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Table S1. Crystal data and structure refinement for KVSe2O7H.

Identification code	KVSe2O7H
Empirical formula	H0.50 K0.50 O3.50 Se V0.50
Formula weight	180.48
Temperature	293(2) K
Wavelength	0.71073 A
Crystal system	monoclinic
Space group	P21/m (No. 11)
Unit cell dimensions	a = 7.8659(7) A alpha = 90 deg. b = 10.4298(7) A beta = 96.450(10) deg. c = 4.0872(7) A gamma = 90 deg.
Volume	333.19(7) A^3
Z	4
Density (calculated)	3.598 Mg/m^3
Absorption coefficient	13.024 mm^-1
F(000)	334
Crystal size	0.3 x 0.2 x 0.15 mm
Theta range for data collection	2.61 to 24.95 deg.
Index ranges	0<=h<=9, 0<=k<=12, -4<=l<=4
Reflections collected	663
Independent reflections	621 [R(int) = 0.0146]
Refinement method	Full-matrix least-squares on F^2
Data / restraints / parameters	621 / 0 / 57
Goodness-of-fit on F^2	1.317
Final R indices [I>2sigma(I)]	R1 = 0.0207, wR2 = 0.0565
R indices (all data)	R1 = 0.0222, wR2 = 0.0571
Extinction coefficient	0.040(2)
Largest diff. peak and hole	0.713 and -0.501 e.A^-3

Table S3. Bond lengths [A] and angles [deg] for KVSe2O7H.

Se-O(4)	1.701(3)
Se-O(3)	1.702(3)
Se-O(2)	1.706(3)
Se-K#1	3.6815(12)
Se-K#2	3.9173(13)
V-O(1)	1.608(5)
V-O(2)#3	1.997(3)
V-O(2)#4	1.997(3)
V-O(3)#1	1.998(3)
V-O(3)#5	1.998(3)
V-K#1	3.880(2)
K-O(4)#6	2.765(4)
K-O(4)#1	2.765(4)
K-O(4)#2	2.792(3)
K-O(4)#7	2.792(3)
K-O(3)#8	2.808(3)
K-O(3)	2.808(3)
K-O(2)#1	2.989(3)
K-O(2)#6	2.989(3)
K-Se#1	3.6815(12)
K-Se#6	3.6815(12)
K-V#1	3.880(2)
K-Se#2	3.9173(13)
O(2)-V#9	1.997(3)
O(2)-K#1	2.989(3)
O(3)-V#1	1.998(3)
O(4)-K#1	2.765(4)
O(4)-K#2	2.792(3)
O(4)-Se-O(3)	99.9(2)
O(4)-Se-O(2)	97.5(2)
O(3)-Se-O(2)	102.2(2)
O(4)-Se-K#1	45.35(11)
O(3)-Se-K#1	98.55(10)
O(2)-Se-K#1	53.16(10)
O(4)-Se-K#2	38.40(12)
O(3)-Se-K#2	135.49(10)
O(2)-Se-K#2	99.12(11)
K#1-Se-K#2	64.99(2)
O(1)-V-O(2)#3	100.8(2)
O(1)-V-O(2)#4	100.8(2)
O(2)#3-V-O(2)#4	87.9(2)
O(1)-V-O(3)#1	101.5(2)
O(2)#3-V-O(3)#1	157.71(13)
O(2)#4-V-O(3)#1	88.88(12)
O(1)-V-O(3)#5	101.5(2)
O(2)#3-V-O(3)#5	88.88(12)
O(2)#4-V-O(3)#5	157.71(13)

O(3)#1-V-O(3)#5	85.8(2)
O(1)-V-K#1	95.0(2)
O(2)#3-V-K#1	132.54(9)
O(2)#4-V-K#1	132.54(9)
O(3)#1-V-K#1	43.97(9)
O(3)#5-V-K#1	43.97(9)
O(4)#6-K-O(4)#1	82.66(14)
O(4)#6-K-O(4)#2	161.03(14)
O(4)#1-K-O(4)#2	94.70(10)
O(4)#6-K-O(4)#7	94.70(10)
O(4)#1-K-O(4)#7	161.03(14)
O(4)#2-K-O(4)#7	81.69(14)
O(4)#6-K-O(3)#8	82.26(9)
O(4)#1-K-O(3)#8	120.33(10)
O(4)#2-K-O(3)#8	114.76(10)
O(4)#7-K-O(3)#8	77.61(9)
O(4)#6-K-O(3)	120.33(10)
O(4)#1-K-O(3)	82.26(9)
O(4)#2-K-O(3)	77.61(9)
O(4)#7-K-O(3)	114.76(10)
O(3)#8-K-O(3)	57.93(12)
O(4)#6-K-O(2)#1	90.35(10)
O(4)#1-K-O(2)#1	52.67(9)
O(4)#2-K-O(2)#1	73.44(9)
O(4)#7-K-O(2)#1	108.76(10)
O(3)#8-K-O(2)#1	170.71(10)
O(3)-K-O(2)#1	122.53(8)
O(4)#6-K-O(2)#6	52.67(9)
O(4)#1-K-O(2)#6	90.35(10)
O(4)#2-K-O(2)#6	108.76(10)
O(4)#7-K-O(2)#6	73.44(9)
O(3)#8-K-O(2)#6	122.53(8)
O(3)-K-O(2)#6	170.71(10)
O(2)#1-K-O(2)#6	55.26(12)
O(4)#6-K-Se#1	89.56(8)
O(4)#1-K-Se#1	25.95(6)
O(4)#2-K-Se#1	80.50(7)
O(4)#7-K-Se#1	135.87(8)
O(3)#8-K-Se#1	146.28(8)
O(3)-K-Se#1	100.26(6)
O(2)#1-K-Se#1	27.17(6)
O(2)#6-K-Se#1	74.71(7)
O(4)#6-K-Se#6	25.95(6)
O(4)#1-K-Se#6	89.56(8)
O(4)#2-K-Se#6	135.87(8)
O(4)#7-K-Se#6	80.50(7)
O(3)#8-K-Se#6	100.26(7)
O(3)-K-Se#6	146.28(8)
O(2)#1-K-Se#6	74.71(7)
O(2)#6-K-Se#6	27.17(6)
Se#1-K-Se#6	84.90(3)
O(4)#6-K-V#1	97.47(7)

O(4)#1-K-V#1	97.47(7)
O(4)#2-K-V#1	101.50(7)
O(4)#7-K-V#1	101.50(7)
O(3)#8-K-V#1	29.60(6)
O(3)-K-V#1	29.60(6)
O(2)#1-K-V#1	147.99(6)
O(2)#6-K-V#1	147.99(6)
Se#1-K-V#1	121.48(3)
Se#6-K-V#1	121.48(3)
O(4)#6-K-Se#2	139.19(8)
O(4)#1-K-Se#2	85.36(7)
O(4)#2-K-Se#2	22.23(7)
O(4)#7-K-Se#2	84.49(8)
O(3)#8-K-Se#2	136.36(8)
O(3)-K-Se#2	96.28(6)
O(2)#1-K-Se#2	52.32(6)
O(2)#6-K-Se#2	88.69(7)
Se#1-K-Se#2	64.99(2)
Se#6-K-Se#2	115.69(4)
V#1-K-Se#2	122.76(3)
Se-O(2)-V#9	121.5(2)
Se-O(2)-K#1	99.67(12)
V#9-O(2)-K#1	108.34(12)
Se-O(3)-V#1	118.9(2)
Se-O(3)-K	128.00(14)
V#1-O(3)-K	106.43(12)
Se-O(4)-K#1	108.71(14)
Se-O(4)-K#2	119.4(2)
K#1-O(4)-K#2	94.70(10)

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

Table S4. Anisotropic displacement parameters (A^2 x 10^3) for KVSe2O7H. The anisotropic displacement factor exponent takes the form: -2 pi^2 [h^2 a*^2 U11 + ... + 2 h k a* b* U12]

	U11	U22	U33	U23	U13	U12
Se	10 (1)	7 (1)	12 (1)	0 (1)	-2 (1)	1 (1)
V	9 (1)	6 (1)	12 (1)	0	-2 (1)	0
K	18 (1)	16 (1)	20 (1)	0	2 (1)	0
O (1)	18 (2)	13 (2)	15 (2)	0	-1 (2)	0
O (2)	14 (2)	10 (2)	16 (2)	3 (1)	-2 (1)	4 (1)
O (3)	9 (1)	7 (2)	21 (2)	-5 (1)	0 (1)	-1 (1)
O (4)	13 (2)	14 (2)	25 (2)	-2 (1)	-6 (1)	-2 (1)