Table 1S (a) Hydrogen-bond geometry (Å, º).

| D—H···A | D—H | H...A | D...A | D—H...A |
|---|---|---|---|---|
| 114 K | | | | |
| N1—H1A···O4 | 0.908(16) | 1.934(17) | 2.8109(12) | 161.6(15) |
| N1—H1B···O1$^{iv}$ | 0.892(15) | 2.137(16) | 2.9324(11) | 148.2(14) |
| N1—H1B···O2$^{iii}$ | 0.892(15) | 2.230(17) | 2.9408(12) | 136.4(13) |
| O2—H2···O4 | 0.825(16) | 1.70(2) | 2.4643(9) | 154(2) |
| O4—H4···O2 | 0.836(19) | 1.68(3) | 2.4643(9) | 156(3) |
| 120 K | | | | |
| N1—H1A···O4 | 0.914(16) | 1.930(17) | 2.8126(12) | 161.8(15) |
| N1—H1B···O1$^{iv}$ | 0.891(15) | 2.137(16) | 2.9314(11) | 148.0(14) |
| N1—H1B···O2$^{iii}$ | 0.891(15) | 2.228(17) | 2.9408(12) | 136.6(13) |
| O2—H2···O4 | 0.822(16) | 1.70(2) | 2.4661(9) | 154(2) |
| O4—H4···O2 | 0.838(19) | 1.68(3) | .4661(9) | 156(3) |
| 130 K | | | | |
| N1—H1A···O4 | 0.912(16) | 1.934(17) | 2.8165(12) | 161.9(15) |
| N1—H1B···O1$^{iv}$ | 0.902(15) | 2.127(16) | 2.9288(11) | 147.7(14) |
| N1—H1B···O2$^{iii}$ | 0.902(15) | 2.220(17) | 2.9402(12) | 136.5(13) |
| O2—H2···O4 | 0.823(16) | 1.70(2) | 2.4695(9) | 154(2) |
| O4—H4···O2 | 0.838(19) | 1.68(3) | 2.4695(9) | 155(3) |
| 145 K | | | | |
| N1—H1A···O4 | 0.917(16) | 1.930(17) | 2.8207(12) | 162.4(15) |
| N1—H1B···O1$^{iv}$ | 0.897(15) | 2.128(16) | 2.9272(12) | 147.9(14) |
| N1—H1B···O2$^{iii}$ | 0.897(15) | 2.225(17) | 2.9403(12) | 136.4(13) |
| O2—H2···O4 | 0.821(17) | 1.71(2) | 2.4747(9) | 153(2) |
| O4—H4···O2 | 0.835(19) | 1.69(3) | 2.4882(11) | 155(3) |
| 160 K | | | | |
| N1—H1A···O4 | 0.910(16) | 1.943(17) | 2.8244(12) | 163.4(16) |
| N1—H1B···O1$^{iv}$ | 0.904(15) | 2.122(16) | 2.9250(12) | 147.8(14) |
| N1—H1B···O2$^{iii}$ | 0.904(15) | 2.225(17) | 2.9412(12) | 136.0(13) |
| O2 —H2···O4 | 0.821(17) | 1.72(2) | 2.4787(10) | 154(2) |
| O4—H4···O2 | 0.837(19) | 1.70(3) | 2.4787(10) | 154(3) |
| 180 K | | | | |
| N1—H1A···O4 | 0.910(16) | 1.948(17) | 2.8277(13) | 162.8(15) |
| N1—H1B···O1$^{iv}$ | 0.901(15) | 2.120(16) | 2.9235(12) | 147.7(14) |
| N1—H1B···O2$^{iii}$ | 0.903(17) | 2.222(17) | 2.9429(13) | 136.5(13) |
| O2—H2···O4 | 0.820(17) | 1.72(2) | 2.4836(10) | 154(3) |
| O4—H4···O2 | 0.835(19) | 1.71(3) | 2.4836(10) | 155(3) |
| 200 K | | | | |
| N1—H1A···O4 | 0.904(16) | 1.955(17) | 2.8318(13) | 162.2(16) |
| N1—H1B···O1$^{iv}$ | 0.909(16) | 2.117(16) | 2.9224(12) | 147.4(14) |
| N1—H1B···O2$^{iii}$ | 0.907(17) | 2.220(18) | 2.9445(13) | 136.5(13) |
| O2—H2···O4 | 0.812(17) | 1.73(2) | 2.4882(11) | 154(2) |
| O4—H4···O2 | 0.832(17) | 1.72(3) | 2.4882(11) | 152(3) |

Symmetry codes: (iii) 1-x,1-y,1-z ; (iv) 1+x,y,-1+z.

Table 1S (b) Selected crystal data and experimental details for morpholinium hydrogen chloranilate at 338 K

| | | | |
|---|---|---|---|
| Temperature (K) | 338 | | |
| $a$, $b$, $c$ (Å) | 8.66982(18), | 9.21282(19), | 9.26605(19) |
| $\alpha$, $\beta$, $\gamma$ (°) | 92.6113(7), | 116.6498(7), | 113.4563(7) |
| Volume (Å$^3$), $Z$, $D_{calc}$ (g cm$^{-3}$) | 583.72(2), | 2, | 1.685 |
| $q_{max}$ | 30.0 | | |
| $N_{total}$, $N_{unique}$, $R_{int}$ | 17198, | 3389, | 0.026 |
| $N_{reflections}$, $N_{parameters}$ | 3389, | 177 | |
| $R[F^2 > 2s(F^2)]$, $wR(F^2)$, $S$ | 0.0364, | 0.0984, | 1.12 |
| $\Delta\rho_{max}$ (e Å$^{-3}$), $\Delta\rho_{min}$ (e Å$^{-3}$) | 0.35, | -0.70 | |

Table 1S (c) Hydrogen-bond geometry (Å, º) determined at 338 K

| D—H···A | D—H | H...A | D...A | D—H...A |
|---|---|---|---|---|
| N1—H1A···O4 | 0.93(3) | 1.96(3) | 2.8612(17) | 162(2) |
| N1—H1B···O1$^{iv}$ | 0.93(2) | 2.08(3) | 2.9156(17) | 149.1(17) |
| N1—H1B···O2$^{iii}$ | 0.93(2) | 2.23(2) | 2.9573(18) | 134.6(19) |
| O2—H2···O4 | 0.81(3) | 1.79(4) | 2.5078(13) | 148(4) |
| O4—H4···O2 | 0.82(3) | 1.80(3) | 2.5078(13) | 144(4) |

Symmetry codes: (iii) 1-x,1-y,1-z ; (iv) 1+x,y,-1+z.