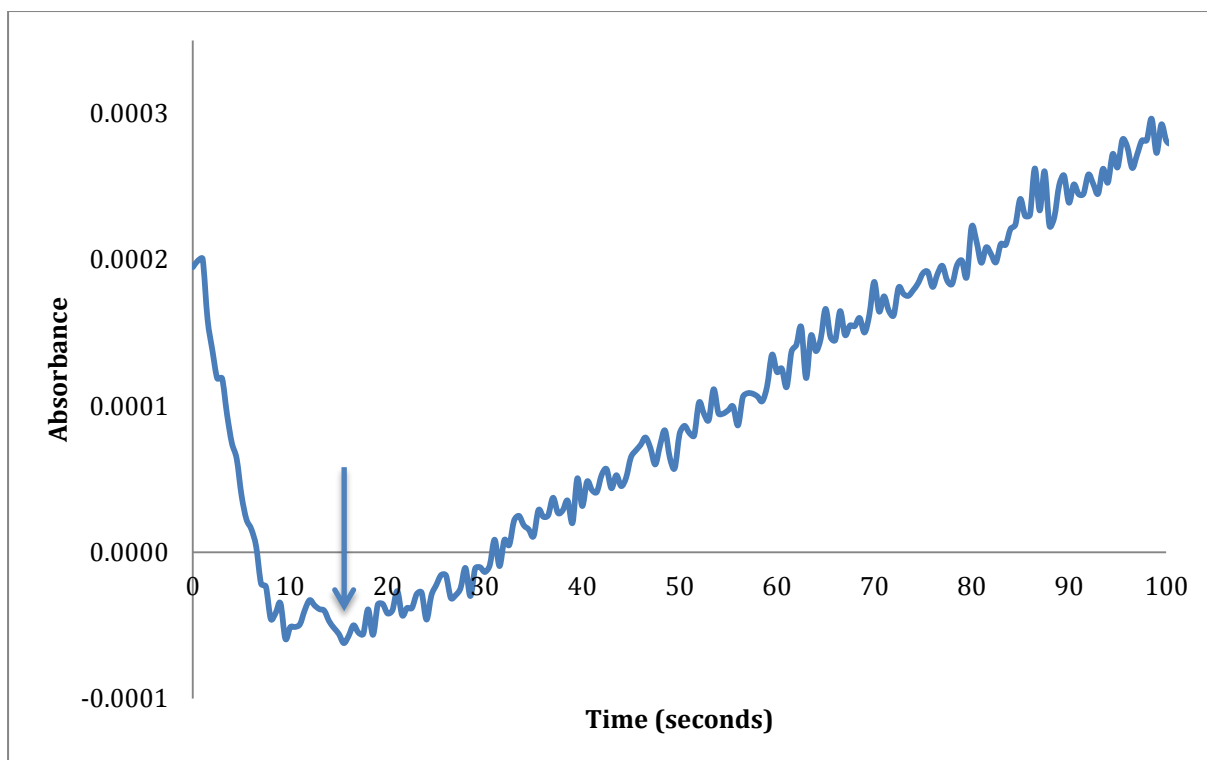


Figure S11. Turbidity experiment with calcium oxalate using the additive **BaPh⁻** (8.18 mM) (averaged from 6 plots)

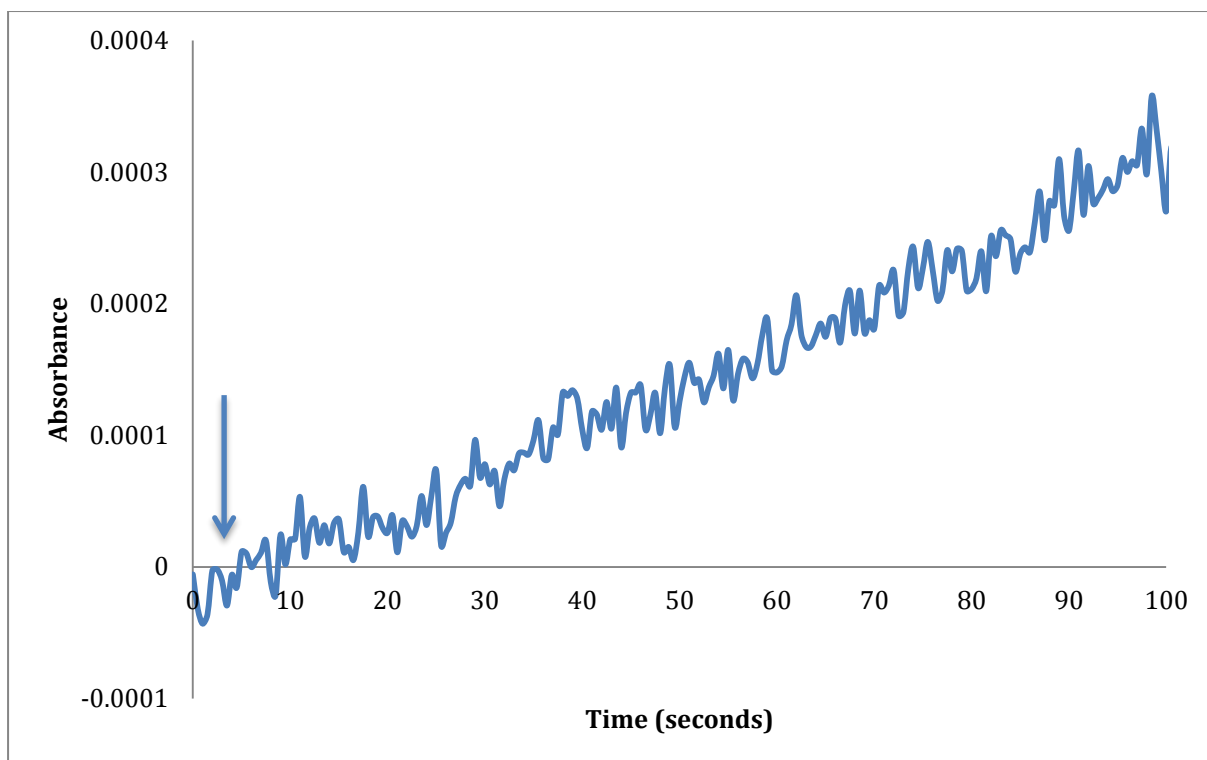


Figure S12. Turbidity experiment with calcium oxalate using the additive **BaPha⁻** (6.66 mM) (averaged from 3 plots)

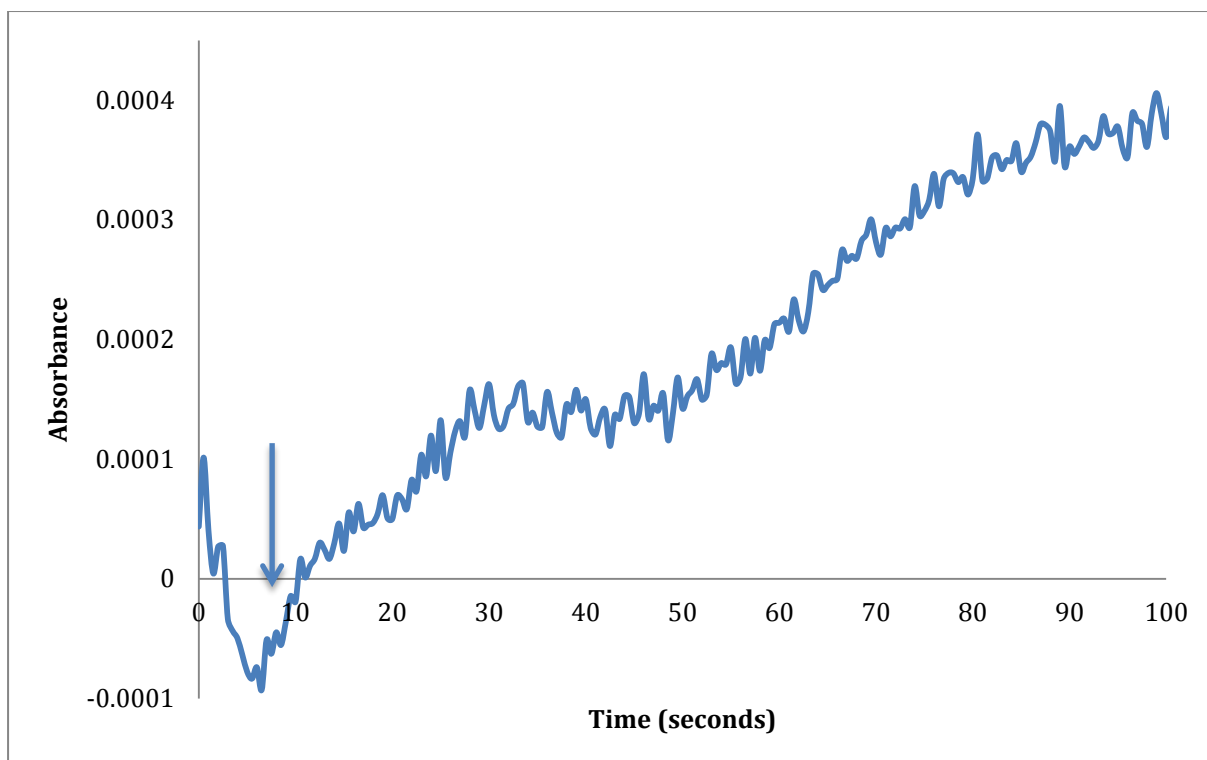


Figure S13. Turbidity experiment with calcium oxalate using the additive **BaPhCN⁻** (6.80 mM) (averaged from 4 plots)

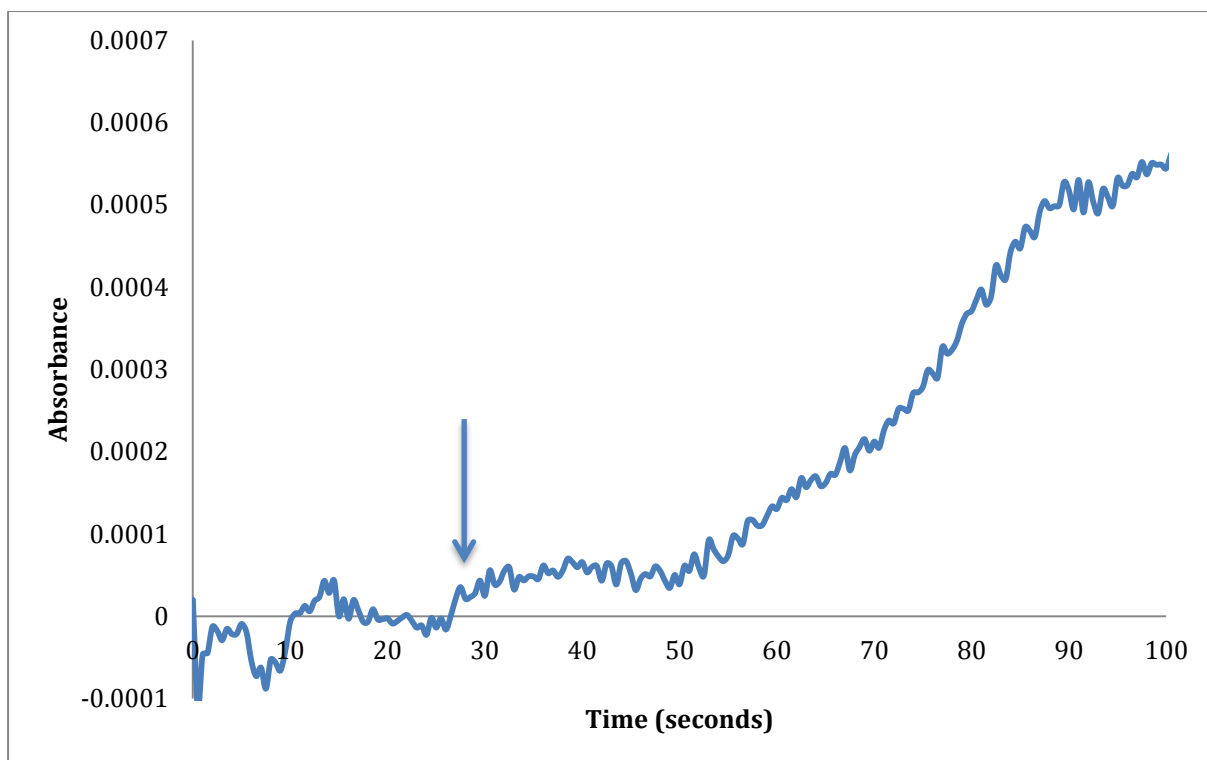


Figure S14. Turbidity experiment with calcium oxalate without an additive
(**Control** -averaged from 5 plots)

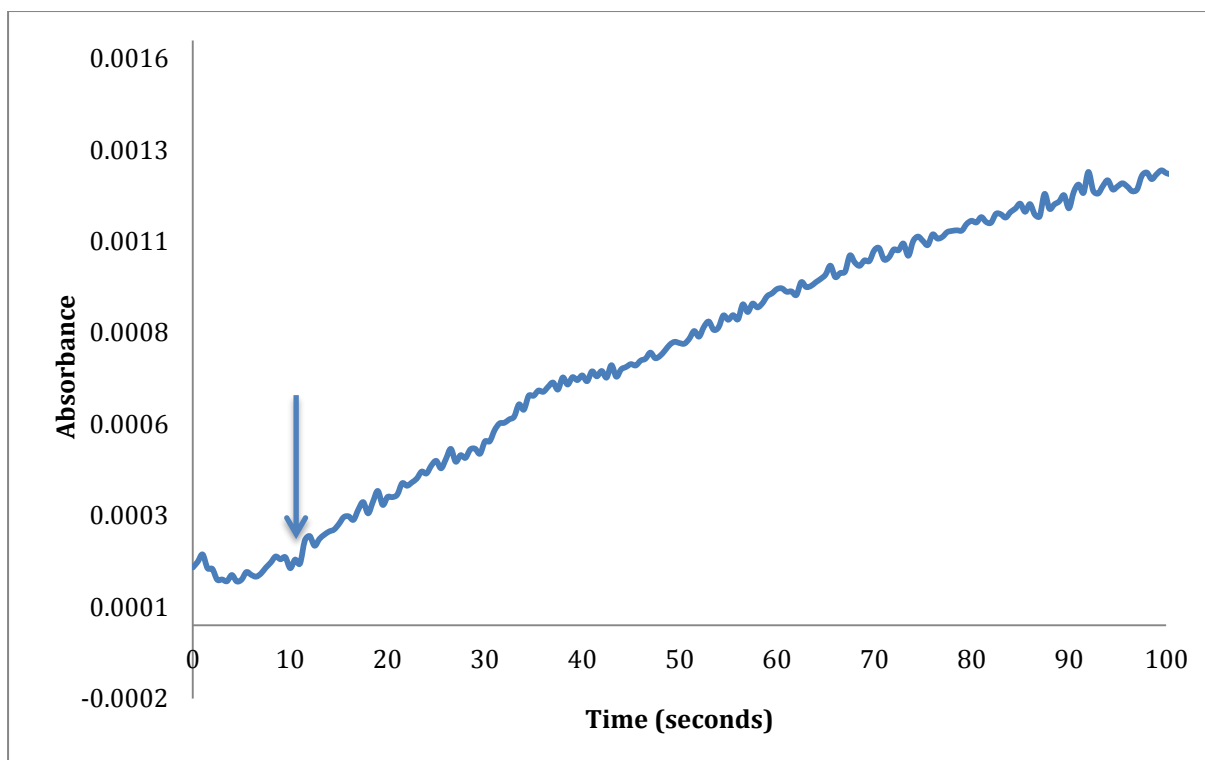


Figure S15. Turbidity experiment with calcium oxalate using the additive $\mathbf{TzTz}^{-2}$ (4.66 mM) (averaged from 4 plots)

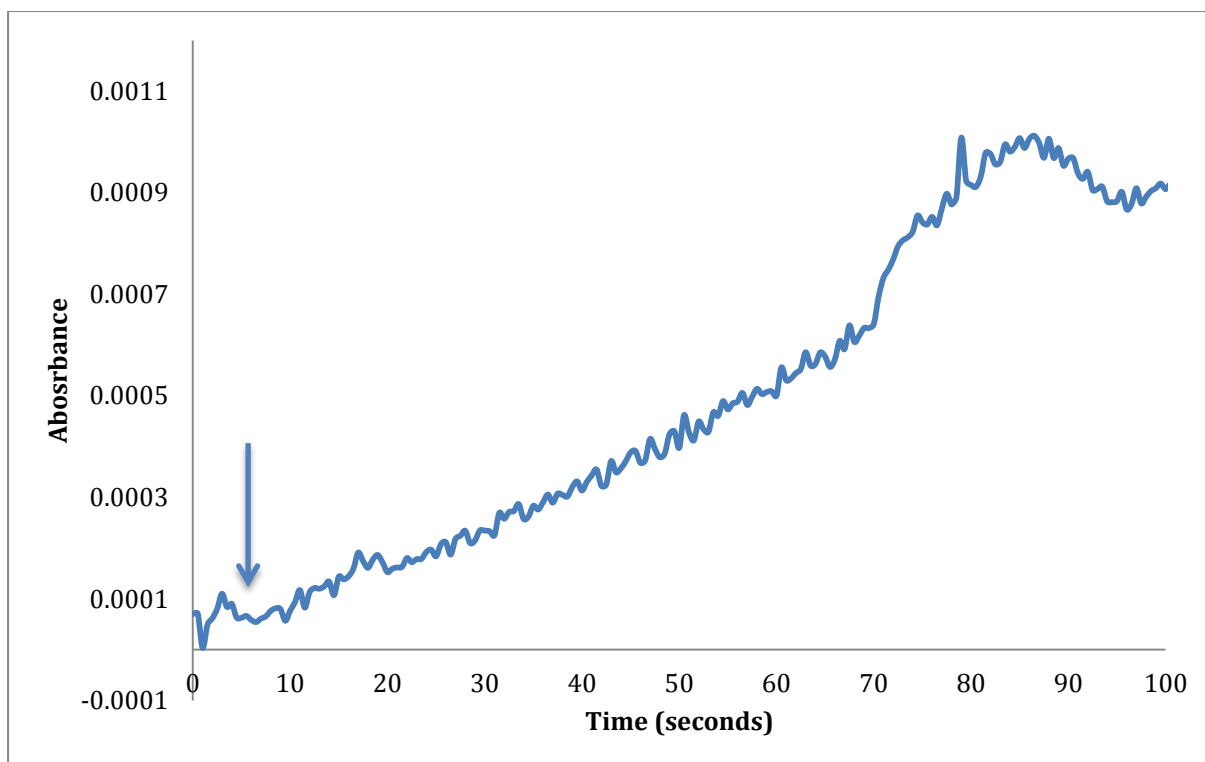


Figure S16. Turbidity experiment with calcium oxalate using the additive **BaBa**⁻² (6.02 mM) (averaged from 4 plots)

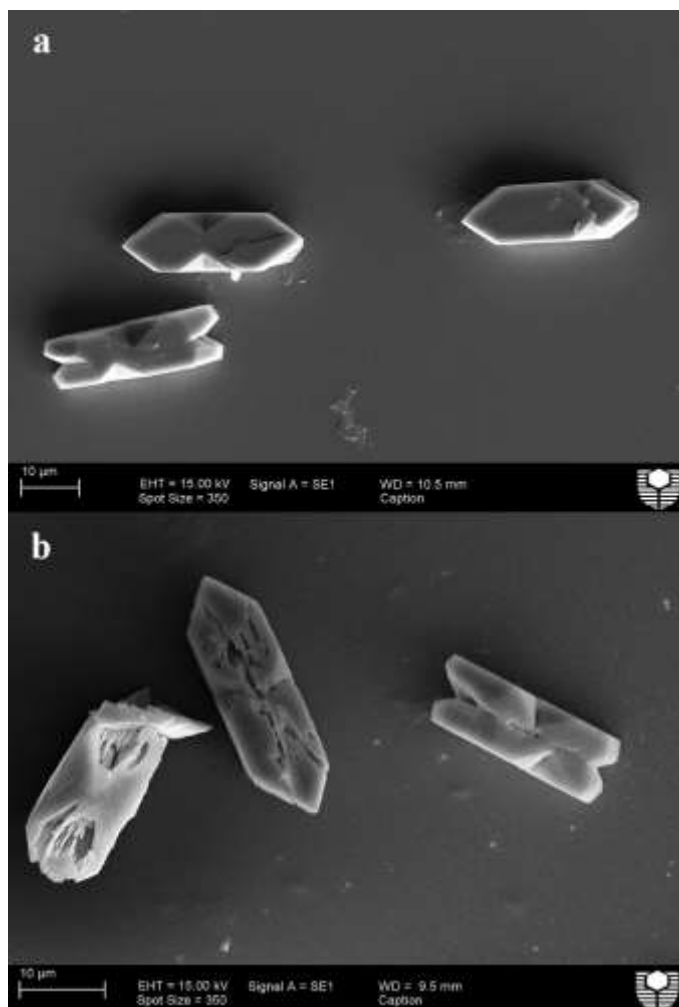


Figure S17. SEM images of calcium oxalate (0.30 mM) particles grown in the presence of TzPh^- (6.84 mM) at 30°C after (a) 3 days, (b) 4 days



Figure S18. SEM image of calcium oxalate (0.50 mM) particles formed in the presence of 1 g/L **TzPh⁻** (6.84 mM)



Figure S19. SEM image of calcium oxalate (0.30 mM) particles formed in the presence of 1g/L **TzPh⁻** (6.84 mM)



Figure S20. SEM timed experiment of calcium oxalate (0.30 mM) particles formed after 19 days in the presence of a) no additive, b) 1g/L **BaPh⁻** (8.19 mM) c) 1 g/L **TzPh⁻** (6.84 mM)

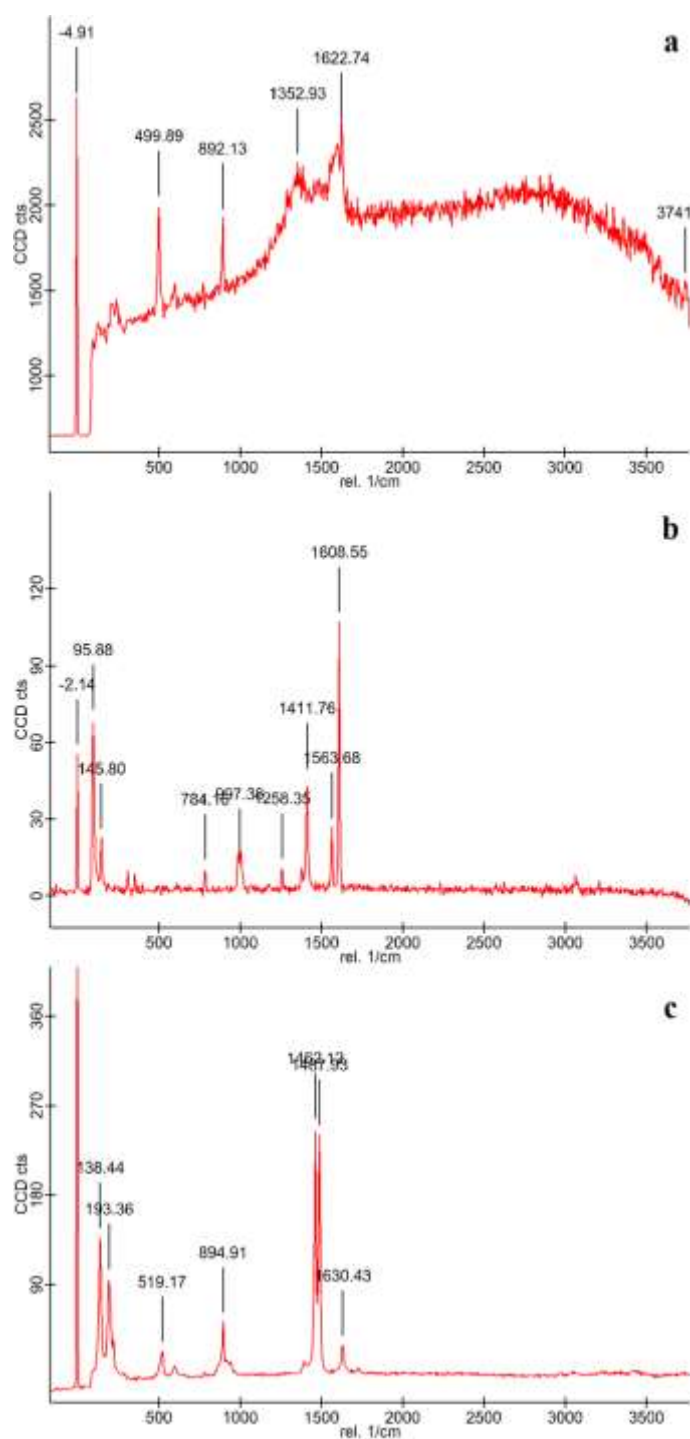


Figure S21. Raman spectra of (a) Fig. S17a COM crystals in the presence of **TzPh⁻** (6.84 mM) (b) **TzPhH** synthesised in-house (c) Control COM crystals (0.30 mM).