Supporting Information for:

'$Ln_2(OH)_5NO_3.xH_2O$ (Ln = Y, Gd – Lu) – A Novel Family of Anion Exchange Intercalation Hosts' Laura J. McIntyre, Lauren K. Jackson and Andrew M. Fogg

$Y_2(OH)_5NO_3.xH_2O$

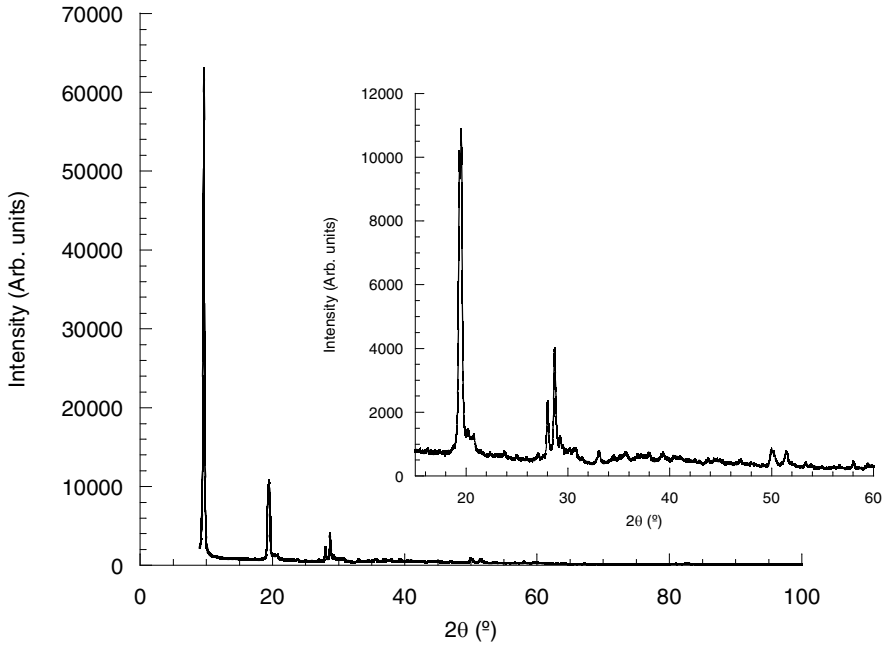

Figure S1 Powder X-ray diffraction pattern of $Y_2(OH)_5NO_3.xH_2O$.

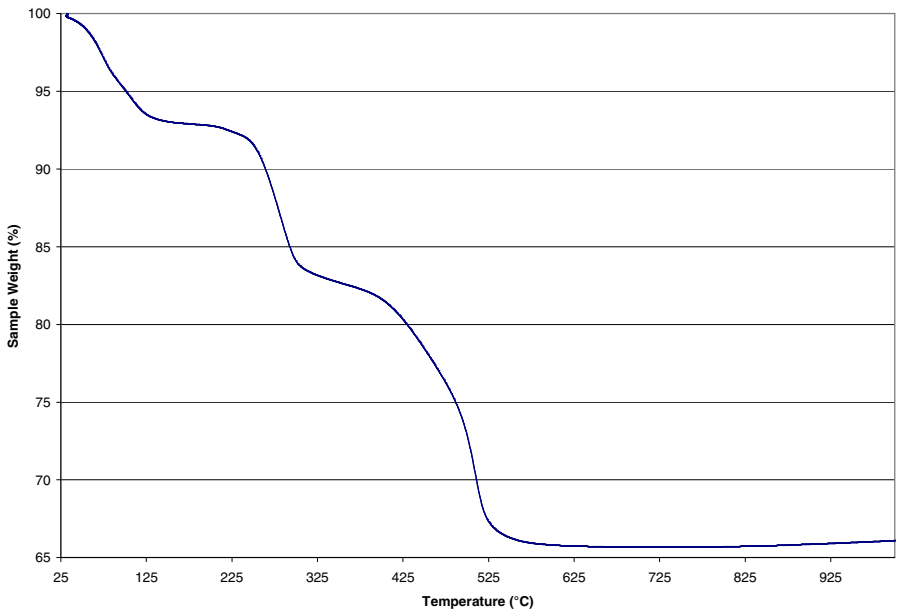

Figure S2 TGA trace for $Y_2(OH)_5NO_3.xH_2O$ showing mass losses of 6.86 % below 150 ºC and further mass losses of 9.79 % by 350 ºC and 17.28 % by 600 ºC.

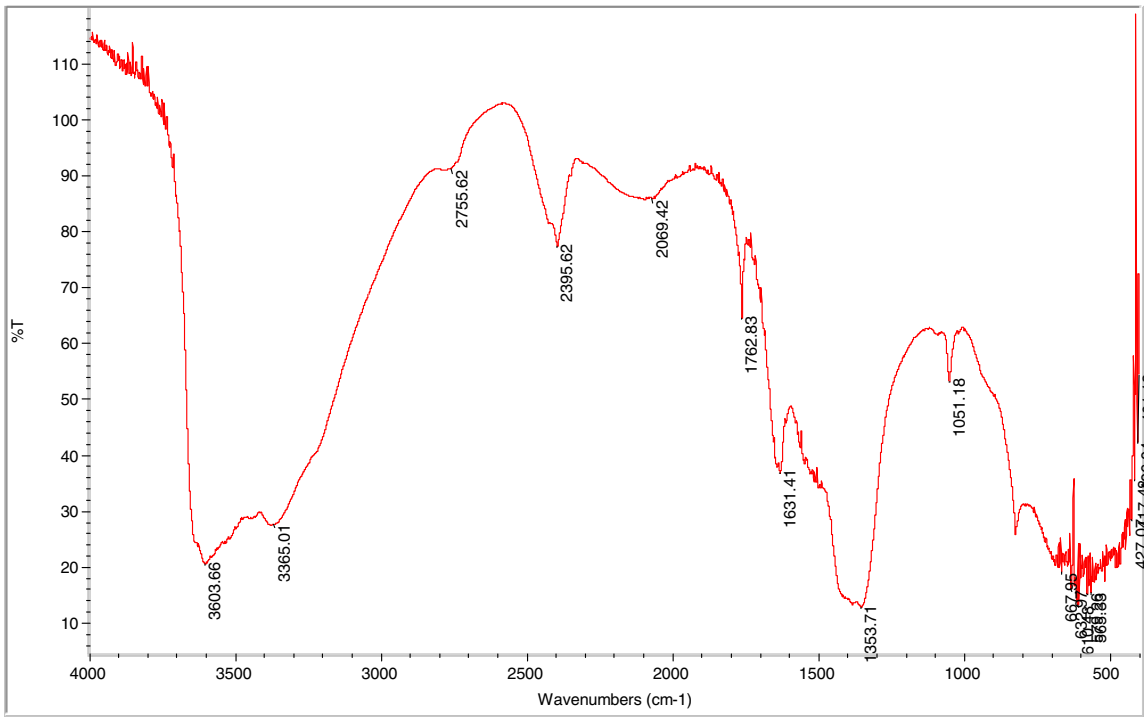

Figure S3 FTIR spectrum of $Y_2(OH)_5NO_3.xH_2O$ showing bands due to uncoordinated NO_3^- anions (1370 cm^{-1}) and OH/H_2O (approx. 3500 cm^{-1}).

$Gd_2(OH)_5NO_3.xH_2O$

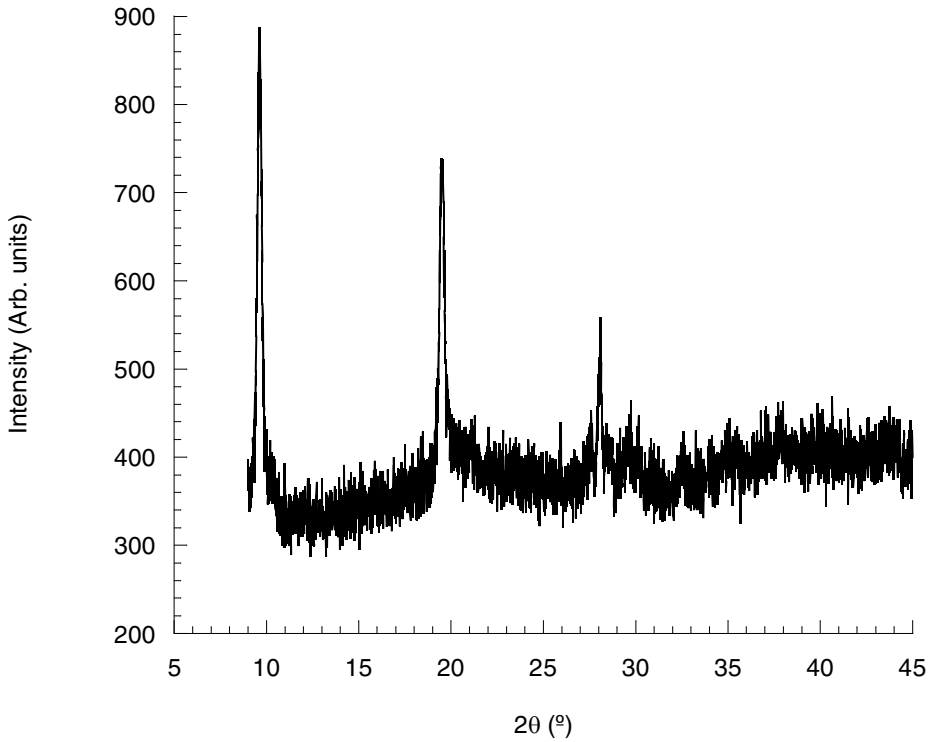

Figure S4 Powder X-ray diffraction pattern of $Gd_2(OH)_5NO_3.xH_2O$.

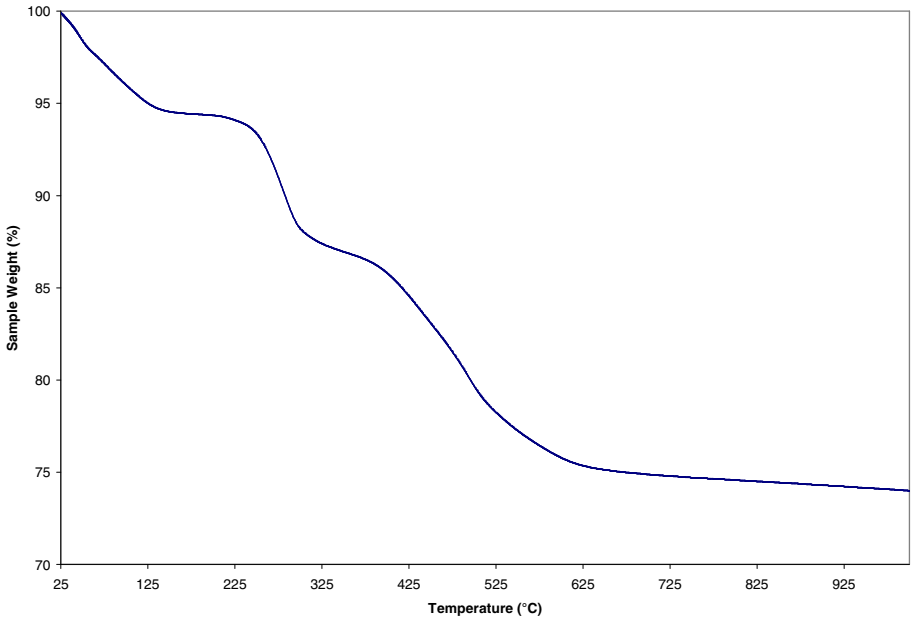

Figure S5 TGA trace for $Gd_2(OH)_5NO_3.xH_2O$ showing mass losses of 5.57 % below 170 ºC and further mass losses of 7.51 % by 350 ºC and 12.24 % by 750 ºC.

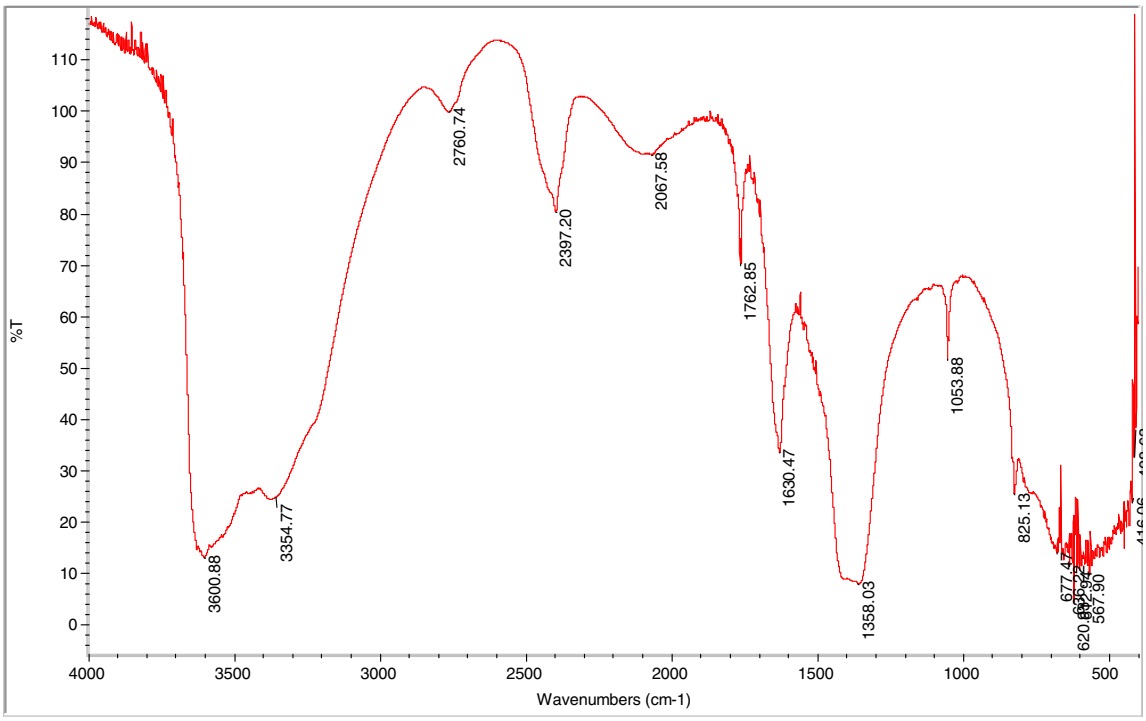

Figure S6 FTIR spectrum of $Gd_2(OH)_5NO_3.xH_2O$ showing bands due to uncoordinated NO_3^- anions (1370 cm^{-1}) and OH/H_2O (approx. 3500 cm^{-1}).

$Tb_2(OH)_5NO_3.xH_2O$

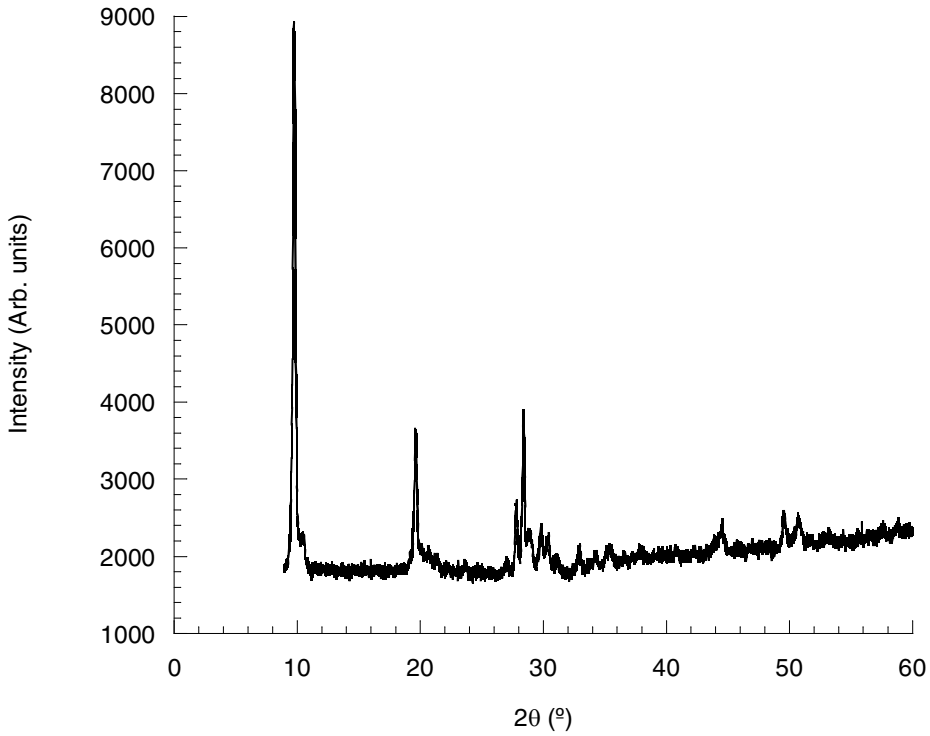

Figure S7 Powder X-ray diffraction pattern of $Tb_2(OH)_5NO_3.xH_2O$.

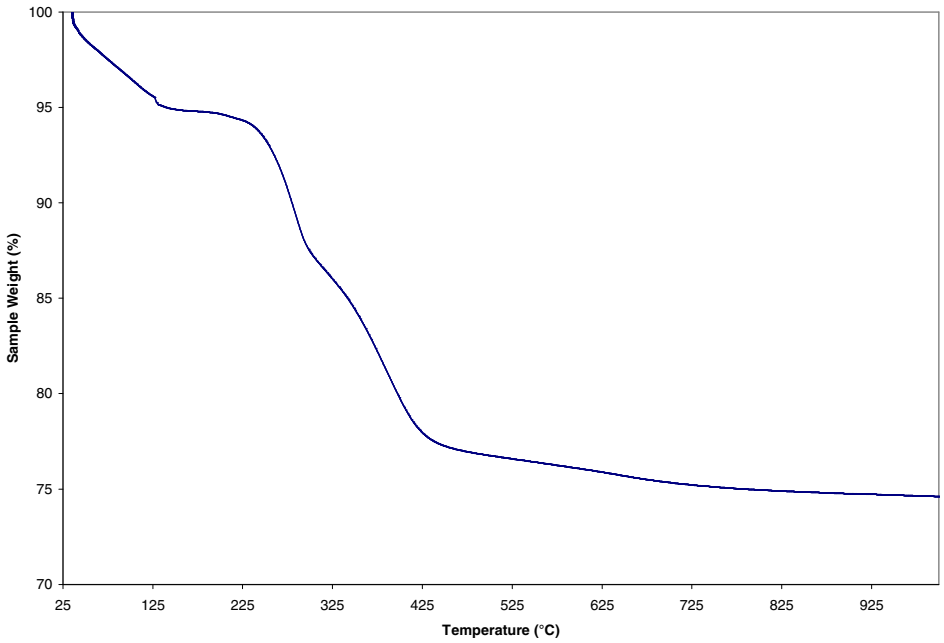

Figure S8 TGA trace for $Tb_2(OH)_5NO_3.xH_2O$ showing mass losses of 5.20 % below 170 ºC and further mass losses of 9.36 % by 350 ºC and 10.69 % by 750 ºC.

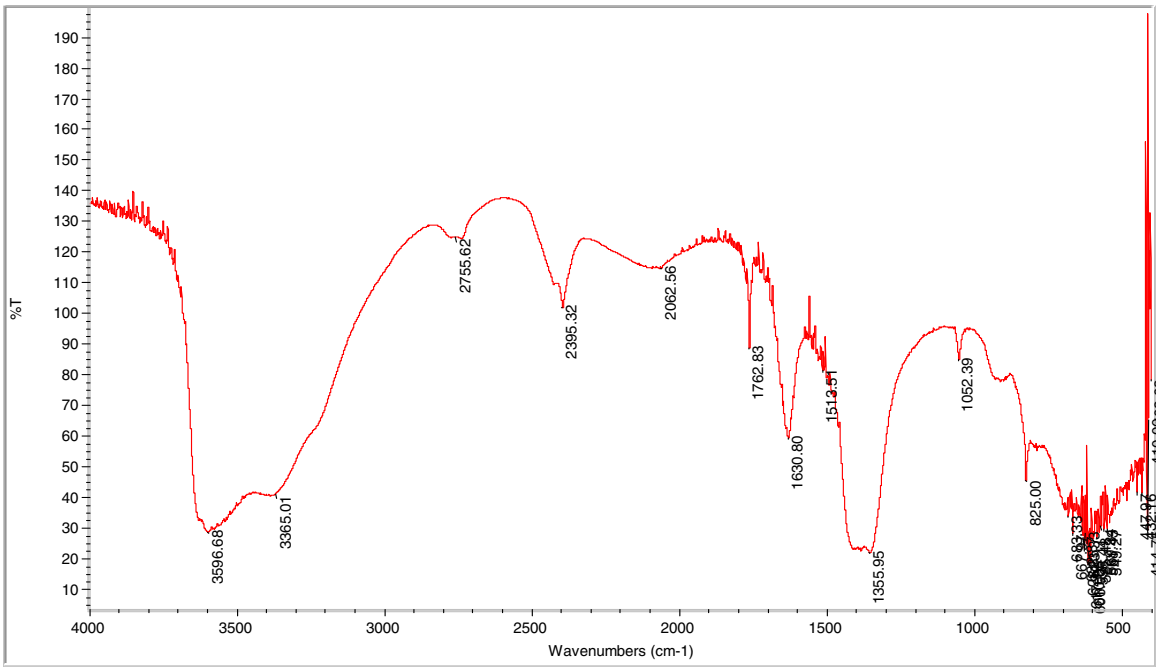

Figure S9 FTIR spectrum of $Tb_2(OH)_5NO_3.xH_2O$ showing bands due to uncoordinated NO_3^- anions (1370 cm^{-1}) and OH/H_2O (approx. 3500 cm^{-1}).

$Dy_2(OH)_5NO_3.xH_2O$

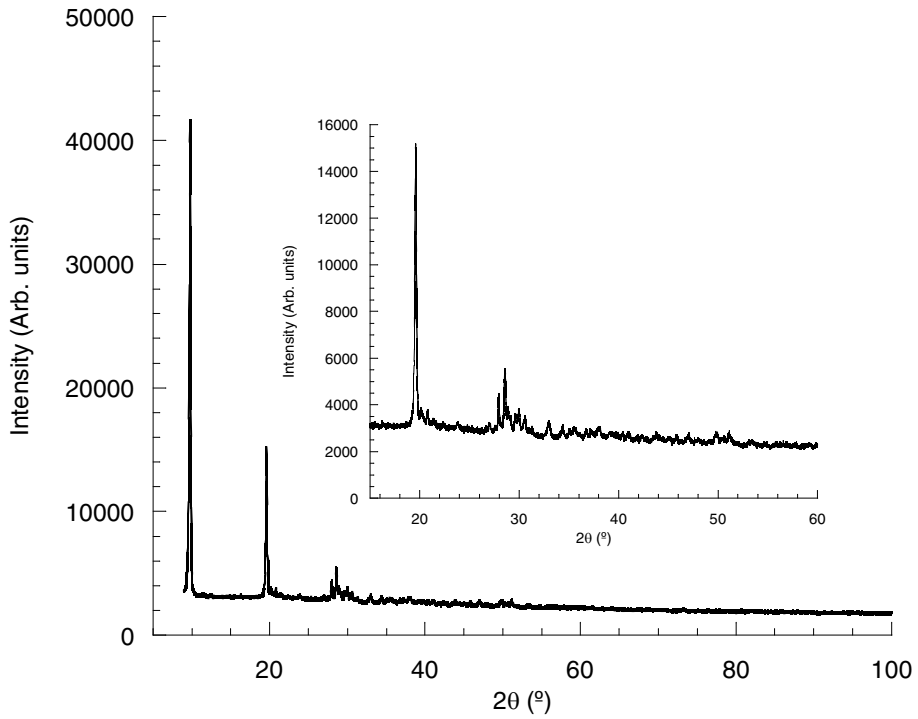

Figure S10 Powder X-ray diffraction pattern of $Dy_2(OH)_5NO_3.xH_2O$.

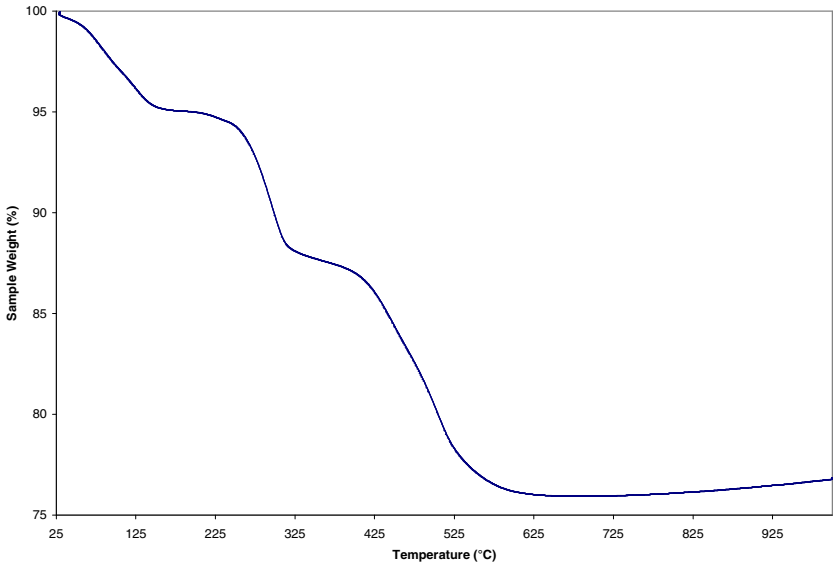

Figure S11 TGA trace for $Dy_2(OH)_5NO_3.xH_2O$ showing mass losses of 4.95 % below 150 ºC and further mass losses of 7.35 % by 350 ºC and 11.77 % by 650 ºC.

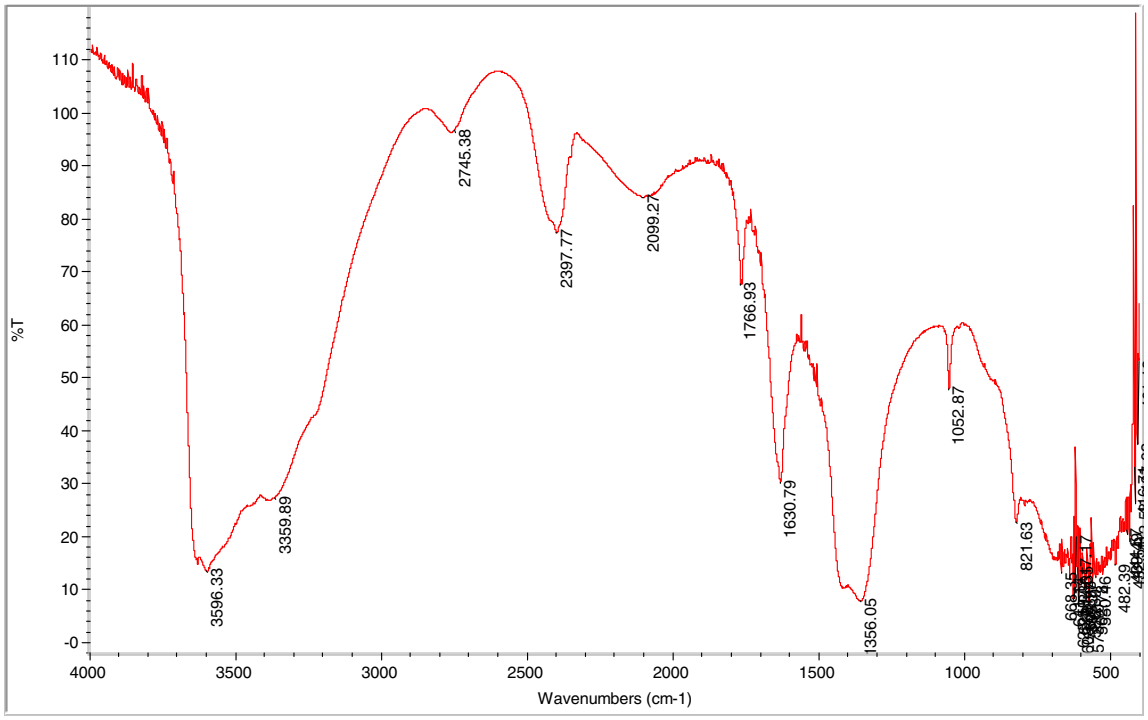

Figure S12 FTIR spectrum of $Dy_2(OH)_5NO_3.xH_2O$ showing bands due to uncoordinated NO_3^- anions (1370 cm^{-1}) and OH/H_2O (approx. 3500 cm^{-1}).

$Ho_2(OH)_5NO_3.xH_2O$

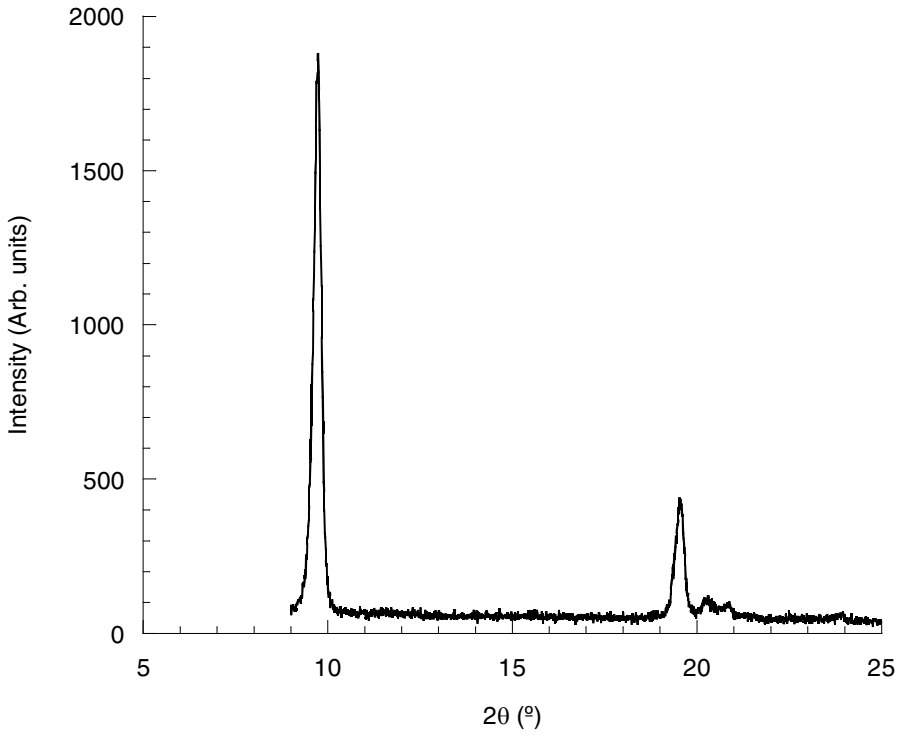

Figure S13 Powder X-ray diffraction pattern of $Ho_2(OH)_5NO_3.xH_2O$.

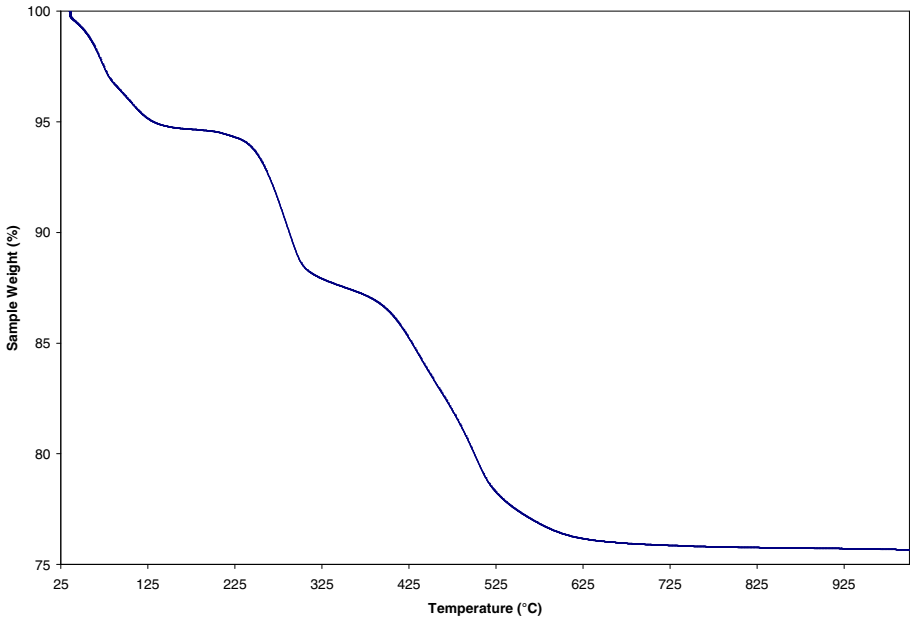

Figure S14 TGA trace for $Ho_2(OH)_5NO_3.xH_2O$ showing mass losses of 5.34 % below 170 ºC and further mass losses of 7.09 % by 350 ºC and 11.67 % by 750 ºC.

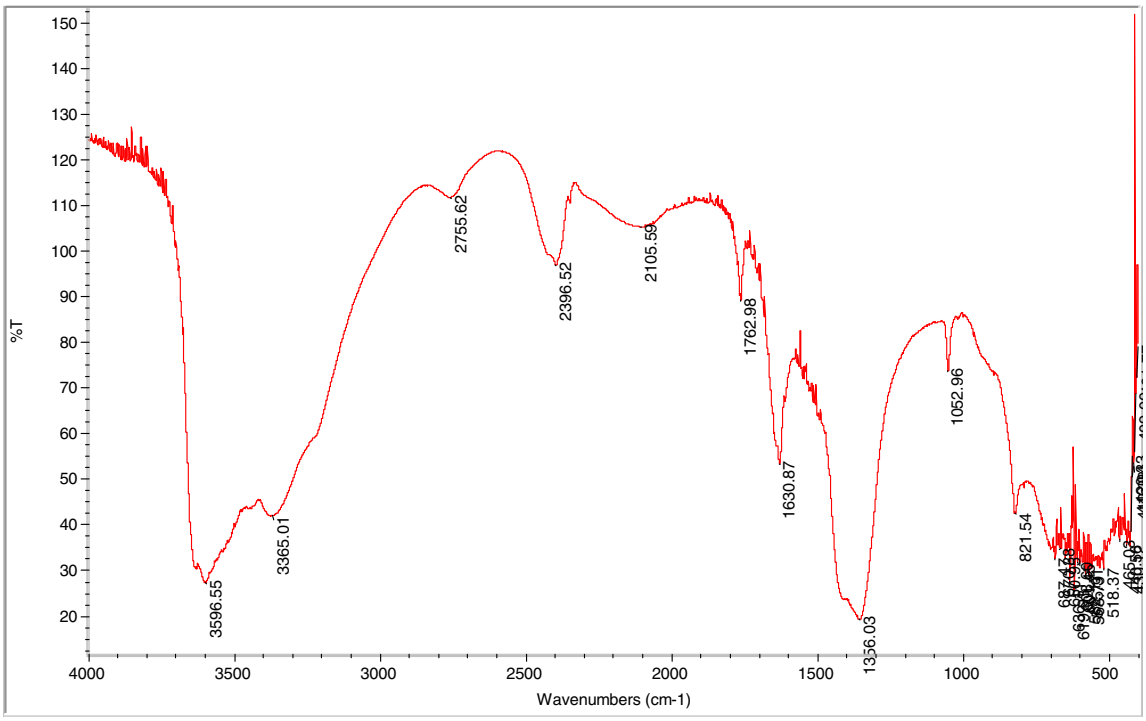

Figure S15 FTIR spectrum of $Ho_2(OH)_5NO_3.xH_2O$ showing bands due to uncoordinated NO_3^- anions (1370 cm^{-1}) and OH/H_2O (approx. 3500 cm^{-1}).

$Er_2(OH)_5NO_3.xH_2O$

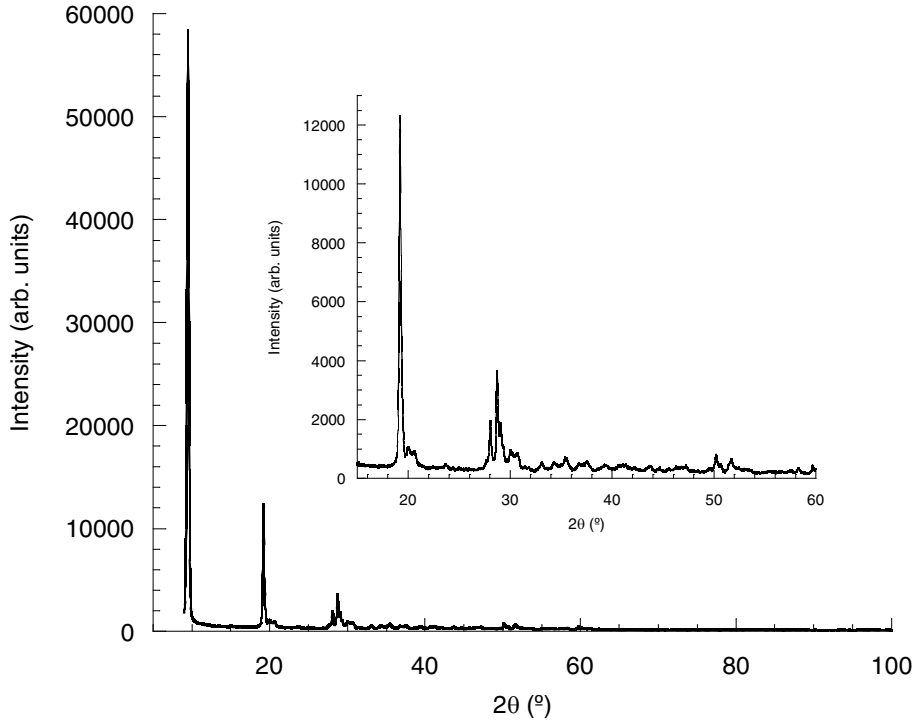

Figure S16 Powder X-ray diffraction pattern of $Er_2(OH)_5NO_3.xH_2O$.

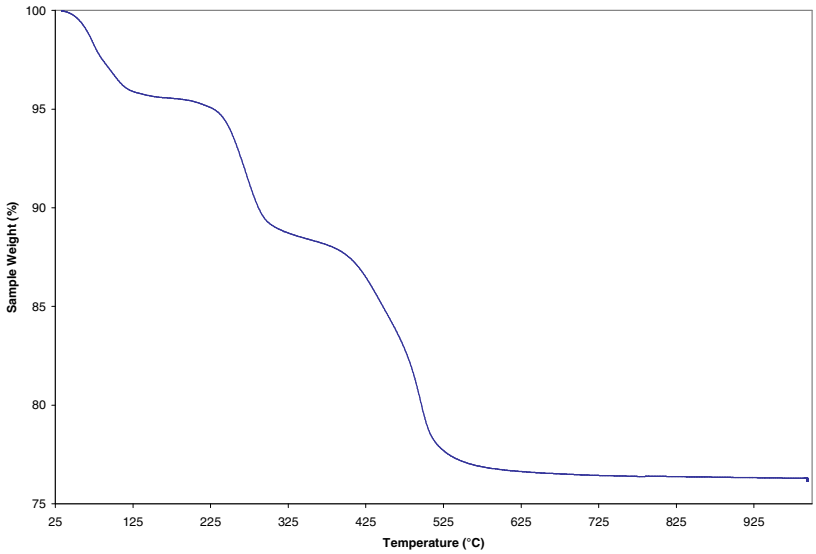

Figure S17 TGA trace for $Er_2(OH)_5NO_3.xH_2O$ showing mass losses of 4.35 % below 150 ºC and further mass losses of 7.24 % by 350 ºC and 11.68 % by 650 ºC.

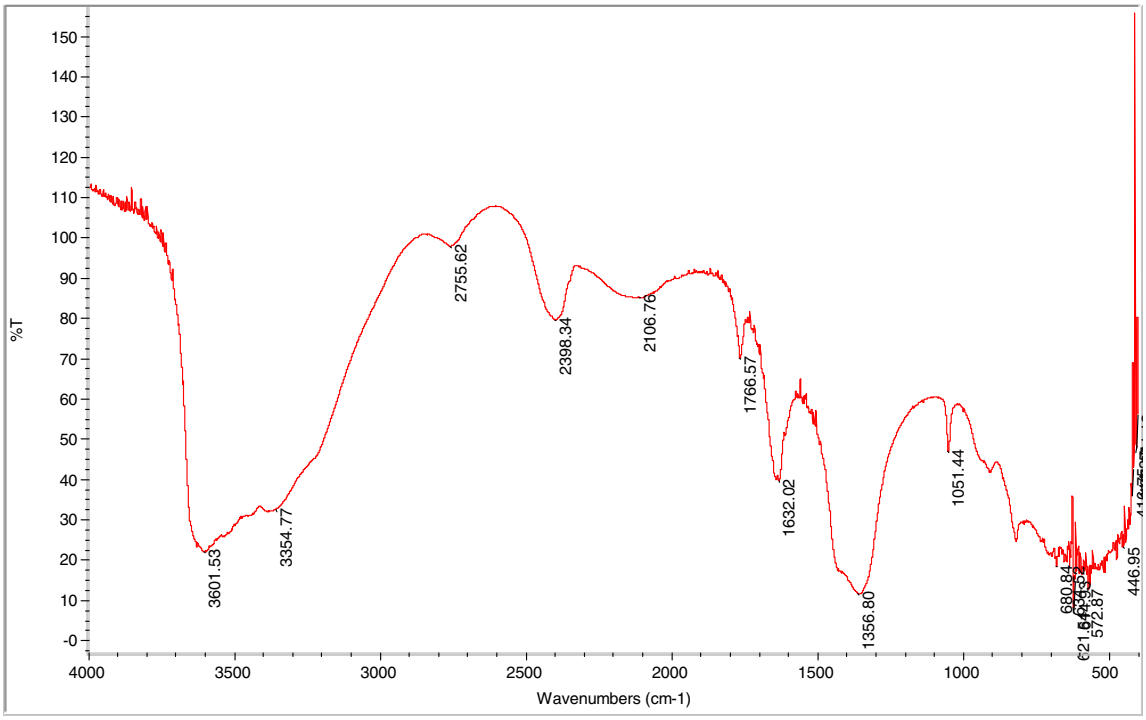

Figure S18 FTIR spectrum of $Er_2(OH)_5NO_3.xH_2O$ showing bands due to uncoordinated NO_3^- anions (1370 cm^{-1}) and OH/H_2O (approx. 3500 cm^{-1}).

$Tm_2(OH)_5NO_3.xH_2O$

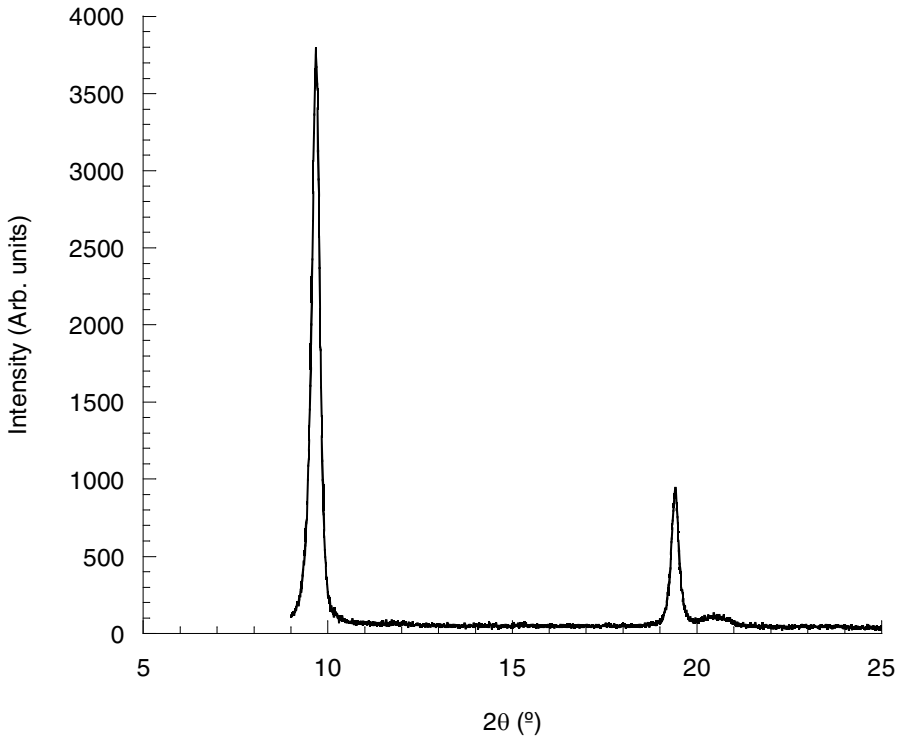

Figure S19 Powder X-ray diffraction pattern of $Tm_2(OH)_5NO_3.xH_2O$.

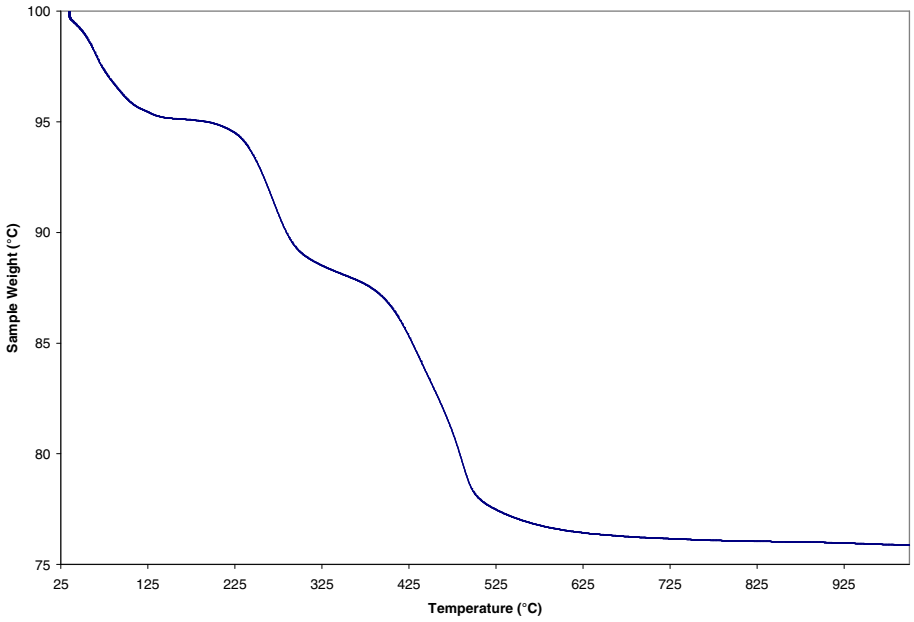

Figure S20 TGA trace for $Tm_2(OH)_5NO_3.xH_2O$ showing mass losses of 4.84 % below 170 ºC and further mass losses of 7.07 % by 350 ºC and 11.84 % by 750 ºC.

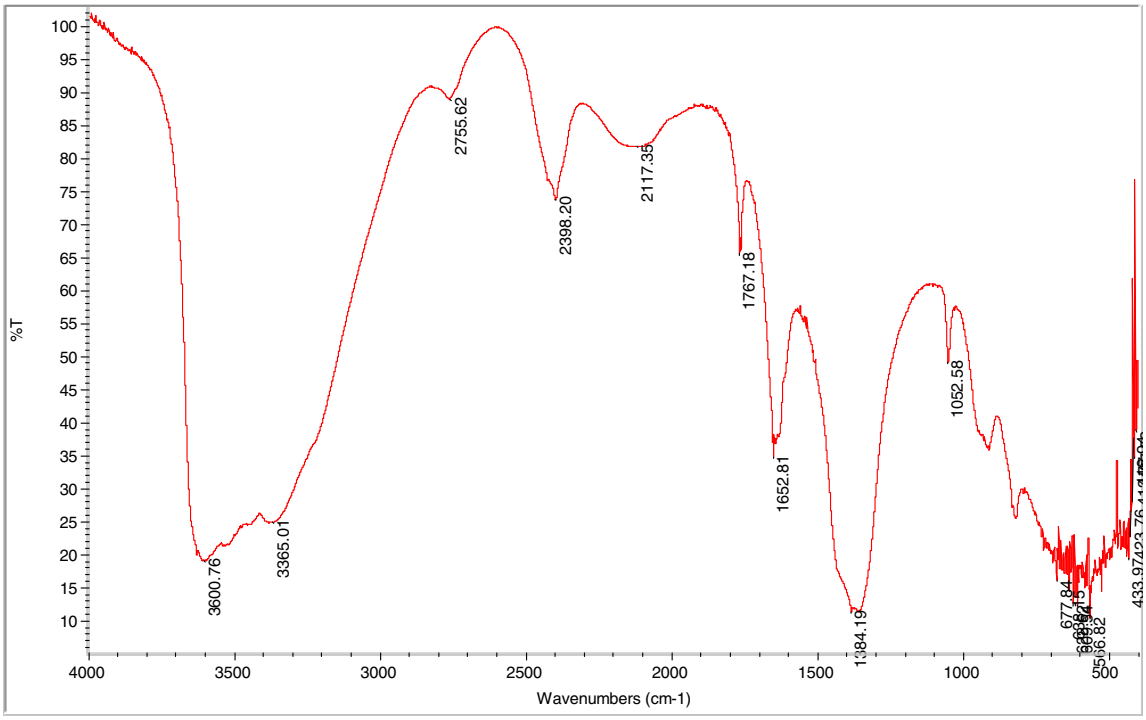

Figure S21 FTIR spectrum of $Tm_2(OH)_5NO_3.xH_2O$ showing bands due to uncoordinated NO_3^- anions (1370 cm^{-1}) and OH/H_2O (approx. 3500 cm^{-1}).

$Yb_2(OH)_5NO_3.xH_2O$

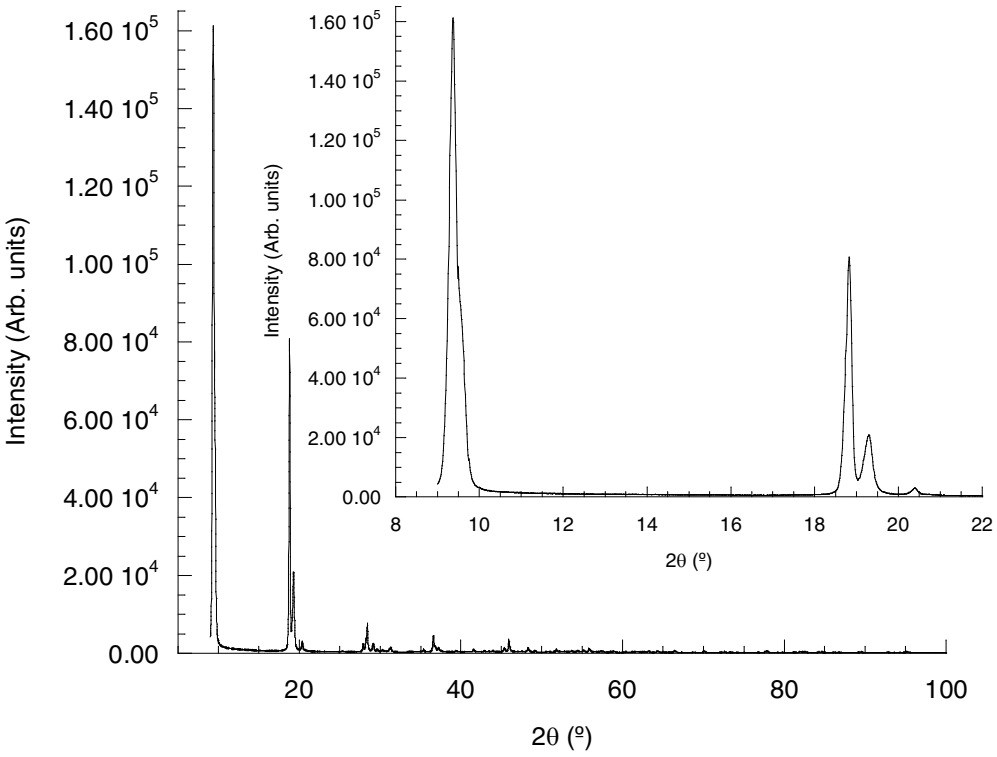

Figure S22 Powder X-ray diffraction pattern of $Yb_2(OH)_5NO_3.xH_2O$. INSET: Expanded region showing the presence of a second phase.

$Lu_2(OH)_5NO_3.xH_2O$

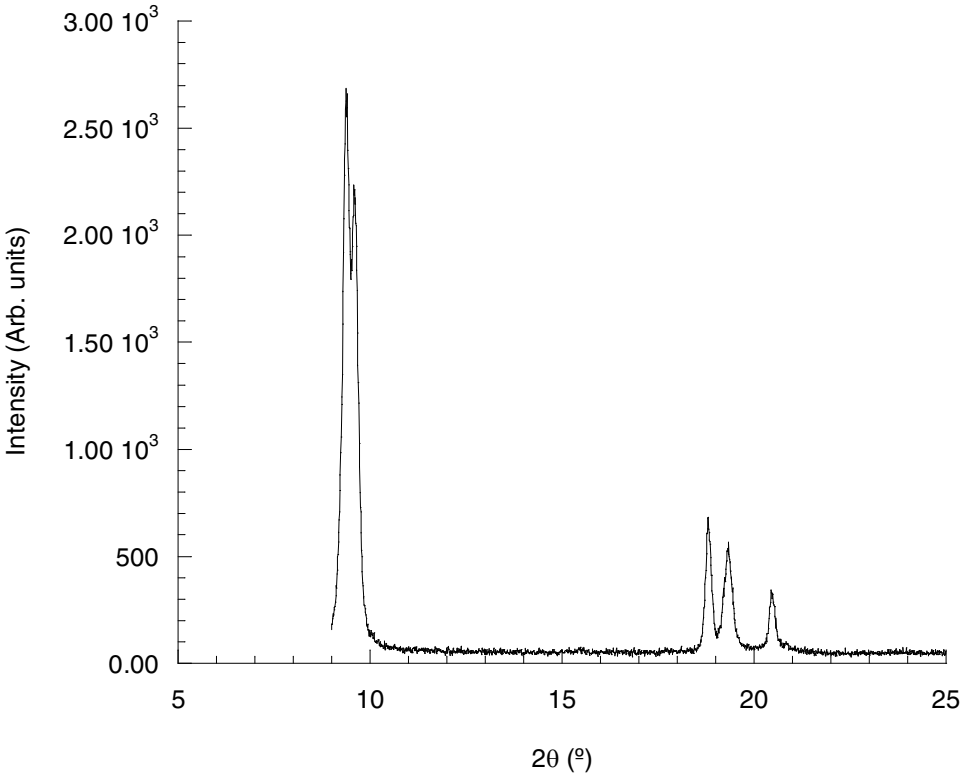

Figure S23 Powder X-ray diffraction pattern of $Lu_2(OH)_5NO_3.xH_2O$ showing the presence of a second phase.

Anion Exchange Derivatives of $Y_2(OH)_5NO_3.xH_2O$

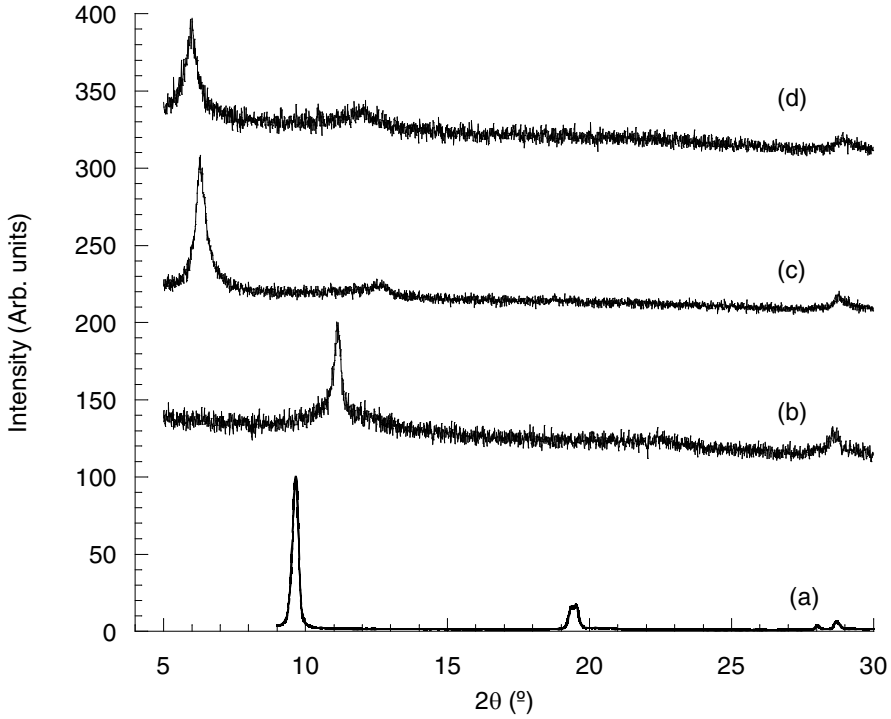

Figure S24 Powder X-ray diffraction patterns of (a) $Y_2(OH)_5NO_3.xH_2O$ and the anion exchange derivatives with (b) oxalate, (c) phthalate and (d) suberate.

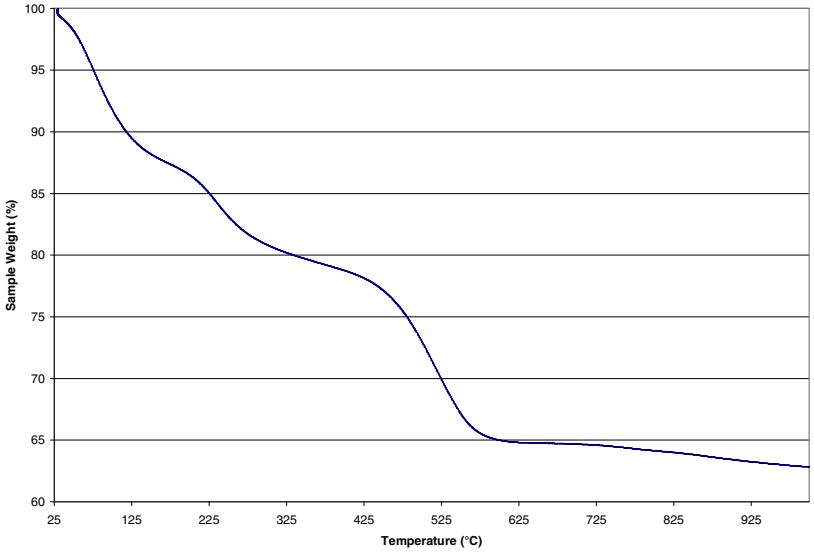

Figure S25 TGA trace for $Y_2(OH)_5(o\text{-}C_8H_4O_4)_{0.5}.xH_2O$ showing a total mass loss of 37.14 % by 1000 ºC.

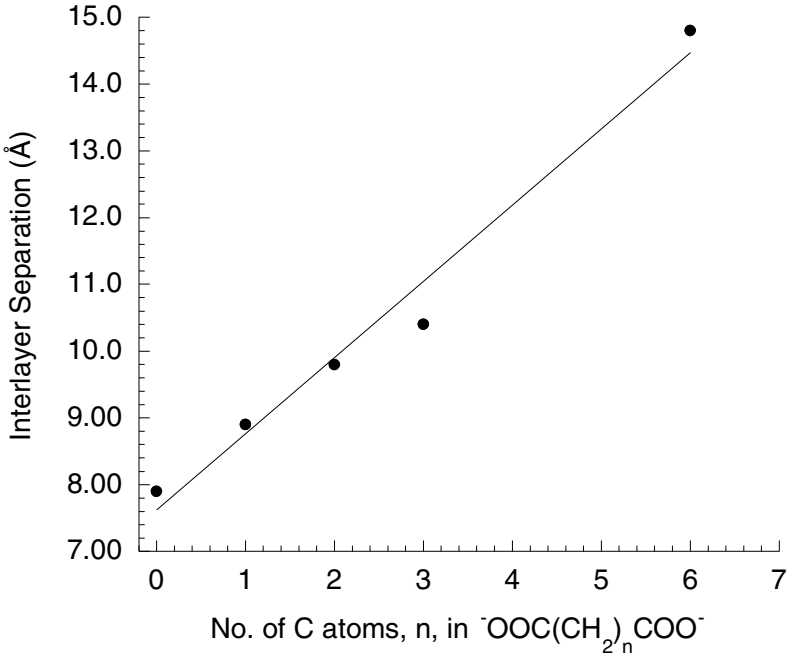

Figure S26 Plot of interlayer separation against number of CH_2 groups, n, in the aliphatic chain of some dicarboxylate intercalates, $Y_2(OH)_5(OOC(CH_2)_nCOO)_{0.5}.xH_2O$. The gradient of the line is 1.14 Å/C atom indicating an orientation of approximately 64 º.

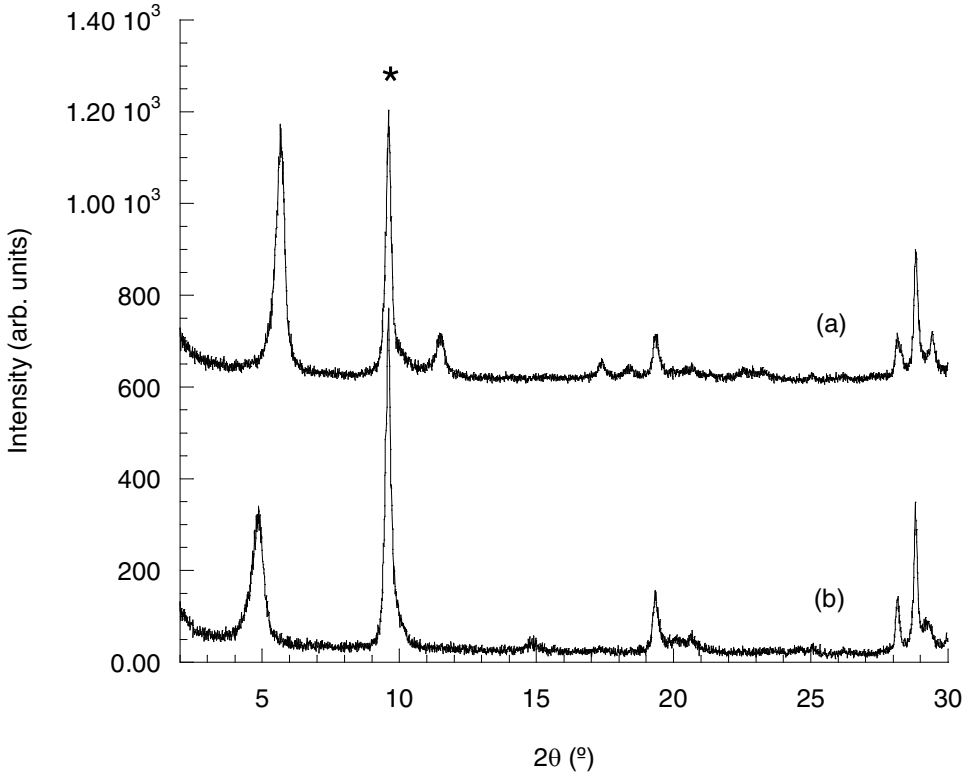

Figure S27 Powder X-ray diffraction patterns of the anion exchange derivatives of $Y_2(OH)_5NO_3.xH_2O$ with (a) NDS and (b) AQDS. The asterisk (*) marks characteristic reflections of unreacted $Y_2(OH)_5NO_3.xH_2O$ in the products.

Table S1 Characterizing data for the organic anion exchange derivatives of $Y_2(OH)_5NO_3.xH_2O$.

A	Composition	Interlayer Separation (Å)	Elemental Analysis	
			Observed (%)	Calculated (%)
Maleate	$Y_2(OH)_5(cis\text{-}C_4H_2O_4)_{0.5}.1.5H_2O$	10.2	Y (51.00) C (6.84) H (2.57)	Y (51.25) C (6.92) H (2.62)
Fumarate	$Y_2(OH)_5(trans\text{-}C_4H_2O_4)_{0.5}.1.5H_2O$	9.6	Y (50.88) C (6.69) H (2.59)	Y (51.26) C (6.92) H (2.62)
Phthalate	$Y_2(OH)_5(o\text{-}C_8H_4O_4)_{0.5}.1.5H_2O$	14.0	Y (47.31) C (12.94) H (2.92)	Y (47.68) C (12.88) H (2.97)
Terephthalate	$Y_2(OH)_5(p\text{-}C_8H_4O_4)_{0.5}.1.5H_2O$	12.8	Y (47.29) C (12.78) H (2.93)	Y (47.68) C (12.88) H (2.97)
Oxalate	$Y_2(OH)_5(C_2O_4)_{0.5}.H_2O$	7.9	Y (50.66) C (3.93) H (2.14)	Y (53.26) C (3.690) H (2.17)
Succinate	$Y_2(OH)_5(C_4H_4O_4)_{0.5}.1.5H_2O$	9.8	C (6.91) H (2.89)	C (6.90) H (2.88)
Glutarate	$Y_2(OH)_5(C_5H_6O_4)_{0.5}.1.5H_2O$	10.4	C (8.05) H (2.88)	C (8.46) H (3.12)
Suberate	$Y_2(OH)_5(C_8H_{12}O_4)_{0.5}.H_2O$	14.8	C (13.96) H (3.48)	C (13.09) H (3.57)
Decylsulfonate	$Y_2(OH)_5(C_{10}H_{21}SO_4).H_2O$	23.8	C (21.70) H (5.39)	C (22.78) H (5.54)
NDS	$Y_2(OH)_5(C_{10}H_6(SO_3)_2)_{0.28}(NO_3)_{0.44}(H_2O)_{1.5}$	15.6	C (8.20) H (2.31)	C (8.46) H (2.46)
AQDS	$Y_2(OH)_5(C_{14}H_6O_2(SO_3)_2)_{0.31}(NO_3)_{0.38}(H_2O)_{1.5}$	18.2	C (12.05) H (2.26)	C (12.21) H (2.33)

Anion Exchange Derivatives of $Tb_2(OH)_5NO_3.xH_2O$

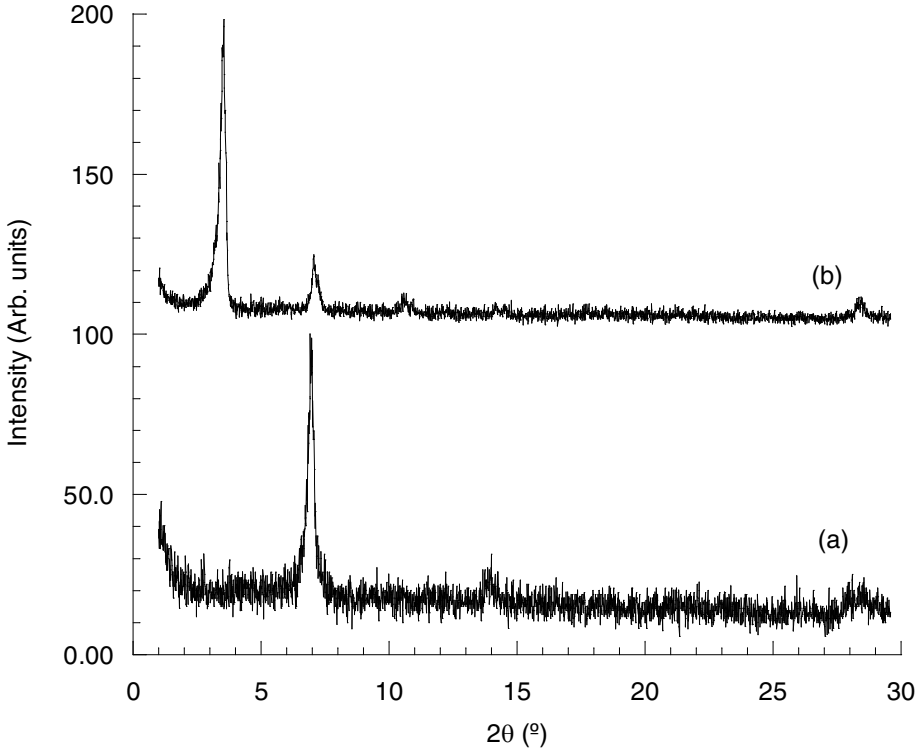

Figure S28 Powder X-ray diffraction patterns of (a) $Tb_2(OH)_5(p\text{-}C_8H_4O_4)_{0.5}.1.5H_2O$ and (b) $Tb_2(OH)_5(C_{12}H_{25}SO_4)_{0.5}.1.5H_2O$.

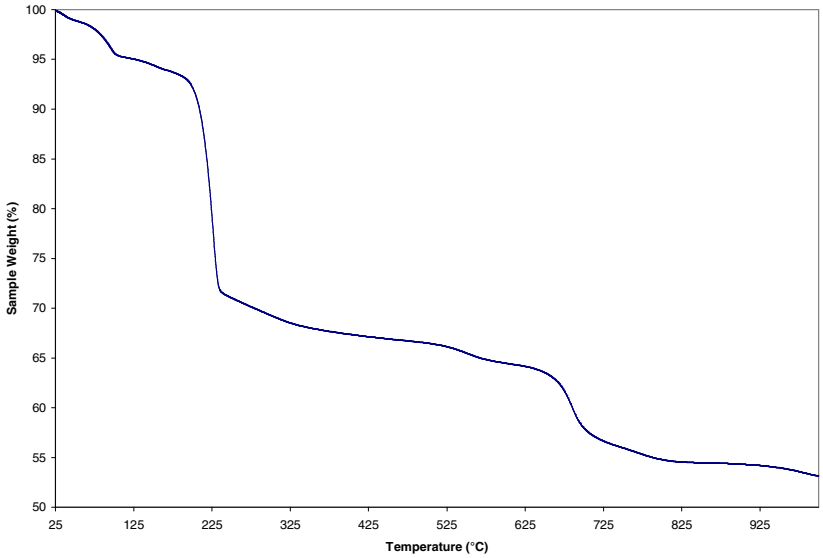

Figure S29 TGA trace for $Tb_2(OH)_5(C_{12}H_{25}SO_4).xH_2O$ showing a total mass loss of 45.64 % by 900 ºC.

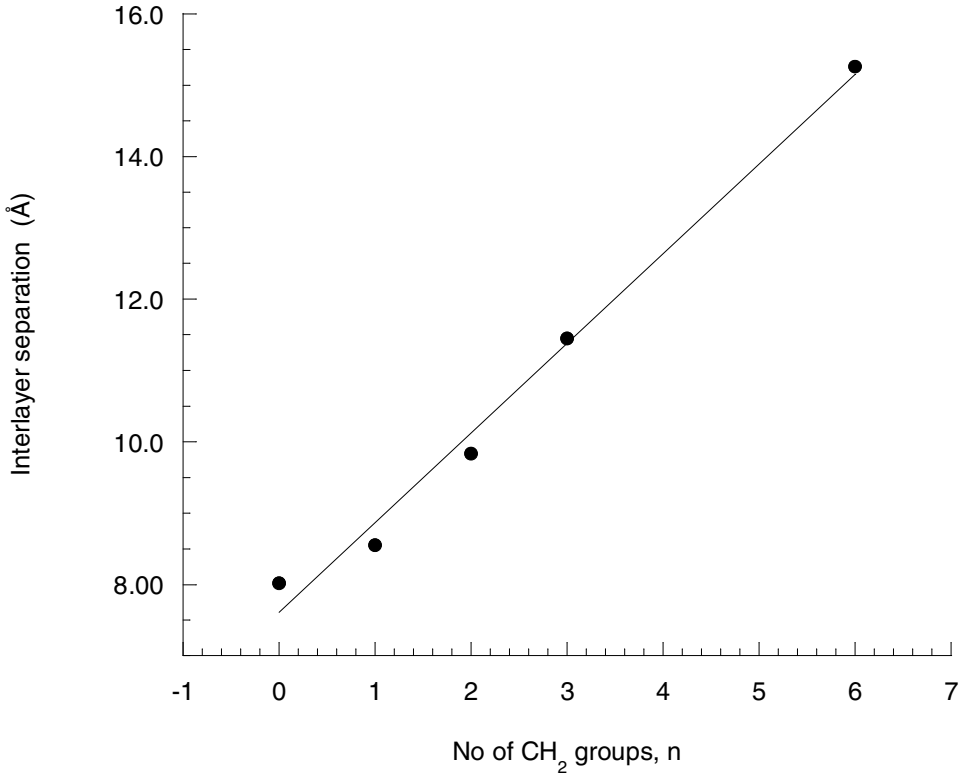

Figure S30 Plot of interlayer separation against number of CH_2 groups, n, in the aliphatic chain of some dicarboxylate intercalates, $Tb_2(OH)_5(OOC(CH_2)_nCOO)_{0.5}.xH_2O$. The gradient of the line is 1.25 Å/C atom indicating an orientation of approximately 82 º.

Table S3 Characterizing data for the organic anion exchange derivatives of $Tb_2(OH)_5NO_3.xH_2O$.

A	Composition	Interlayer Seperation (A)	Elemental Analysis	
			Observed (%)	Calculated (%)
Nitrate	$Tb_2(OH)_5(NO_3).1.5H_2O$	9.06	Tb (62.66)	Tb (64.61)
			N (2.55)	N (2.85)
			H (1.53)	H (1.64)
Phthalate	$Tb_2(OH)_5(o\text{-}C_8H_4O_4)_{0.5}.1.5H_2O$	12.71	Tb (58.78)	Tb (61.96)
			C (10.00)	C (9.37)
			H (1.88)	H (2.16)
Terephthalate	$Tb_2(OH)_5(p\text{-}C_8H_4O_4)_{0.5}.1.5H_2O$	12.90	Tb (59.13)	Tb (61.96)
			C (10.37)	C (9.37)
			H (1.85)	H (2.16)
Oxalate	$Tb_2(OH)_5(C_2O_4)_{0.5}.1.5H_2O$	8.02	C (3.09)	C (2.53)
			H (1.48)	H (1.70)
Malonate	$Tb_2(OH)_5(C_3H_2O_4)_{0.5}.1.5H_2O$	8.55	C (4.08)	C (3.75)
			H (1.55)	H (1.89)
Succinate	$Tb_2(OH)_5(C_4H_4O_4)_{0.5}.1.5H_2O$	9.83	C (4.99)	C (4.92)
			H (1.69)	H (1.89)
Glutarate	$Tb_2(OH)_5(C_5H_6O_4)_{0.5}.1.5H_2O$	11.45	C (6.34)	C (6.07)
			H (2.08)	H (2.24)
Suberate	$Tb_2(OH)_5(C_8H_{12}O_4)_{0.5}.1.5H_2O$	15.26	C (10.23)	C (9.31)
			H (2.58)	H (2.73)
Decylsulfate	$Tb_2(OH)_5(C_{10}H_{21}SO_4).1.5H_2O$	23.42	Tb (46.23)	Tb (47.64)
			C (17.21)	C (18.00)
			H (4.28)	H (4.38)
Dodecylsulfate	$Tb_2(OH)_5(C_{12}H_{25}SO_4).1.5H_2O$	25.23	Tb (44.05)	Tb (45.71)
			C (18.92)	C (20.73)
			H (4.42)	H (4.78)

Anion Exchange Derivatives of $Dy_2(OH)_5NO_3.xH_2O$

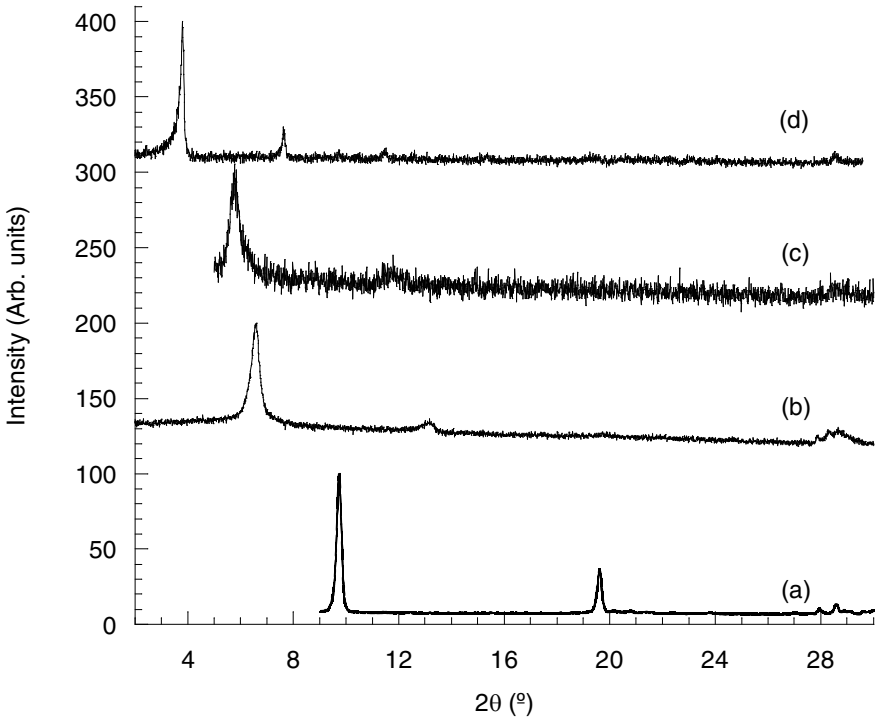

Figure S31 Powder X-ray diffraction patterns of (a) $Dy_2(OH)_5NO_3.xH_2O$ and the organic anion exchange derivatives with (b) phthalate, (c) suberate and (d) decylsulfonate.

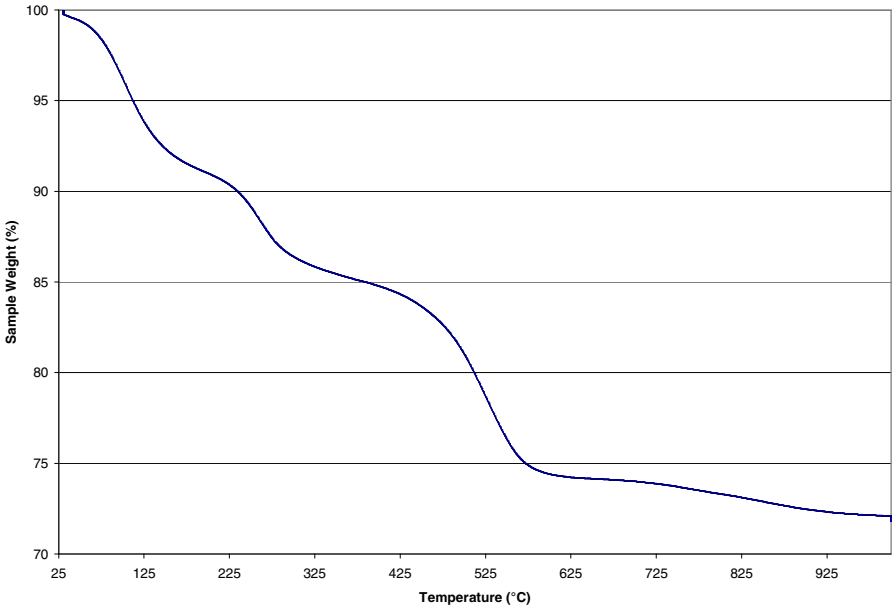

Figure S32 TGA trace for $Dy_2(OH)_5(o\text{-}C_8H_4O_4).xH_2O$ showing a total mass loss of 27.85 % by 1000 ºC.

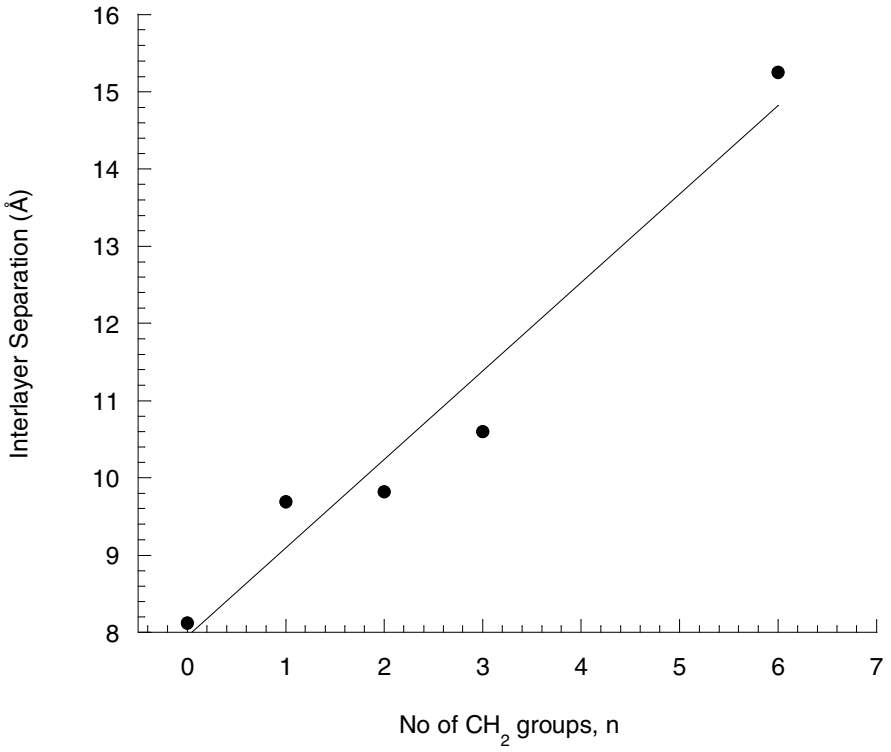

Figure S33 Plot of interlayer separation against number of CH_2 groups, n, in the aliphatic chain of some dicarboxylate intercalates, $Dy_2(OH)_5(OOC(CH_2)_nCOO)_{0.5}.xH_2O$. The gradient of the line is 1.14 Å/C atom indicating an orientation of approximately 64 º.

Table S4 Characterizing data for the organic anion exchange derivatives of $Dy_2(OH)_5NO_3.xH_2O$.

A	Composition	Interlayer Seperation (A)	Elemental Analysis	
			Observed (%)	Calculated (%)
Nitrate	$Dy_2(OH)_5(NO_3).1.5H_2O$	9.08	Dy (62.71) N (3.00) H (1.55)	Dy (65.12) N (2.81) H (1.65)
Maleate	$Dy_2(OH)_5(cis\text{-}C_4H_2O_4)_{0.5}.1.5H_2O$	11.33	Dy (60.77) C (5.20) H (1.78)	Dy (65.78) C (4.86) H (1.83)
Fumarate	$Dy_2(OH)_5(trans C_4H_2O_4)_{0.425}(NO_3)_{0.15}.1.5H_2O$	9.59	Dy (64.40) C (3.93) H (1.78) N (0.40)	Dy (65.78) C (4.13) H (1.80) N (0.42)
Phthalate	$Dy_2(OH)_5(o\text{-}C_8H_4O_4)_{0.5}.1.5H_2O$	13.47	Dy (61.77) C (9.48) H (1.91)	Dy (62.48) C (9.24) H (2.13)
Terephthalate	$Dy_2(OH)_5(p\text{-}C_8H_4O_4)_{0.5}.1.5H_2O$	12.83	Dy (59.80) C (10.09) H (2.00)	Dy (62.48) C (9.24) H (2.13)
Oxalate	$Dy_2(OH)_5(C_2O_4)_{0.5}.1.5H_2O$	8.12	C (3.09) H (1.31)	C (2.50) H (1.68)
Malonate	$Dy_2(OH)_5(C_3H_2O_4)_{0.5}.1.5H_2O$	9.69	Dy (65.79) C (3.43) H (1.77)	Dy (66.59) C (3.69) H (1.86)
Succinate	$Dy_2(OH)_5(C_4H_4O_4)_{0.425}(NO_3)_{0.15}.1.5H_2O$	9.82	Dy (63.87) C (3.92) H (1.93) N (0.47)	Dy (65.64) C (4.11) H (1.97) N (0.42)
Glutarate	$Dy_2(OH)_5(C_5H_6O_4)_{0.5}.1.5H_2O$	10.60	Dy (64.04) C (5.69) H (1.94)	Dy (64.73) C (5.98) H (2.21)
Suberate	$Dy_2(OH)_5(C_8H_{12}O_4)_{0.5}.1.5H_2O$	15.25	Dy (59.59) C (10.53) H (2.44)	Dy (62.12) C (9.18) H (2.70)
Decylsulfate	$Dy_2(OH)_5(C_{10}H_{21}SO_4).1.5H_2O$	23.44	Dy (47.81) C (17.38) H (3.93)	Dy (46.27) C (20.52) H (4.74)
Dodecylsulfate	$Dy_2(OH)_5(C_{12}H_{25}SO_4).1.5H_2O$	25.93	Dy (46.99) C (18.81) H (4.39)	Dy (46.27) C (20.52) H (4.74)

Anion Exchange Derivatives of $Ho_2(OH)_5NO_3.xH_2O$

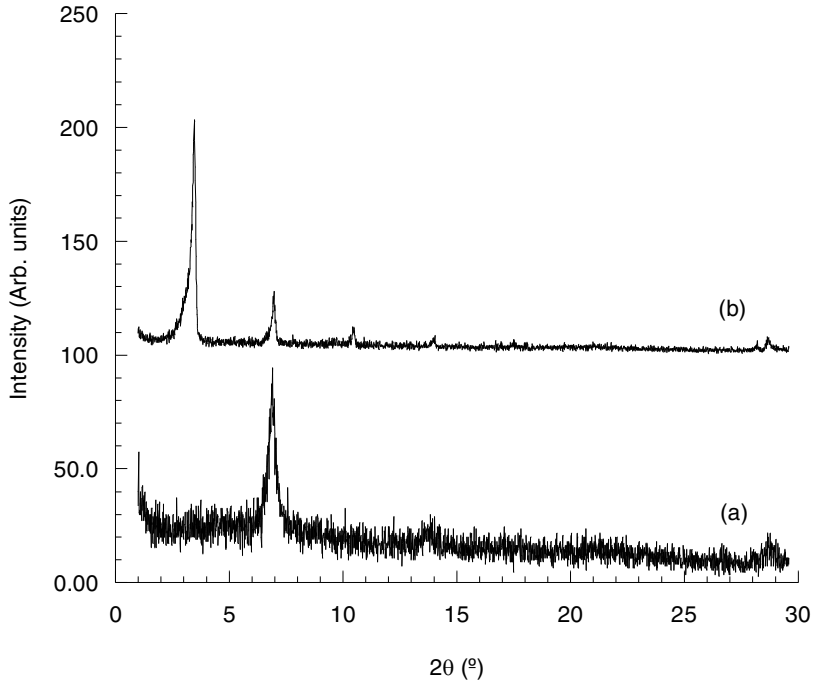

Figure S34 Powder X-ray diffraction patterns of (a) $Ho_2(OH)_5(p\text{-}C_8H_4O_4)_{0.5}.1.5H_2O$ and (b) $Ho_2(OH)_5(C_{12}H_{25}SO_4)_{0.5}.1.5H_2O$

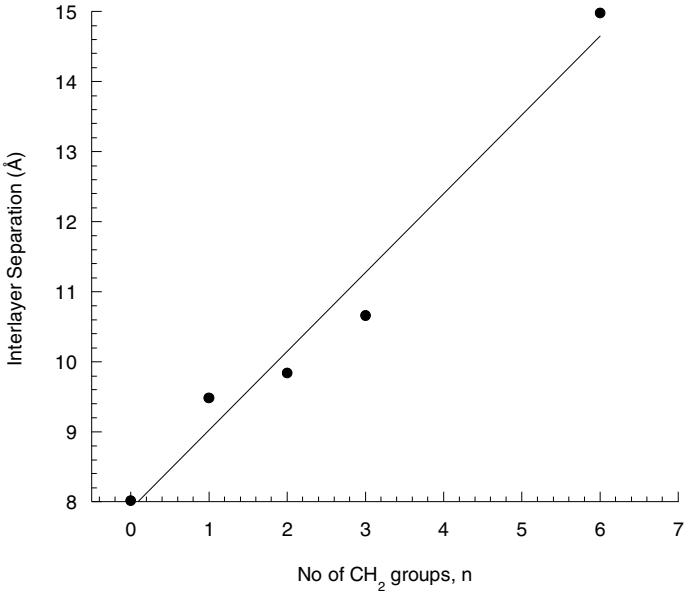

Figure S35 Plot of interlayer separation against number of CH_2 groups, n, in the aliphatic chain of some dicarboxylate intercalates, $Ho_2(OH)_5(OOC(CH_2)_nCOO)_{0.5}.xH_2O$. The gradient of the line is 1.13 Å/C atom indicating an orientation of approximately 62 º.

Table S5 Characterizing data for the organic anion exchange derivatives of $Ho_2(OH)_5NO_3.xH_2O$.

A	Composition	Interlayer Seperation (A)	Elemental Analysis	
			Observed (%)	Calculated (%)
Nitrate	$Ho_2(OH)_5(NO_3).1.5H_2O$	9.10	Ho ()	Ho (65.46)
			N (2.98)	N (2.78)
			H (1.39)	H (1.60)
Phthalate	$Ho_2(OH)_5(o\text{-}C_8H_4O_4)_{0.5}.1.5H_2O$	12.83	Ho (59.99)	Ho (62.83)
			C (9.90)	C (9.15)
			H (1.84)	H (2.11)
Terephthalate	$Ho_2(OH)_5(p\text{-}C_8H_4O_4)_{0.5}.1.5H_2O$	13.68	Ho (59.63)	Ho (62.83)
			C (10.71)	C (9.15)
			H (1.99)	H (2.11)
Oxalate	$Ho_2(OH)_5(C_2O_4)_{0.5}.1.5H_2O$	8.02	Ho ()	Ho (67.88)
			C (3.08)	C (2.47)
			H (1.37)	H (1.66)
Malonate	$Ho_2(OH)_5(C_3H_2O_4)_{0.5}.1.5H_2O$	11.17	Ho ()	Ho (66.92)
			C (3.87)	C (3.65)
			H (1.62)	H (1.84)
Succinate	$Ho_2(OH)_5(C_4H_4O_4)_{0.5}.1.5H_2O$	11.71/9.84	Ho ()	Ho (65.98)
			C (4.70)	C (4.80)
			H (1.90)	H (2.02)
Glutarate	$Ho_2(OH)_5(C_5H_6O_4)_{0.5}.1.5H_2O$	10.66	Ho ()	Ho (65.07)
			C (5.75)	C (5.92)
			H (1.98)	H (2.19)
Suberate	$Ho_2(OH)_5(C_8H_{12}O_4)_{0.5}.1.5H_2O$	14.98	Ho ()	Ho (62.47)
			C (9.61)	C (9.10)
			H (2.42)	H (2.67)
Decylsulfate	$Ho_2(OH)_5(C_{10}H_{21}SO_4).1.5H_2O$	23.54	Ho (46.70)	Ho (48.56)
			C (16.93)	C (17.68)
			H (4.13)	H (4.30)
Dodecylsulfate	$Ho_2(OH)_5(C_{12}H_{25}SO_4).1.5H_2O$	25.84	Ho (44.83)	Ho (46.64)
			C (18.41)	C (20.38)
			H (4.35)	H (4.70)

Anion Exchange Derivatives of $Er_2(OH)_5NO_3.xH_2O$

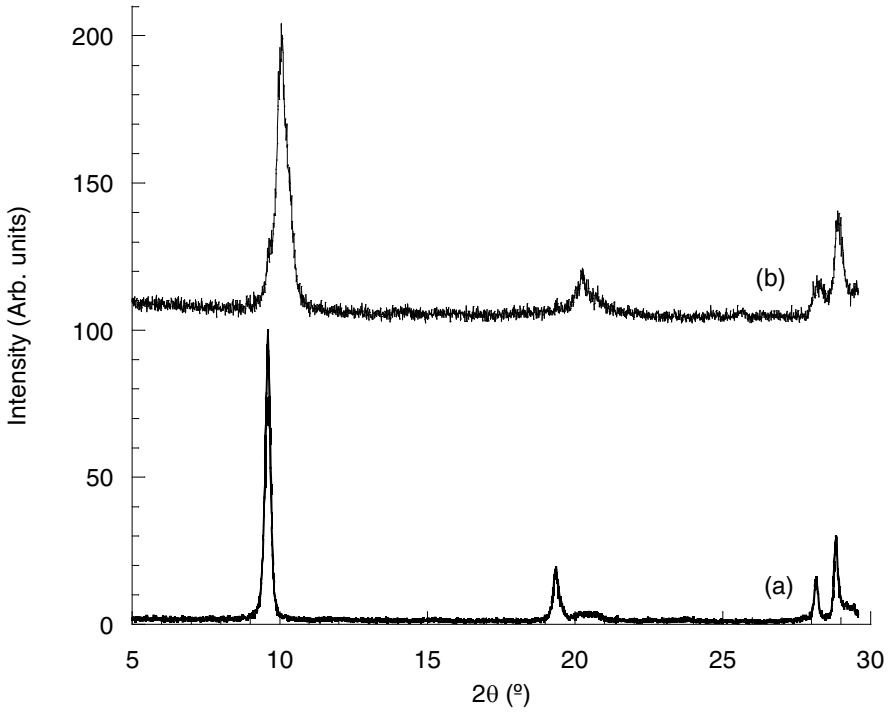

Figure S36 Powder X-ray diffraction patterns of (a) $Er_2(OH)_5NO_3.xH_2O$ and the anion exchange product with (b) sulphate (interlayer separation 8.8 Å).

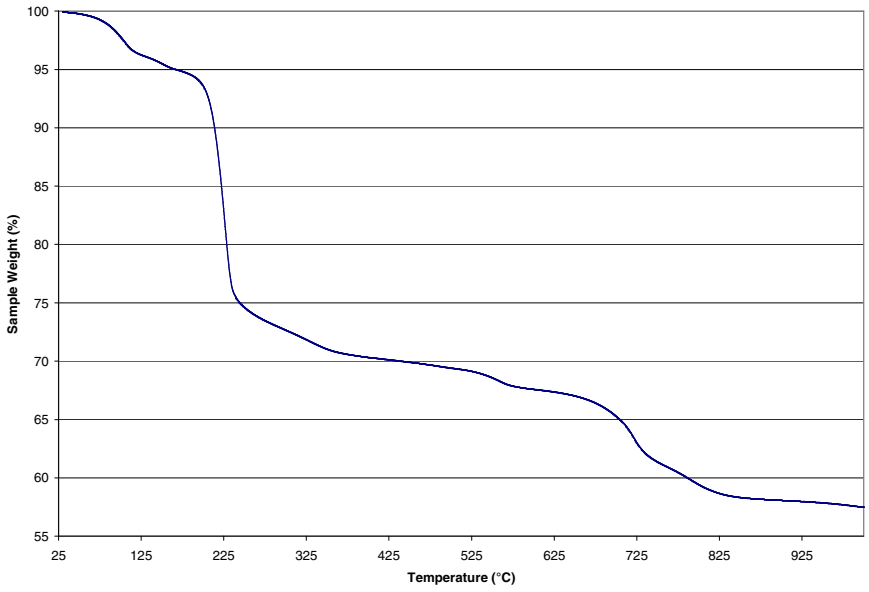

Figure S37 TGA trace for $Er_2(OH)_5(C_{10}H_{21}SO_4).xH_2O$ showing a total mass loss of 42.53 % by 1000 ºC.

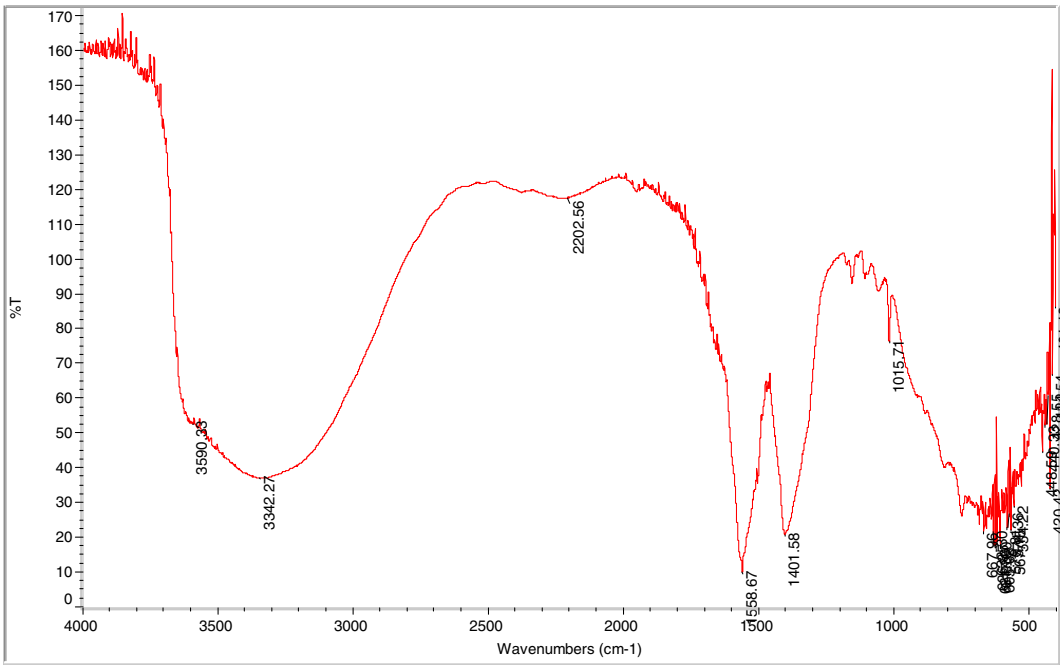

Figure S38 FTIR spectrum of $Er_2(OH)_5(C_8H_4O_4)_{0.5}.xH_2O$ showing bands due to the carbonyl stretch of uncoordinated terephthalate anions (1560and 1400 cm^{-1}) and OH/H_2O (approx. 3500 cm^{-1}).

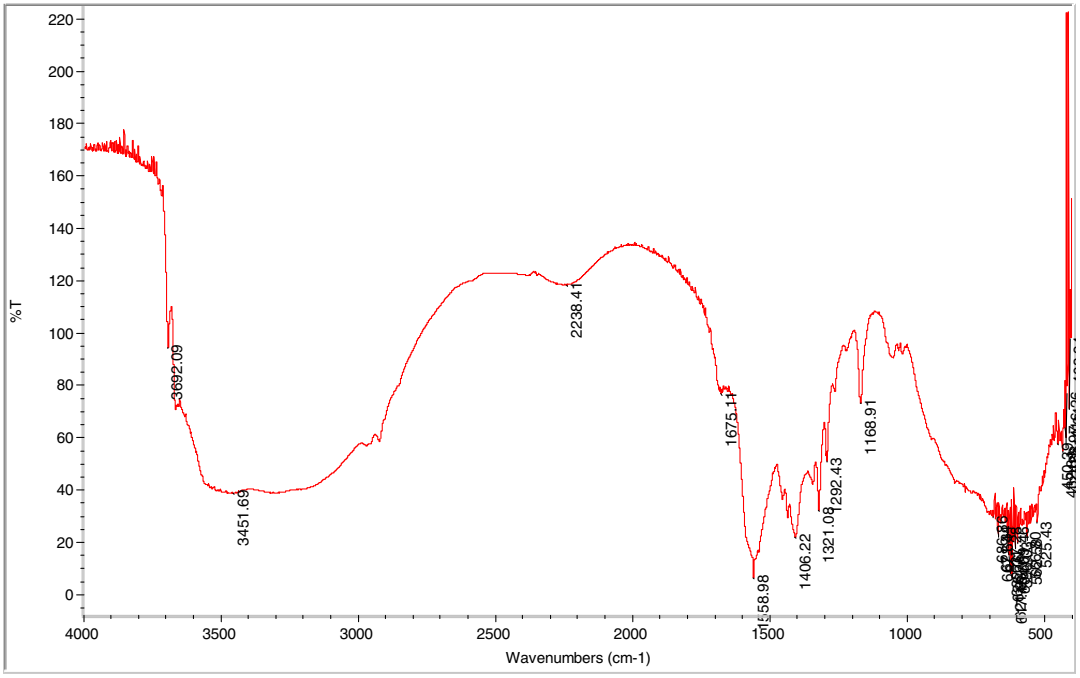

Figure S39 FTIR spectrum of $Er_2(OH)_5(C_5H_6O_4)_{0.5}.xH_2O$ showing bands due to the carbonyl stretch of uncoordinated glutarate anions (1560 and 1400 cm^{-1}) and OH/H_2O (approx. 3500 cm^{-1}).

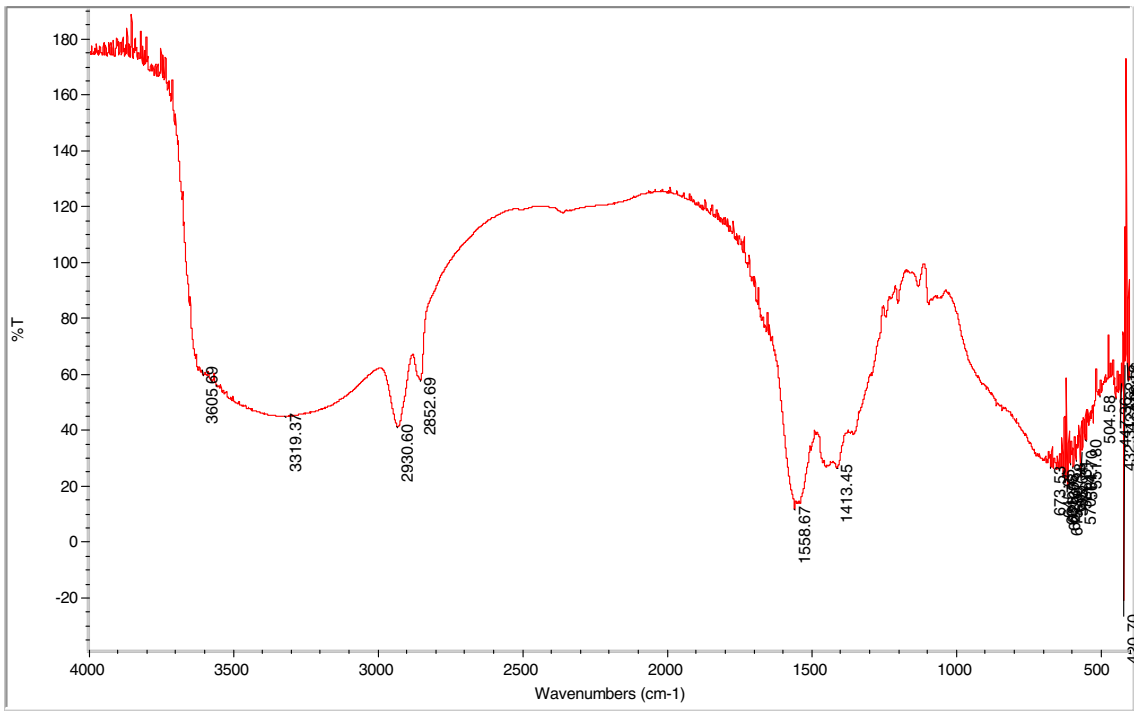

Figure S40 FTIR spectrum of $Er_2(OH)_5(C_8H_{12}O_4)_{0.5}.xH_2O$ showing bands due to the carbonyl stretch of uncoordinated suberate anions (1560 and 1400 cm^{-1}) and OH/H_2O (approx. 3500 cm^{-1}) and C-H stretches between 2800-3000 cm^{-1}.

Table S6 Characterizing data for the organic anion exchange derivatives of $Er_2(OH)_5NO_3.xH_2O$.

A	Composition	Interlayer Seperation (A)	Elemental Analysis	
			Observed (%)	Calculated (%)
Nitrate	$Er_2(OH)_5(NO_3).1.5H_2O$	9.31	Er (65.20) N (2.82) H (1.54)	Er (65.77) N (2.75) H (1.59)
Maleate	$Er_2(OH)_5(cis\text{-}C_4H_2O_4)_{0.5}.1.5H_2O$	9.38	Er (65.35) C (4.93) H (1.76)	Er (66.42) C (4.77) H (1.80)
Fumarate	$Er_2(OH)_5(trans\text{-}C_4H_2O_4)_{0.5}.1.5H_2O$	9.63	Er (65.90) C (4.66) H (1.78)	Er (66.42) C (4.77) H (1.80)
Terephthalate	$Er_2(OH)_5(p\text{-}C_8H_4O_4)_{0.5}.1.5H_2O$	13.07	Er (58.87) C (9.42) H (2.06)	Er (63.06) C (9.07) H (2.09)
Phthalate	$Er_2(OH)_5(o\text{-}C_8H_4O_4)_{0.5}.1.5H_2O$	14.01	Er (62.72) C (8.99) H (2.08)	Er (63.16) C (9.07) H (2.09)
Oxalate	$Er_2(OH)_5(C_2O_4)_{0.45}(NO_3)_{0.1}.1.5H_2O$	7.98	C (2.26) H (1.41) N (0.29)	C (2.19) H (1.64) N (0.28)
Malonate	$Er_2(OH)_5(C_3H_2O_4)_{0.475}(NO_3)_{0.05}.1.5H_2O$	9.86	C (3.79) H (1.46) N (0.12)	C (3.44) H (1.81) N (0.14)
Succinate	$Er_2(OH)_5(C_4H_4O_4)_{0.5}.1.5H_2O$	9.84	Er (66.07) C (4.68) H (1.98)	Er (66.29) C (4.76) H (2.00)
Glutarate	$Er_2(OH)_5(C_5H_6O_4)_{0.5}.1.5H_2O$	10.45	Er (63.68) C (6.00) H (2.21)	Er (65.38) C (5.87) H (2.17)
Suberate	$Er_2(OH)_5(C_8H_{12}O_4)_{0.5}.1.5H_2O$	14.83	Er (60.80) C (10.12) H (2.52)	Er (62.80) C (9.02) H (2.65)
NDS	$Er_2(OH)_5(C_{10}H_6(SO_3)_2)_{0.28}(NO_3)_{0.44}.3H_2O$	15.6	Er (57.19) C (4.69) H (1.64) N (0.73)	Er (57.57) C (5.78) H (2.19) N (1.06)
AQDS	$Er_2(OH)_5(C_{14}H_6O_2(SO_3)_2)_{0.22}(NO_3)_{0.54}.3H_2O$	18.2	Er (55.46) C (5.14) H (1.63) N (1.10)	Er (56.74) C (6.27) H (2.10) N (1.35)
Decylsulfate	$Er_2(OH)_5(C_{10}H_{21}SO_4).1.5H_2O$	23.95	Er (50.37) C (16.99) H (4.20)	Er (48.91) C (17.56) H (4.27)
Dodecylsulfate	$Er_2(OH)_5(C_{12}H_{25}SO_4).1.5H_2O$	30.10	Er (47.40) C (18.78) H (4.48)	Er (46.99) C (20.24) H (4.67)

Anion Exchange Derivatives of $Tm_2(OH)_5NO_3.xH_2O$

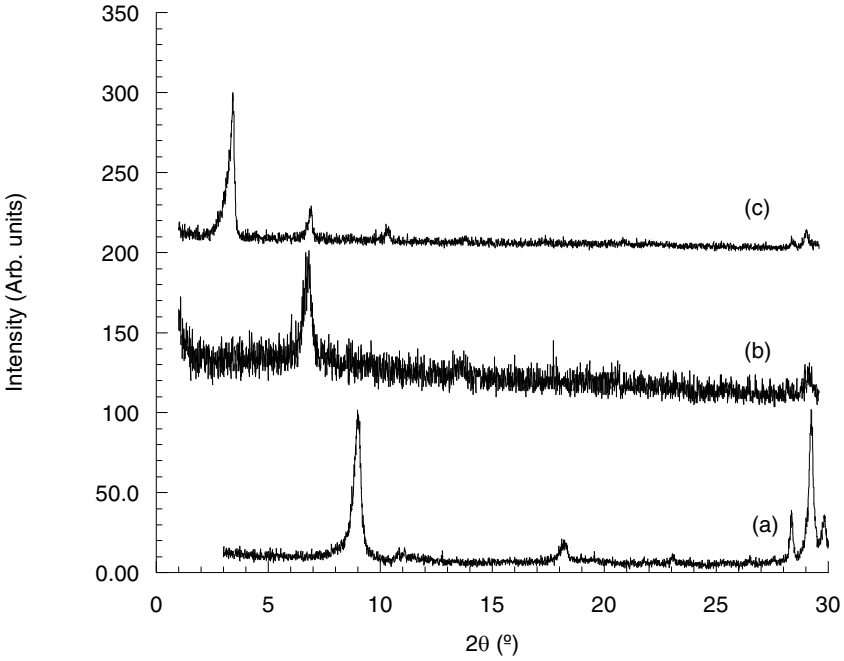

Figure S41 Powder X-ray diffraction patterns of (a) $Tm_2(OH)_5(C_4H_4O_4)_{0.5}.1.5H_2O$, (b) $Tm_2(OH)_5(p\text{-}C_8H_4O_4)_{0.5}.1.5H_2O$ and (c) $Tm_2(OH)_5(C_{12}H_{25}SO_4)_{0.5}.1.5H_2O$

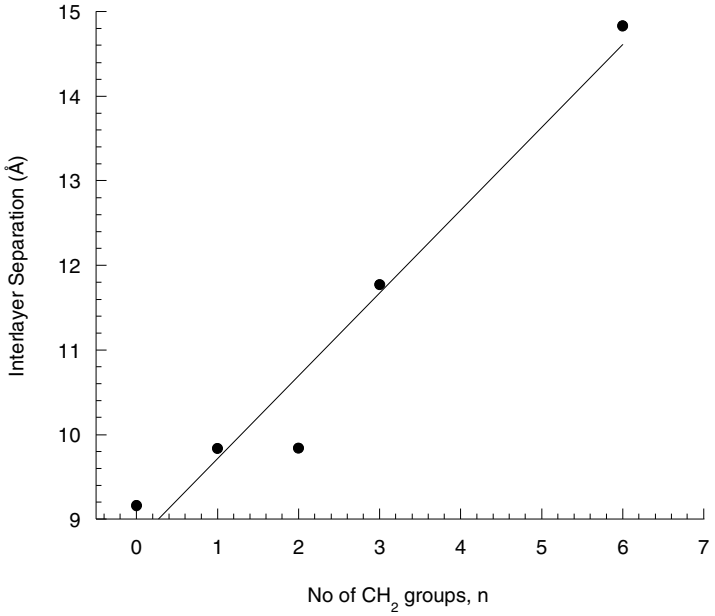

Figure S42 Plot of interlayer separation against number of CH_2 groups, n, in the aliphatic chain of some dicarboxylate intercalates, $Tm_2(OH)_5(OOC(CH_2)_nCOO)_{0.5}.xH_2O$. The gradient of the line is 0.97 Å/C atom indicating an orientation of approximately 51 º.

Table S7 Characterizing data for the organic anion exchange derivatives of $Tm_2(OH)_5NO_3.xH_2O$.

A	Composition	Interlayer Seperation (A)	Elemental Analysis	
			Observed (%)	Calculated (%)
Nitrate	$Tm_2(OH)_5(NO_3).1.5H_2O$	9.14	Tm (60.55) N (2.46) H (1.39)	Tm (65.99) N (2.73) H (1.58)
Phthalate	$Tm_2(OH)_5(o\text{-}C_8H_4O_4)_{0.5}.1.5H_2O$	14.28	Tm (53.61) C (9.26) H (1.77)	Tm (63.39) C (9.01) H (2.08)
Terephthalate	$Tm_2(OH)_5(p\text{-}C_8H_4O_4)_{0.475}(NO_3)_{0.05}.1.5H_2O$	13.96	Tm (51.46) C (8.56) H (1.89) N (0.19)	Tm (63.39) C (8.59) H (1.88) N (0.13)
Oxalate	$Tm_2(OH)_5(C_2O_4)_{0.45}(NO_3)_{0.1}.1.5H_2O$	9.16	Tm (58.97) C (2.71) H (1.36) N (0.35)	Tm (68.40) C (2.18) H (1.63) N (0.28)
Malonate	$Tm_2(OH)_5(C_3H_2O_4)_{0.45}(NO_3)_{0.1}.1.5H_2O$	9.83	Tm (60.54) C (3.22) H (1.50) N (0.31)	Tm (67.45) C (3.22) H (1.78) N (0.28)
Succinate	$Tm_2(OH)_5(C_4H_4O_4)_{0.5}.1.5H_2O$	9.84	Tm (61.00) C (4.66) H (1.82)	Tm (66.51) C (4.73) H (1.98)
Glutarate	$Tm_2(OH)_5(C_5H_6O_4)_{0.5}.1.5H_2O$	11.77	Tm (55.52) C (5.60) H (1.78)	Tm (65.61) C (5.83) H (2.15)
Suberate	$Tm_2(OH)_5(C_8H_{12}O_4)_{0.5}.1.5H_2O$	14.83	Tm (55.06) C (9.26) H (2.51)	Tm (63.03) C (8.96) H (2.63)
Decylsulfate	$Tm_2(OH)_5(C_{10}H_{21}SO_4).1.5H_2O$	23.86	Tm (46.42) C (17.13) H (4.19)	Tm (49.16) C (17.48) H (4.25)
Dodecylsulfate	$Tm_2(OH)_5(C_{12}H_{25}SO_4).1.5H_2O$	26.37	Tm (41.68) C (19.40) H (4.38)	Tm (47.23) C (20.15) H (4.65)