Carbonate encapsulation from dissolved atmospheric CO_2 into a polyoxovanadate capsule †‡

Sateesh Mulkapuri, Sathish Kumar Kurapati, and Samar K. Das*

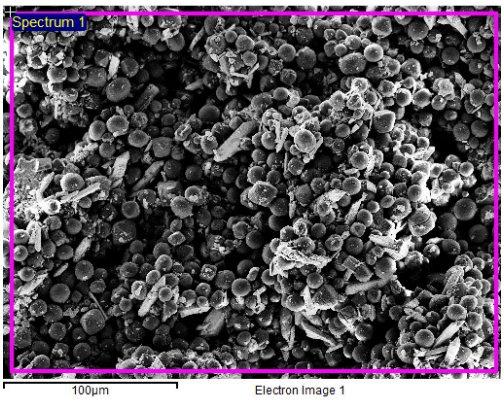
School of Chemistry, University of Hyderabad,

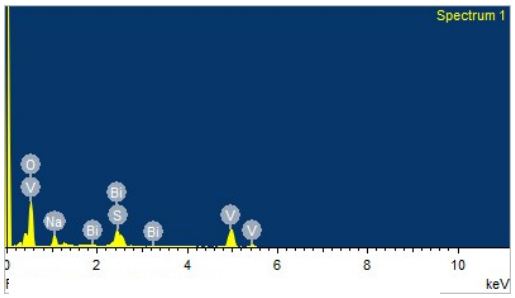
P.O. Central University, Hyderabad – 500046, India

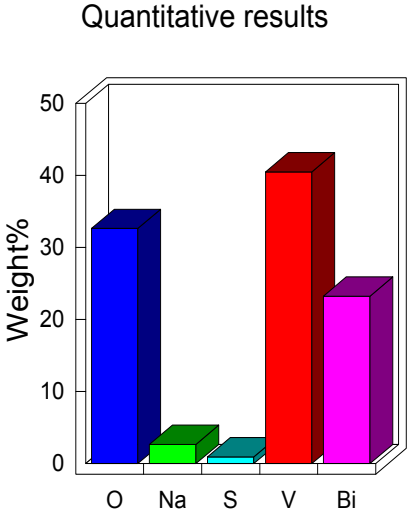
Electronic Supporting Information (ESI)

Section S1. FESEM-EDX analysis of compound 1 reaction mixture solution

a) FESEM-EDX analysis and elemental mapping of reaction mixture solution of compound 1 collected after one day







Element	Weight%	Atomic%
O K	32.64	65.99
Na K	2.67	3.76
S K	0.94	0.95
V K	40.49	25.71
Bi M	23.25	3.60
Totals	100.00	

Fig. S1. FESEM-EDX analysis of reaction mixture solution of compound 1 collected after one day.

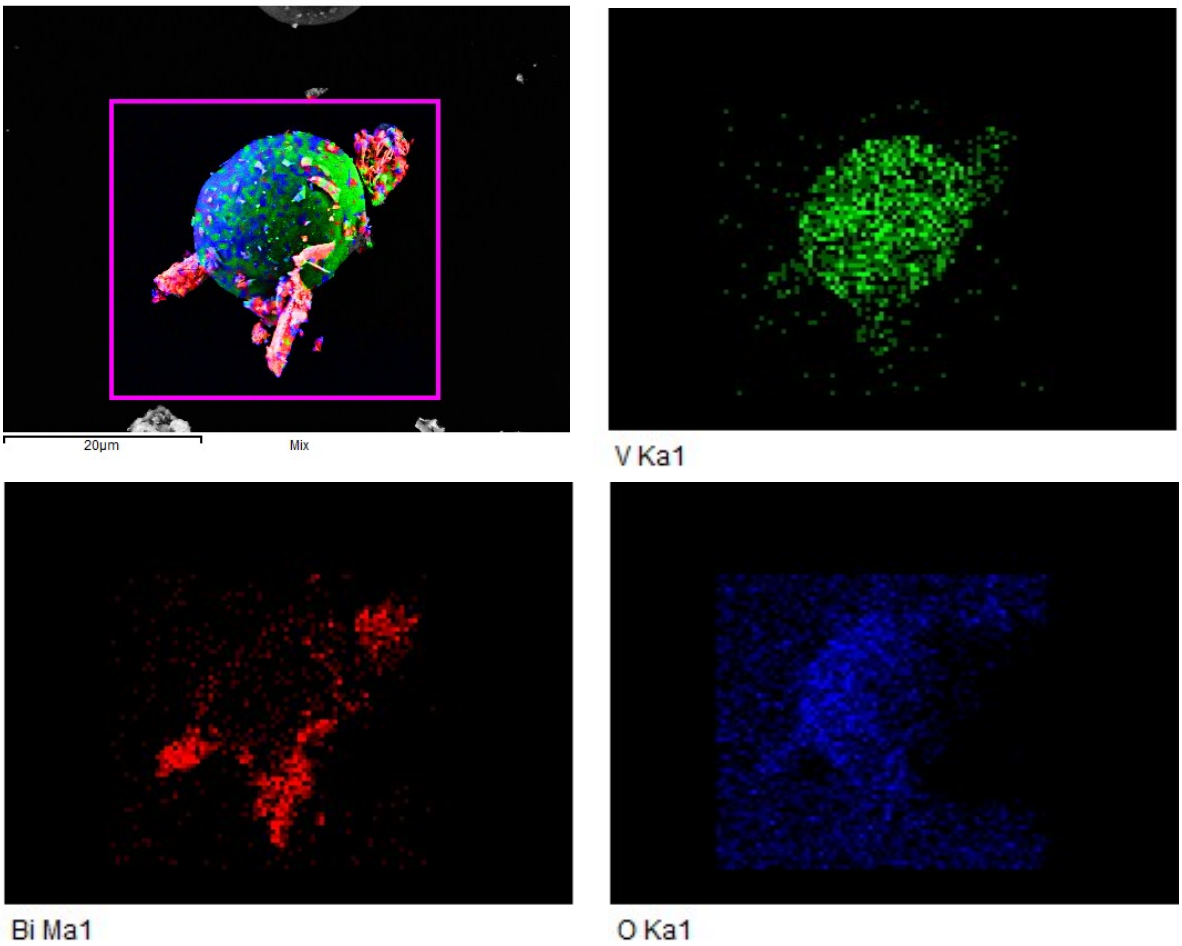
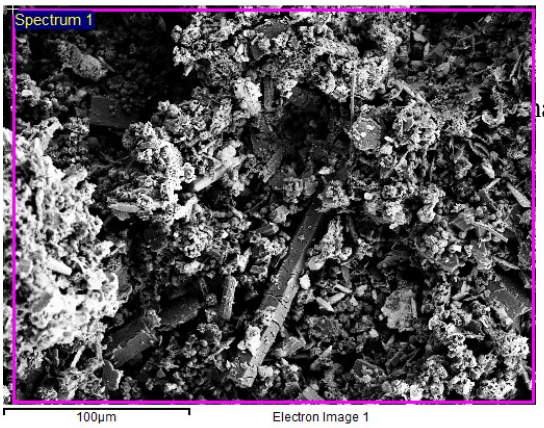
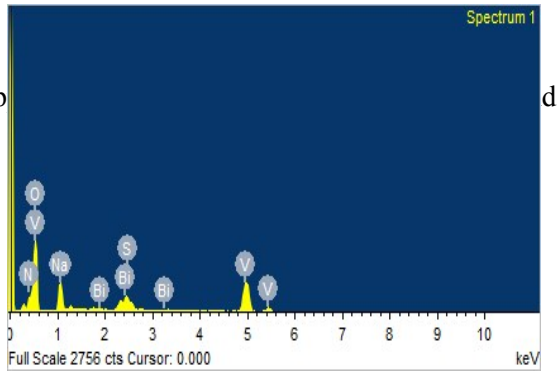
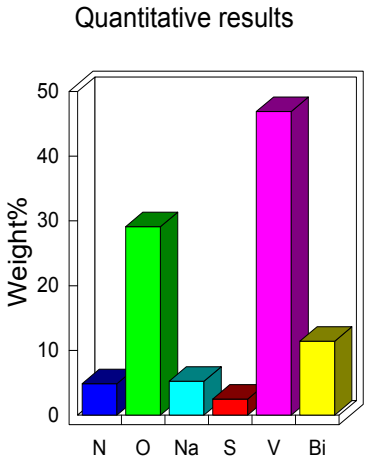


Fig. S2. Elemental mapping of reaction mixture solution of compound 1 collected after one day.







Element	Weight%	Atomic%
N K	4.86	10.07
O K	29.13	52.81
Na K	5.22	6.59
S K	2.48	2.25
V K	46.89	26.70
Bi M	11.42	1.59
Totals	100.00	

Fig. S3. FESEM-EDX analysis of reaction mixture solution of compound 1 collected after four days.

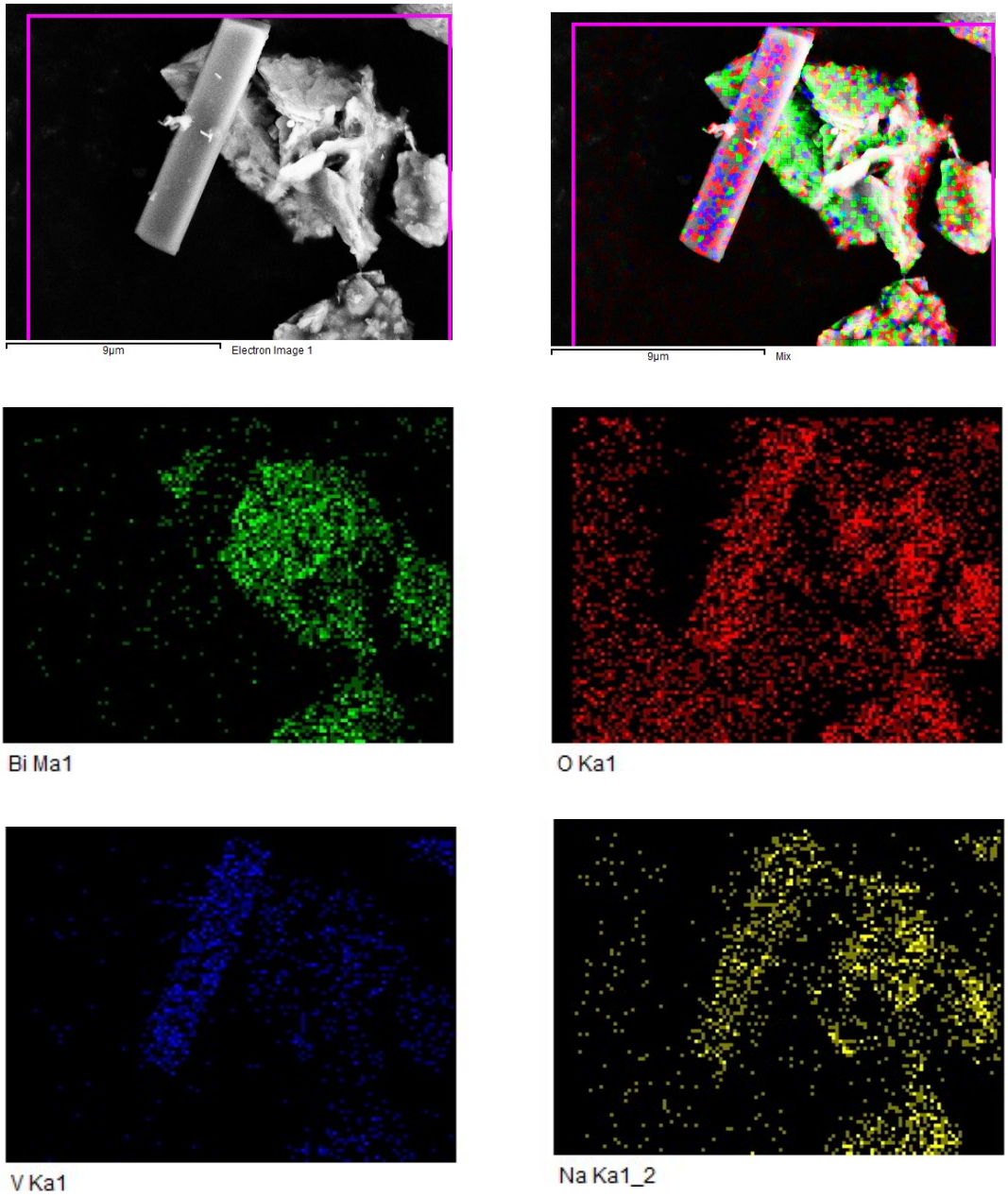


Fig. S4. Elemental mapping of reaction mixture solution of compound 1 collected after four days.

Section S2. Details of bond distances and angles for compounds 1 and 2

Table S1. Bond distances (Å) and angles (°) for compound 1

V(2)-O(4)	1.6236(18)	O(3)-V(2)-V(1)	39.48(5)
V(2)-O(5)#1	1.9067(18)	O(5)-V(2)-V(1)	110.54(6)
V(2)-O(3)	1.9280(17)	O(8)#1-V(2)-V(1)	42.91(5)
V(2)-O(5)	1.9287(18)	V(3)-V(2)-V(1)	74.706(15)
V(2)-O(8)#1	1.9952(18)	V(3)#1-V(2)-V(1)	72.696(15)
V(2)-V(3)	2.9530(6)	O(6)-V(3)-O(7)	102.61(10)
V(2)-V(3)#1	2.9550(6)	O(6)-V(3)-O(3)	106.26(9)
V(2)-V(1)	3.0002(4)	O(7)-V(3)-O(3)	93.21(9)
V(3)-O(6)	1.6290(19)	O(6)-V(3)-O(8)	105.19(9)
V(3)-O(7)	1.8318(11)	O(7)-V(3)-O(8)	92.99(10)
V(3)-O(3)	1.9206(17)	O(3)-V(3)-O(8)	145.71(8)
V(3)-O(8)	1.9469(19)	O(6)-V(3)-O(5)	99.96(9)
V(3)-O(5)	1.9665(19)	O(7)-V(3)-O(5)	157.43(9)
V(1)-O(2)	1.637(3)	O(3)-V(3)-O(5)	80.01(7)
V(1)-O(3)#2	1.9464(17)	O(8)-V(3)-O(5)	81.44(7)
V(1)-O(3)	1.9465(17)	O(6)-V(3)-V(2)	104.14(7)
V(1)-O(8)#1	2.0527(18)	O(7)-V(3)-V(2)	131.05(8)
V(1)-O(8)#3	2.0527(18)	O(3)-V(3)-V(2)	39.98(5)
V(1)-O(1)	2.293(3)	O(8)-V(3)-V(2)	117.96(6)
O(1)-C(1)	1.275(3)	O(5)-V(3)-V(2)	40.23(5)
N(1)-N(1)#8	1.446(5)	O(6)-V(3)-V(2)#9	109.40(7)
		O(7)-V(3)-V(2)#9	129.72(8)
O(4)-V(2)-O(5)#1	109.53(9)	O(3)-V(3)-V(2)#9	112.92(6)
O(4)-V(2)-O(3)	113.15(9)	O(8)-V(3)-V(2)#9	42.07(5)
O(5)#1-V(2)-O(3)	137.08(8)	O(5)-V(3)-V(2)#9	39.53(5)
O(4)-V(2)-O(5)	105.90(9)	V(2)-V(3)-V(2)#9	76.814(19)
O(5)#1-V(2)-O(5)	92.06(11)	O(2)-V(1)-O(3)#2	103.35(8)
O(3)-V(2)-O(5)	80.78(8)	O(2)-V(1)-O(3)	103.35(8)
O(4)-V(2)-O(8)#1	107.87(9)	O(3)#2-V(1)-O(3)	92.18(10)
O(5)#1-V(2)-O(8)#1	81.69(8)	O(2)-V(1)-O(8)#1	99.73(8)
O(3)-V(2)-O(8)#1	81.29(7)	O(3)#2-V(1)-O(8)#1	156.71(8)
O(5)-V(2)-O(8)#1	145.81(8)	O(3)-V(1)-O(8)#1	79.40(7)
O(4)-V(2)-V(3)	112.94(7)	O(2)-V(1)-O(8)#3	99.73(8)
O(5)#1-V(2)-V(3)	123.15(6)	O(3)#2-V(1)-O(8)#3	79.41(7)
O(3)-V(2)-V(3)	39.80(5)	O(3)-V(1)-O(8)#3	156.71(8)
O(5)-V(2)-V(3)	41.18(6)	O(8)#1-V(1)-O(8)#3	99.83(10)
O(8)#1-V(2)-V(3)	117.39(5)	O(2)-V(1)-O(1)	165.98(13)
O(4)-V(2)-V(3)#1	117.92(7)	O(3)#2-V(1)-O(1)	86.24(8)
O(5)#1-V(2)-V(3)#1	41.03(6)	O(3)-V(1)-O(1)	86.24(8)
O(3)-V(2)-V(3)#1	110.55(5)	O(8)#1-V(1)-O(1)	71.67(7)
O(5)-V(2)-V(3)#1	122.91(6)	O(8)#3-V(1)-O(1)	71.67(7)
O(8)#1-V(2)-V(3)#1	40.83(5)		
V(3)-V(2)-V(3)#1	128.88(2)	V(3)#2-O(7)-V(3)	127.12(14)
O(4)-V(2)-V(1)	124.95(7)	V(3)-O(8)-V(2)#9	97.10(8)
O(5)#1-V(2)-V(1)	108.87(6)	V(3)-O(8)-V(1)#9	123.88(9)

V(2)#9-O(8)-V(1)#9	95.65(8)	V(2)#9-O(5)-V(3)	99.44(8)
C(1)-O(1)-V(1)	129.80(19)	V(2)-O(5)-V(3)	98.59(8)
V(3)-O(3)-V(2)	100.22(8)	O(1)#1-C(1)-O(1)	120.000(1)
V(3)-O(3)-V(1)	138.15(9)	O(1)#1-C(1)-O(1)#9	120.002(1)
V(2)-O(3)-V(1)	101.49(8)	O(1)-C(1)-O(1)#9	120.0
V(2)#9-O(5)-V(2)	146.26(11)		

Symmetry transformations used to generate equivalent atoms: #1 -x+y,-x,z #2 x,y,-z+3/2 #3 -x+y,-x,-z+3/2 #4 -x+y,-x-1,z #5 -y-1,x-y-1,z #6 -x+y+1,-x,z #7 -y,x-y-1,z #8 x-y,-y,-z+1 #9 -y,x-y,z

Table S2. Bond lengths (Å) and angles (°) for compound 2

O(8)-V(3)	1.611(13)	Na(1)-O(9)#8	2.373(9)
V(1)-O(1)	1.605(8)	Na(1)-O(9)	2.373(9)
V(1)-O(2)#1	1.916(3)	Na(1)-O(9)#9	2.373(9)
V(1)-O(2)	1.916(3)	Na(1)-O(6)#8	2.446(9)
V(1)-O(3)	1.951(5)	Na(1)-O(6)	2.446(9)
V(1)-O(3)#2	1.951(5)	Na(1)-O(6)#9	2.446(9)
V(3)-O(3)#2	1.976(5)	O(5)-V(2)#10	1.820(5)
V(3)-O(3)#3	1.976(5)	O(6)-Na(1)#3	2.446(9)
V(3)-O(3)	1.976(5)	O(7)-Na(3)	2.34(2)
V(3)-O(3)#4	1.976(5)	Na(2)-O(10)	2.90(5)
V(2)-O(4)	1.621(8)	Na(2)-O(10)#11	2.90(5)
V(2)-O(5)	1.820(5)	Na(2)-O(2)#11	2.868(11)
V(2)-O(3)#5	1.915(5)	O(10)-Na(3)#7	3.11(3)
V(2)-O(3)	1.915(5)	Na(3)-O(7)#13	2.34(2)
V(2)-O(2)	2.009(9)	Na(3)-O(1)#14	2.291(14)
O(2)-V(1)#6	1.916(3)	Na(3)-O(1)#15	2.291(14)
O(2)-Na(2)	2.868(11)	Na(3)-O(10)#15	3.11(3)
O(1)-Na(3)#7	2.291(14)	Na(3)-O(10)#14	3.11(3)
		O(3)#2-V(3)-O(3)#4	92.8(3)
O(1)-V(1)-O(2)#1	106.4(3)	O(3)#3-V(3)-O(3)#4	79.1(3)
O(1)-V(1)-O(2)	106.4(3)	O(3)-V(3)-O(3)#4	149.3(3)
O(2)#1-V(1)-O(2)	94.3(5)	O(4)-V(2)-O(5)	104.7(4)
O(1)-V(1)-O(3)	109.0(3)	O(4)-V(2)-O(3)#5	109.47(16)
O(2)#1-V(1)-O(3)	144.0(3)	O(5)-V(2)-O(3)#5	91.16(18)
O(2)-V(1)-O(3)	82.1(3)	O(4)-V(2)-O(3)	109.47(16)
O(1)-V(1)-O(3)#2	109.0(3)	O(5)-V(2)-O(3)	91.16(18)
O(2)#1-V(1)-O(3)#2	82.1(3)	O(3)#5-V(2)-O(3)	139.0(3)
O(2)-V(1)-O(3)#2	144.0(3)	O(4)-V(2)-O(2)	99.6(4)
O(3)-V(1)-O(3)#2	80.3(3)	O(5)-V(2)-O(2)	155.7(4)
O(8)-V(3)-O(3)#2	105.34(17)	O(3)#5-V(2)-O(2)	80.67(18)
O(8)-V(3)-O(3)#3	105.34(17)	O(3)-V(2)-O(2)	80.67(18)
O(3)#2-V(3)-O(3)#3	149.3(3)	V(2)-O(3)-V(1)	99.6(2)
O(8)-V(3)-O(3)	105.34(17)	V(2)-O(3)-V(3)	137.7(3)
O(3)#2-V(3)-O(3)	79.1(3)		
O(3)#3-V(3)-O(3)	92.8(3)	V(1)-O(3)-V(3)	99.9(2)
O(8)-V(3)-O(3)#4	105.34(17)	V(1)#6-O(2)-V(1)	141.1(5)

V(1)#6-O(2)-V(2)	97.6(3)	O(10)-Na(2)-O(10)#11	97.1(12)
V(1)-O(2)-V(2)	97.6(3)	O(10)-Na(2)-O(2)#11	107.1(2)
V(1)#6-O(2)-Na(2)	105.0(2)	O(10)#11-Na(2)-O(2)#11	107.1(2)
V(1)-O(2)-Na(2)	105.0(2)	O(10)-Na(2)-O(2)	107.1(2)
V(2)-O(2)-Na(2)	105.6(5)	O(10)#11-Na(2)-O(2)	107.1(2)
V(1)-O(1)-Na(3)#7	168.8(6)	O(2)#11-Na(2)-O(2)	127.4(7)
O(9)#8-Na(1)-O(9)	94.6(4)	Na(2)-O(10)-Na(3)#7	86.7(12)
O(9)#8-Na(1)-O(9)#9	94.6(4)	O(7)-Na(3)-O(7)#13	103.1(14)
O(9)-Na(1)-O(9)#9	94.6(4)	O(7)-Na(3)-O(1)#14	170.9(9)
O(9)#8-Na(1)-O(6)#8	90.5(3)	O(7)#13-Na(3)-O(1)#14	86.0(6)
O(9)-Na(1)-O(6)#8	171.4(4)	O(7)-Na(3)-O(1)#15	86.0(6)
O(9)#9-Na(1)-O(6)#8	91.8(3)	O(7)#13-Na(3)-O(1)#15	170.9(9)
O(9)#8-Na(1)-O(6)	91.8(3)	O(1)#14-Na(3)-O(1)#15	84.9(7)
O(9)-Na(1)-O(6)	90.5(3)	O(7)-Na(3)-O(10)#15	95.0(5)
O(9)#9-Na(1)-O(6)	171.4(4)	O(7)#13-Na(3)-O(10)#15	95.0(5)
O(6)#8-Na(1)-O(6)	82.5(3)	O(1)#14-Na(3)-O(10)#15	84.0(6)
O(9)#8-Na(1)-O(6)#9	171.4(4)	O(1)#15-Na(3)-O(10)#15	84.0(6)
O(9)-Na(1)-O(6)#9	91.8(3)	O(7)-Na(3)-O(10)#14	95.0(5)
O(9)#9-Na(1)-O(6)#9	90.5(3)	O(7)#13-Na(3)-O(10)#14	95.0(5)
O(6)#8-Na(1)-O(6)#9	82.5(3)	O(1)#14-Na(3)-O(10)#14	84.0(6)
O(6)-Na(1)-O(6)#9	82.5(3)	O(1)#15-Na(3)-O(10)#14	84.0(6)
V(2)-O(5)-V(2)#10	132.4(6)	O(10)#15-Na(3)-O(10)#14	163.8(17)
Na(1)#3-O(6)-Na(1)	80.8(4)		

Symmetry transformations used to generate equivalent atoms: #1 -x+y+1,-x+2,z; #2 x-y+1,-y+2,z; #3 x,y,-z+1; #4 x-y+1,-y+2,-z+1; #5 y,x,z; #6 -y+2,x-y+1,z; #7 x,y+1,z; #8 -y+1,x-y+1,z; #9 -x+y,-x+1,z; #10 y,x,-z+1; #11 y,x,-z+2; #12 -y+1,x-y,z; #13 x-y,-y,-z+2; #14 x-y+1,-y+1,-z+2; #15 x,y-1,z; #16 -x+y+1,-x+1,z.

Section S3. Coupled TGA-IR Spectra of compound 1

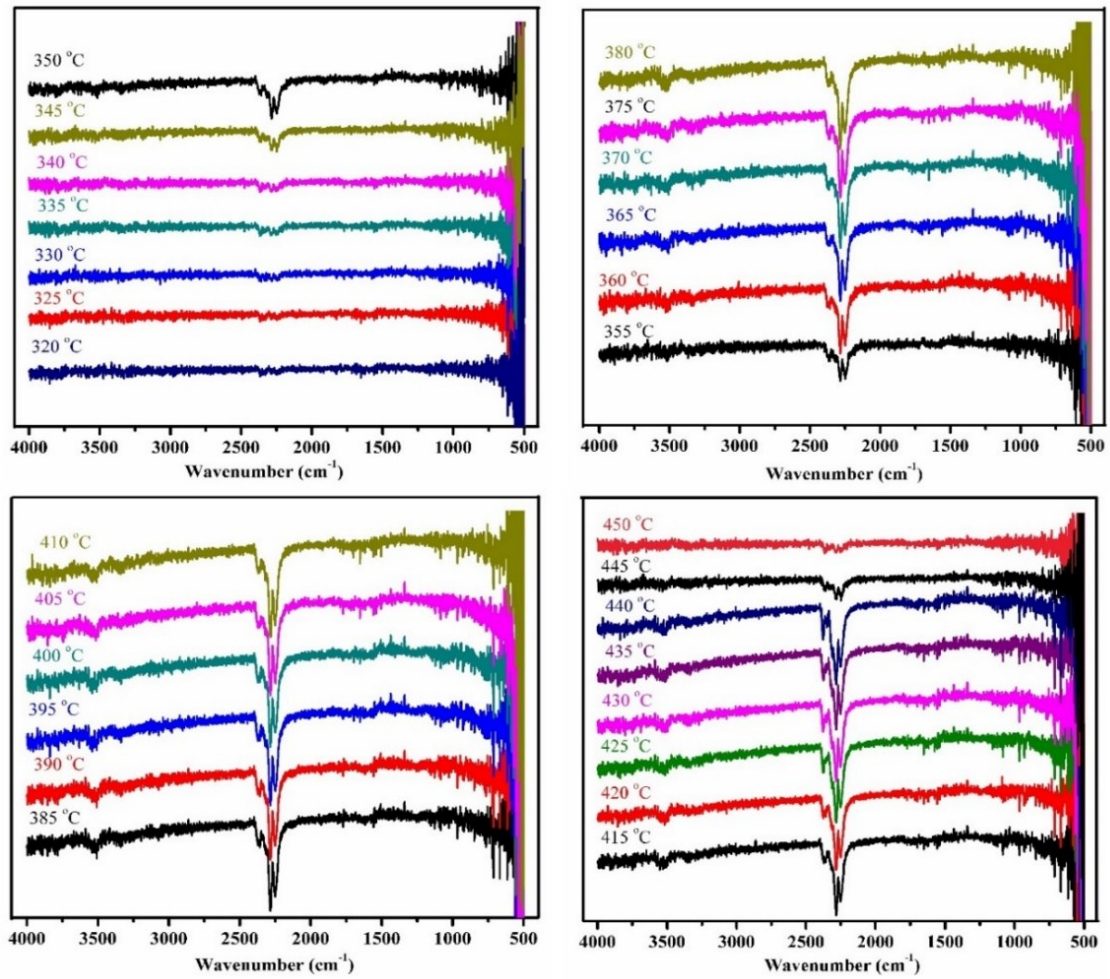


Fig. S5. Coupled TGA-IR spectra of compound 1 collected in the temperature range 320 – 450 ^{O}C.

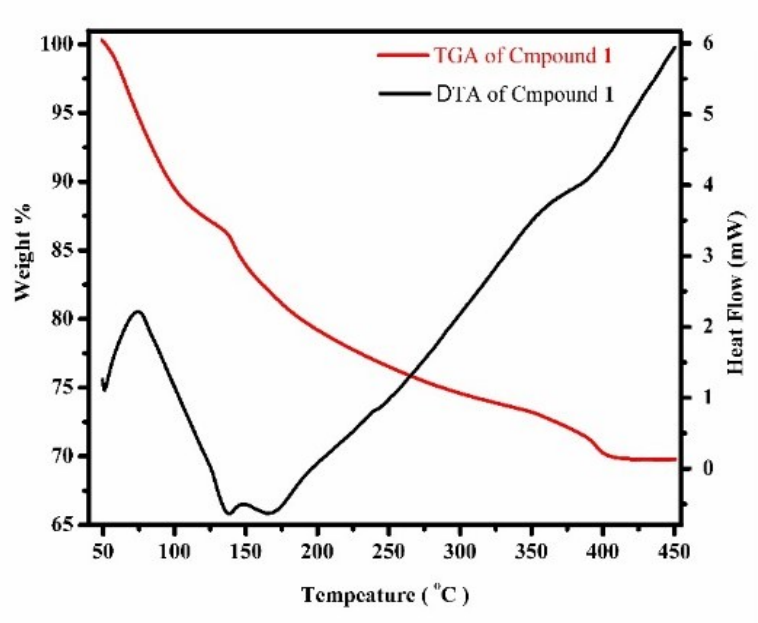


Fig. S6. TGA-DTA profile of coupled TGA-IR analysis of compound 1.

Section S4. Coupled TGA-Mass Spectra of compound 1

The carrier gas (He) was flushed through the sample port for 5 min prior to the measurement to eliminate the interference of atmospheric CO_2. The TGA profile was recorded in the temperature range 50 ^{O}C to 950 ^{O}C (10 ^{O}C/min, Fig. S4) and mass spectra were harvested between 3 to 42 min. A high intense mass peak at m/z = 44 corresponding to CO_2 observed in mass spectra of TGA effluent after 39th min in GC which corresponds to ~400 ^{O}C temperature in TGA.

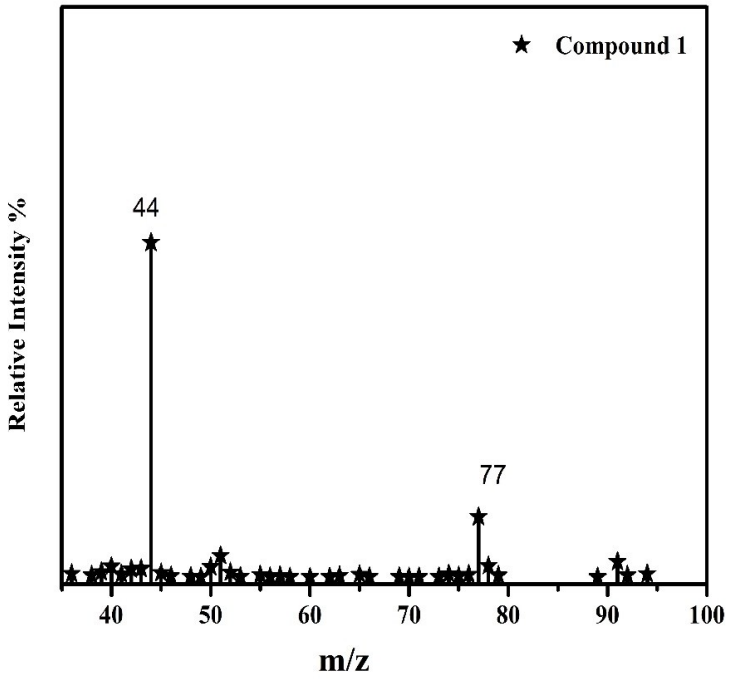


Fig. S7. Mass spectrum of Coupled TGA-Mass analysis of compound 1.

Section S5. Carbonate ion confirmation test for compound 1

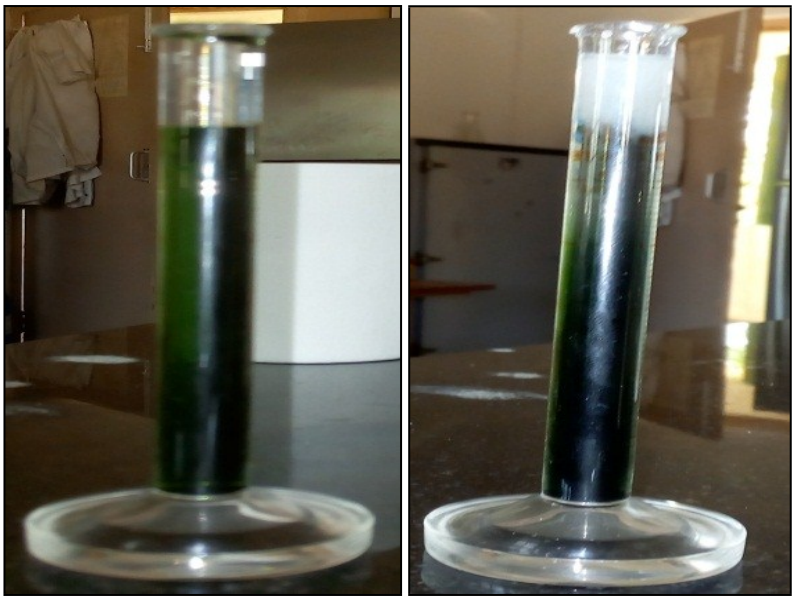


Fig. S8. Before (left), and after (right) addition of calcium hydroxide solution to the compound 1.

Section S6. Powder X-ray diffraction analysis of compounds 1 and 2, and amorphous compound

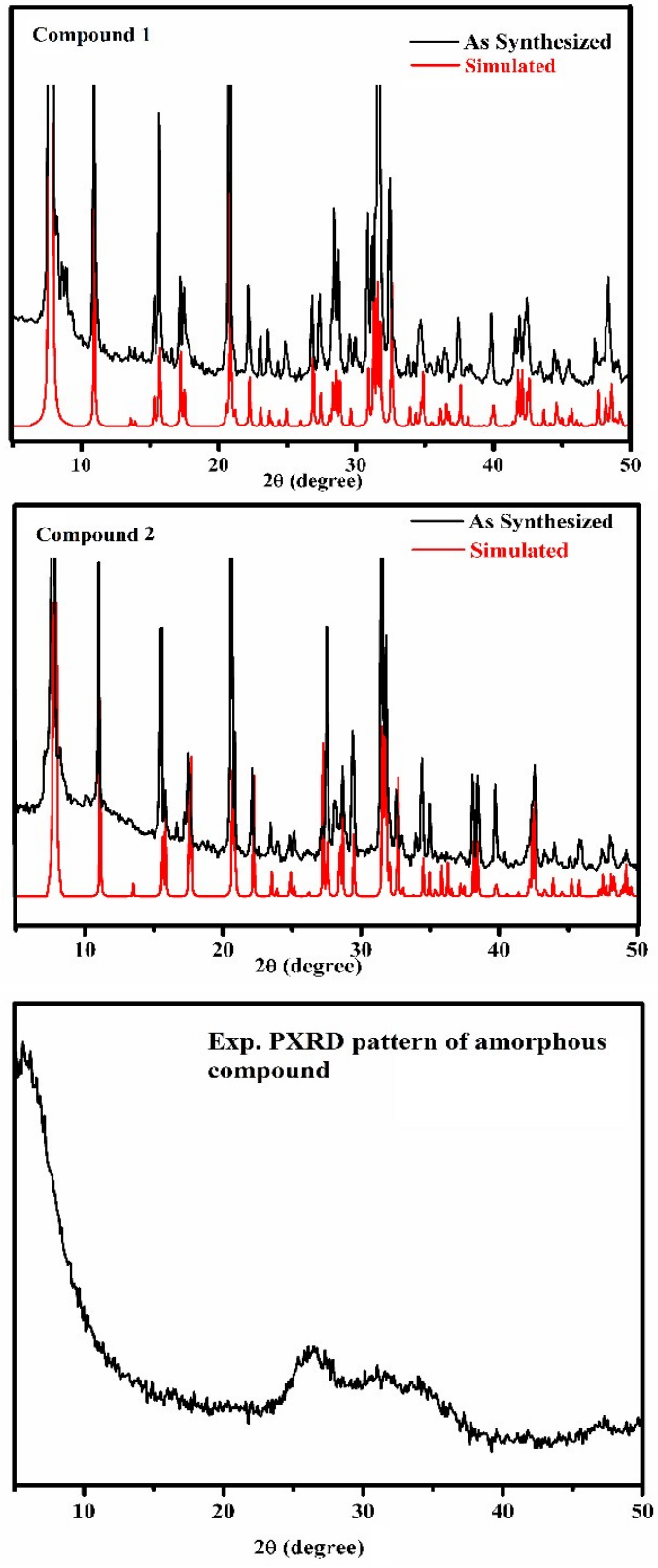


Fig. S9. Powder X-ray diffraction patterns of compounds 1 and 2, and amorphous compound.

Section S7. HRMS analysis reports of CO_2 conversion product in a Grignard reaction

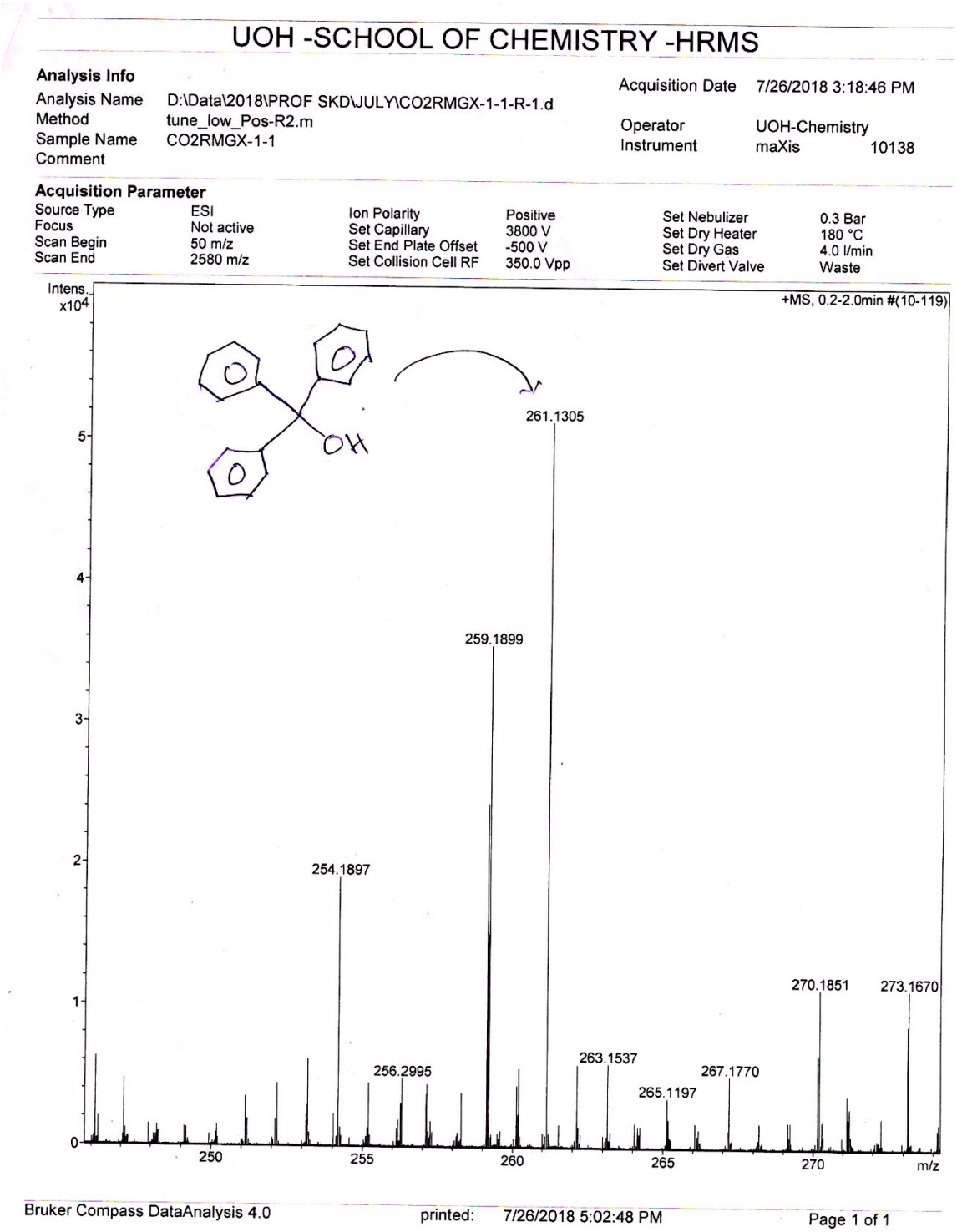


Fig. S10. HR-MS analysis report of triphenyl methanol in 1:1mmol (compound 1: PhMgBr reagent) ratio reaction.

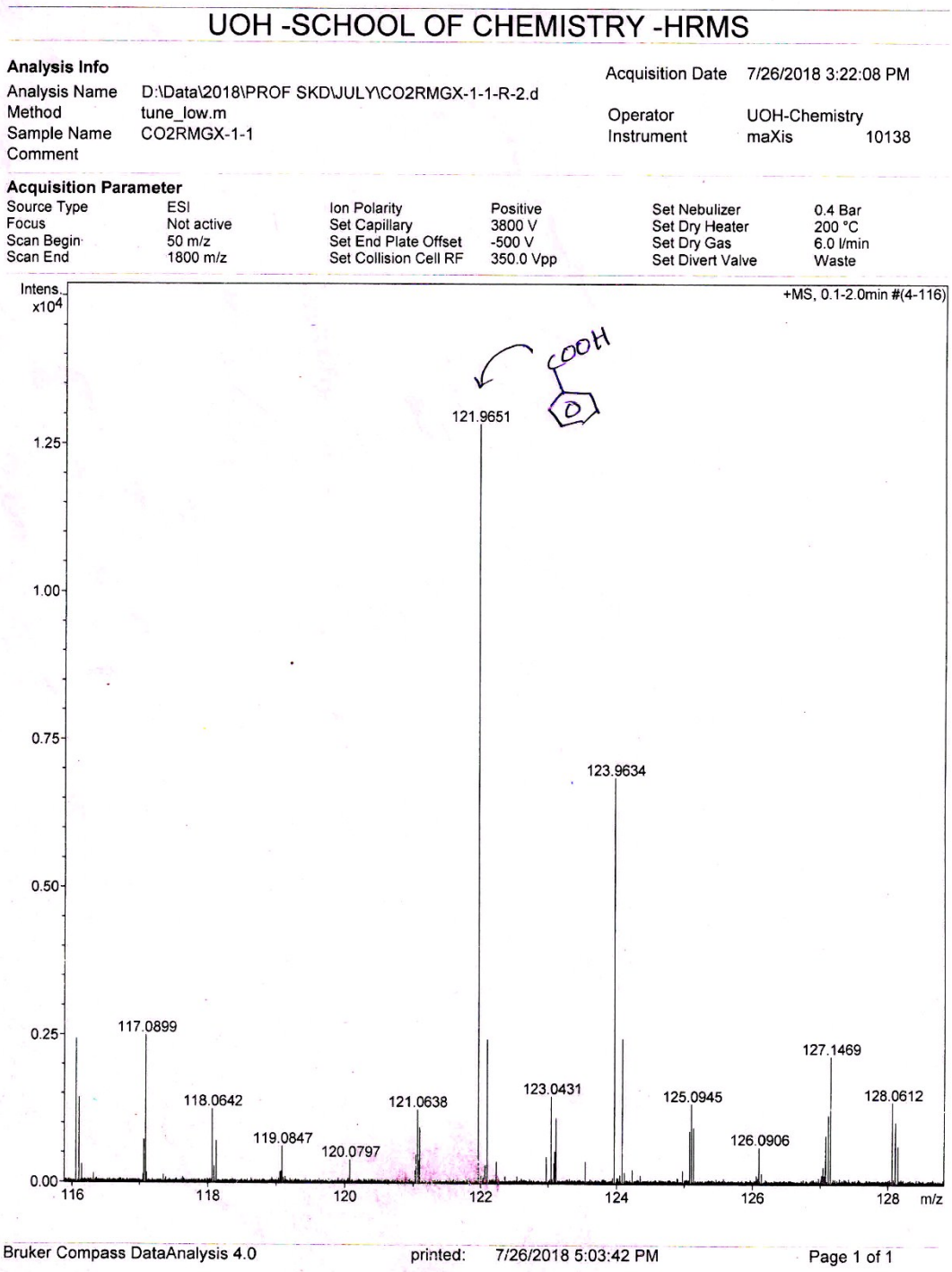


Fig. S11. HR-MS analysis report of benzoic acid in 1:1 mmol (compound 1: PhMgBr reagent) ratio reaction.

Section S8. Bond valance sum (BVS) calculations of compounds 1 and 2

Compound 1

Bond valence calculation. Numbers in brackets after atom symbols are at.no., r and c - see *O"Keeffe and Brese, J.A.C.S. 1991, 113, 3226.*

V1

V (23, 1.21, 1.45)				Rij	Dij	Vij
	-O	(8,	.63, 3.15)	1.77	1.62	1.50
	-O	(8,	.63, 3.15)	1.77	1.93	.65
	-O	(8,	.63, 3.15)	1.77	1.93	.65
	-O	(8,	.63, 3.15)	1.77	1.91	.70
	-O	(8,	.63, 3.15)	1.77	2.00	.55

Bond valence sum for V 4.05

V2

V (23, 1.21, 1.45)				Rij	Dij	Vij
	-O	(8,	.63, 3.15)	1.77	1.97	.59
	-O	(8,	.63, 3.15)	1.77	1.95	.63
	-O	(8,	.63, 3.15)	1.77	1.63	1.48
	-O	(8,	.63, 3.15)	1.77	1.83	.85
	-O	(8,	.63, 3.15)	1.77	1.92	.67

Bond valence sum for V 4.22

V3

V (23, 1.21, 1.45)				Rij	Dij	Vij
	-O	(8,	.63, 3.15)	1.77	2.29	.25
	-O	(8,	.63, 3.15)	1.77	1.64	1.42
	-O	(8,	.63, 3.15)	1.77	1.94	.63
	-O	(8,	.63, 3.15)	1.77	1.94	.63
	-O	(8,	.63, 3.15)	1.77	2.05	.47

Bond valence sum for V 3.40

Compound 2

V1

V (23, 1.21, 1.45)				Rij	Dij	Vij
	-O	(8,	.63, 3.15)	1.77	1.61	1.58
	-O	(8,	.63, 3.15)	1.77	1.92	.68
	-O	(8,	.63, 3.15)	1.77	1.95	.62

```
                      -O  ( 8,  .63, 3.15) 1.77  1.92   .68
                      -O  ( 8,  .63, 3.15) 1.77  1.95   .62

  Bond valence sum for V   4.18


V2

  V  (23, 1.21, 1.45)                          Rij   Dij   Vij
                      -O  ( 8,  .63, 3.15) 1.77  1.62  1.51
                      -O  ( 8,  .63, 3.15) 1.77  2.01   .53
                      -O  ( 8,  .63, 3.15) 1.77  1.82   .88
                      -O  ( 8,  .63, 3.15) 1.77  1.91   .68
                      -O  ( 8,  .63, 3.15) 1.77  1.91   .68

  Bond valence sum for V   4.28

V3

  V  (23, 1.21, 1.45)                          Rij   Dij   Vij
                      -O  ( 8,  .63, 3.15) 1.77  1.61  1.55
                      -O  ( 8,  .63, 3.15) 1.77  1.98   .58
                      -O  ( 8,  .63, 3.15) 1.77  1.98   .58
                      -O  ( 8,  .63, 3.15) 1.77  1.98   .58
                      -O  ( 8,  .63, 3.15) 1.77  1.98   .58

  Bond valence sum for V   3.87
```

Section S9. X-ray photoelectron spectroscopy (XPS)

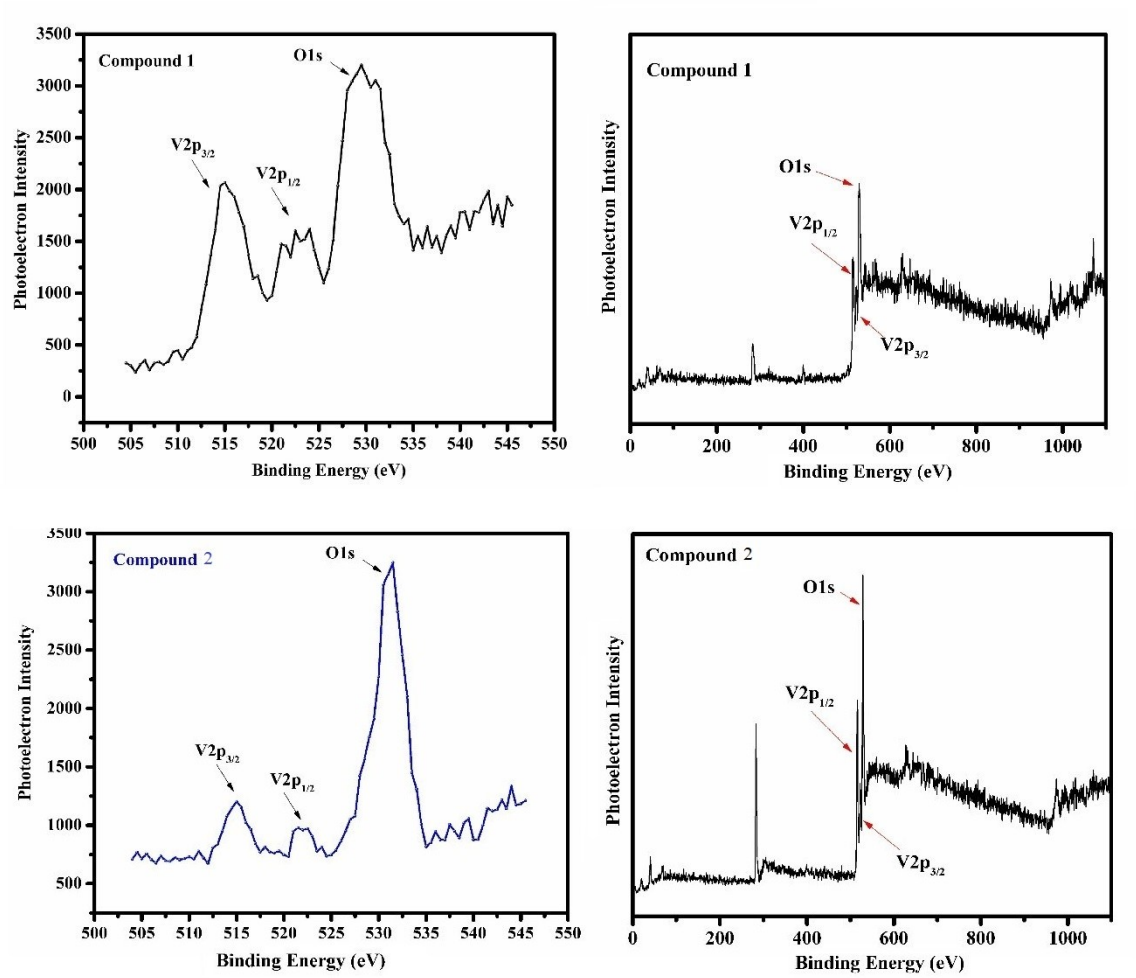


Fig. S12. Core level and areal X-ray photoelectron spectroscopy of compounds 1 and 2.

Section S10. Calculations for Manganometric determination of Vanadium oxidation states in compounds 1 and 2

Compound 1

S No.	0.05N vanadium(IV) in 0.2N H_2SO_4 solution (mL)	Taken amount of 0.05N $KMnO_4$ (in Burette)	
		Initial (mL)	End point (mL)
1	10	0	10.3
2	10	0	10.4
3	10	0	10.4
Average titre value			10.36

Compound 2

S No.	0.05N vanadium(IV) in 0.2N H_2SO_4 solution (mL)	Taken amount of 0.05N $KMnO_4$ (in Burette)	
		Initial (mL)	End point (mL)
1	10	0	10.5
2	10	0	10.5
3	10	0	10.5
Average titre value			10.5

Formula for calculation:

$$\{V^{IV}_{15}\} + 3\ KMnO_4 + 24\ H^+ \rightarrow \{V^{V}_{15}\} + 3\ Mn^{2+} + 12H_2O$$

10 mL of 0.05 N of $KMnO_4$ = 15 no. of V^{IV} centres (in 10 mL of 0.05 N of V15 cluster)
x mL of 0.05 N of $KMnO_4$ = No. of V^{IV} centres (in 10 mL of 0.05 N of V15 cluster)

$$No.\ of\ V(IV)\ centers\ present(in\ 10\ mL\ of\ 0.05\ N\ of\ V15\ cluster) = \frac{15 \times x\ mL\ of\ KMnO4\ (0.05\ N)}{10\ mL\ of\ KMnO4\ (0.05\ N)}$$

For Compound 1,

$$No.\ of\ V(IV)\ centers\ present\ (in\ 10\ mL\ of\ 0.05\ N\ of\ V15\ cluster) = \frac{15 \times 10.36\ mL\ of\ KMnO4\ (0.05\ N)}{10\ mL\ of\ KMnO4\ (0.05\ N)}$$

$$= 15.54$$

For Compound 2,

$$No.\ of\ V(IV)\ centers\ present(in\ 10\ mL\ of\ 0.05\ N\ of\ V15\ cluster) = \frac{15 \times 10.5\ mL\ of\ KMnO4\ (0.05\ N)}{10\ mL\ of\ KMnO4\ (0.05\ N)}$$

$$=15.75$$

Section S11. ICP-OES and CHN analysis reports of compounds 1 and 2

PBMDJFKBOCKEIH
KAOFMBJF
PMJHAEGKBFCJGD
ILBAJOBF
PKCAFAJGBHHGPC
FGKJPHBF

Issued to:

Prof. Samar K. Das
C/o Prof .Samar K.Das Lab -School of chemistry
University of Hyderabad - 019

Kind Attn.:M.sateesh

Report No. : LLPL/16-17/008631
Issue Date : 21/12/2016
Customer Ref.: TRF

Ref.Date : 17/12/2016

Sample Particulars : SKD13

Qty. Received : 260mg, Packed in Sealed bottle

Test Parameters : Vanadium as V,Sodium as Na

Date of Receipt of Sample : 19/12/2016
Date of completion of analysis : 21/12/2016

Date of Starting of Analysis : 21/12/2016

SAMPLE TESTED AS RECEIVED

TEST RESULTS

S.No.	Parameters	UOM	Results
1	Vanadium as V	% by mass	34.96
2	Sodium as Na	% by mass	6.58

Instrument Used: ICP-OES Varian 720-ES
NOTE : This report and results relate only to the sample / items tested.

R.V. Rama Rao
Authorized Signatory

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Fig. S13. ICP-OES analysis report of compound 1.

PBMDJFKBOCKEIH
KAPHKAJF
PMJHCEHNJFCJGD
IPJMBEDF
PKCAFAJGDHHGPA
LJJEHEEF

Issued to:

Prof. Samar K. Das

C/o Prof .Samar K.Das Lab -School of chemistry
University of Hyderabad - 019

Kind Attn.:M.sateesh, +91 9908652965

Report No. : LLPL/17-18/008151
Issue Date : 10/02/2018
Customer Ref.: TRF

Ref.Date : 07/12/2017

Sample Particulars : V15(CO3)

Qty. Received : 150mg, Polythene Cover

Test Parameters : Bismuth as Bi

Date of Receipt of Sample : 06/02/2018
Date of completion of analysis : 10/02/2018

Date of Starting of Analysis : 10/02/2018

SAMPLE TESTED AS RECEIVED

TEST RESULTS

S.No.	Parameters	UOM	Results
1	Bismuth as Bi	ppm	<10.0

Instrument Used: ICP-OES Varian 720-ES

NOTE : This report and results relate only to the sample / items tested.

R.V. Rama Rao
Authorized Signatory

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Fig. S14. ICP-OES analysis report of compound 1.

PBMDJFKBOEKCMG
NFJFJGJF
PNCJCCCAEDCJOE
INDDAIDF
PDBCNFCJGEKCHO
KJNIHHBF

Issued to:

Prof. Samar K. Das
C/o Prof .Samar K.Das Lab -School of chemistry
University of Hyderabad - 019

Kind Attn.:Mr.M.Sateesh

Report No. : LLPL/D/16-17/002209
Issue Date : 21/12/2016
Customer Ref.: TRF

Ref.Date : 30/11/2016

Sample Particulars : [V15(Cl)]

Qty. Received : 0.45gm ,Packed in Sealed bottle

Test Parameters : Vanadium as V,Sodium as Na,Chloride as Cl

Date of Receipt of Sample : 30/11/2016
Date of completion of analysis : 21/12/2016

Date of Starting of Analysis : 05/12/2016

SAMPLE TESTED AS RECEIVED

TEST RESULTS

S.No.	Parameters	UOM	Results
1	Vanadium as V	% by mass	35.53
2	Sodium as Na	% by mass	10.58
3	Chloride as Cl	% by mass	1.68

Instrument Used: ICP-OES Varian 720-ES & IS 3025 part 32
NOTE : This report and results relate only to the sample / items tested.

R.V. Rama Rao
Authorized Signatory

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Fig. S15. CHN analysis report of compound 1.

Fig. S16. ICP-OES report analysis of compound 2.

**********End**********