# Supporting information

## Production of high purity allyl alcohol by the salting-out method from formic acid-mediated deoxydehydration of glycerol

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**Table S1.** Experimental (liquid-liquid) equilibrium mass fractions of a salt-free basis for (allyl alcohol + water + salt) at the given total mass fraction of a salt, temperature $T$ = 298.15 K, and pressure $P$= 101.3 kPa (for Figures 3–5)[a]

| salt | organic phase (wt%) | | aqueous phase (wt%) | |
|---|---|---|---|---|
| | allyl alcohol | water | allyl alcohol | water |
| 5%NaCl | 70.97 | 29.03 | 13.15 | 86.85 |
| 10%NaCl | 72.57 | 27.43 | 10.95 | 89.05 |
| 15%NaCl | 72.89 | 27.11 | 10.96 | 89.04 |
| 20%NaCl | 73.03 | 26.97 | 10.95 | 89.05 |
| 25%NaCl | 73.24 | 26.76 | 10.94 | 89.06 |
| 5%$K_2HPO_4$ | 75.84 | 24.16 | 1.66 | 98.34 |
| 10%$K_2HPO_4$ | 79.08 | 20.92 | 1.05 | 98.95 |
| 15%$K_2HPO_4$ | 82.46 | 17.54 | 0.76 | 99.24 |
| 20%$K_2HPO_4$ | 84.95 | 15.05 | 0.57 | 99.43 |
| 25%$K_2HPO_4$ | 87.28 | 12.72 | 0.45 | 99.55 |
| 30%$K_2HPO_4$ | 89.60 | 10.40 | 0.40 | 99.60 |
| 35%$K_2HPO_4$ | 91.40 | 8.60 | 0.35 | 99.65 |
| 40%$K_2HPO_4$ | 93.10 | 6.90 | 0.34 | 99.66 |
| 5%$K_2CO_3$ | 76.72 | 23.28 | 1.57 | 98.43 |
| 10%$K_2CO_3$ | 85.20 | 14.80 | 0.83 | 99.17 |
| 15%$K_2CO_3$ | 90.55 | 9.45 | 0.55 | 99.45 |
| 20%$K_2CO_3$ | 94.30 | 5.70 | 0.42 | 99.58 |
| 25%$K_2CO_3$ | 96.74 | 3.26 | 0.34 | 99.66 |
| 30%$K_2CO_3$ | 98.24 | 1.76 | 0.32 | 99.68 |
| 35%$K_2CO_3$ | 99.01 | 0.99 | 0.31 | 99.69 |
| 40%$K_2CO_3$ | 99.05 | 0.95 | 0.30 | 99.70 |

[a]Standard uncertainties $u$ are $u(T)$= 0.01 K, $u(p)$= 1 kPa, $u$(wt%)= 0.01

**Table S2.** Experimental (liquid-liquid) equilibrium mass fractions of a salt-free basis for (allyl alcohol + water + salt) at the given (20% + 20%) mass fraction of two salts, temperature $T$ = 298.15 K, and pressure $P$= 101.3 kPa (for Table 3)[a]

| salt | organic phase (wt%) | | aqueous phase (wt%) | |
|---|---|---|---|---|
| | allyl alcohol | water | allyl alcohol | water |
| 20%KCl+20%KCl | 70.72 | 29.28 | 14.64 | 85.36 |
| 20%KCl+20%NaCl | 72.84 | 27.16 | 10.45 | 89.55 |
| 20%KCl+20%$CaCl_2$ | 72.74 | 27.26 | 10.42 | 89.58 |
| 20%KCl+20%$K_2CO_3$ | 85.93 | 14.07 | 0.58 | 99.42 |
| 20%KCl+20%$Na_2CO_3$ | 85.82 | 14.18 | 0.54 | 99.46 |
| 20%KCl+20%$Na_2SO_4$ | 73.39 | 26.61 | 9.66 | 90.34 |
| 20%KCl+20%$K_2C_2O_4$ | 73.33 | 26.67 | 9.69 | 90.31 |
| 20%KCl+20%$KH_2PO_4$ | 72.87 | 27.13 | 10.12 | 89.88 |
| 20%KCl+20%$NH_4H_2PO_4$ | 72.68 | 27.32 | 10.35 | 89.65 |
| 20%KCl+20%$K_2HPO_4$ | 84.49 | 15.51 | 0.67 | 99.33 |
| 20%KCl+20%$Mg(NO_3)_2$ | 70.89 | 29.11 | 14.66 | 85.34 |
| 20%NaCl+20%NaCl | 73.21 | 26.79 | 10.84 | 89.16 |
| 20%NaCl+20%$CaCl_2$ | 72.32 | 27.68 | 11.25 | 88.75 |
| 20%NaCl+20%$K_2CO_3$ | 88.24 | 11.76 | 0.53 | 99.47 |
| 20%NaCl+20%$Na_2CO_3$ | 72.31 | 27.87 | 10.46 | 89.54 |
| 20%NaCl+20%$Na_2SO_4$ | 73.17 | 26.83 | 9.82 | 90.18 |
| 20%NaCl+20%$K_2C_2O_4$ | 71.75 | 28.25 | 13.88 | 86.12 |
| 20%NaCl+20%$KH_2PO_4$ | 70.76 | 29.24 | 13.45 | 86.55 |
| 20%NaCl+20%$NH_4H_2PO_4$ | 70.73 | 29.27 | 13.63 | 86.37 |
| 20%NaCl+20%$K_2HPO_4$ | 82.96 | 17.04 | 0.73 | 99.27 |
| 20%NaCl+20%$Mg(NO_3)_2$ | 70.52 | 29.48 | 14.84 | 85.16 |
| 20%$CaCl_2$+20%$CaCl_2$ | 72.72 | 27.28 | 10.29 | 89.71 |
| 20%$CaCl_2$+20%$K_2CO_3$ | 72.83 | 27.17 | 10.21 | 89.79 |
| 20%$CaCl_2$+20%$Na_2CO_3$ | 72.28 | 27.72 | 10.78 | 89.22 |
| 20%$CaCl_2$+20%$Na_2SO_4$ | 72.95 | 27.05 | 9.87 | 90.13 |

| | | | | |
|---|---|---|---|---|
| 20%$CaCl_2$+20%$K_2C_2O_4$ | 71.92 | 28.08 | 13.65 | 86.35 |
| 20%$CaCl_2$+20%$KH_2PO_4$ | 70.14 | 29.86 | 15.24 | 84.76 |
| 20%$CaCl_2$+20%$NH_4H_2PO_4$ | 70.68 | 29.32 | 14.64 | 85.36 |
| 20%$CaCl_2$+20%$K_2HPO_4$ | 84.39 | 15.61 | 0.64 | 99.36 |
| 20%$CaCl_2$+20%$Mg(NO_3)_2$ | 70.72 | 29.28 | 14.62 | 85.38 |
| 20%$K_2CO_3$+20%$K_2CO_3$ | 99.12 | 0.88 | 0.28 | 99.72 |
| 20%$K_2CO_3$+20%$Na_2CO_3$ | 94.87 | 5.13 | 0.32 | 99.68 |
| 20%$K_2CO_3$+20%$Na_2SO_4$ | 92.52 | 7.48 | 0.33 | 99.67 |
| 20%$K_2CO_3$+20%$K_2C_2O_4$ | 92.13 | 7.87 | 0.33 | 99.67 |
| 20% $K_2CO_3$+20% $KH_2PO_4$ | 85.23 | 14.77 | 0.62 | 99.38 |
| 20% $K_2CO_3$+20% $NH_4H_2PO_4$ | 86.29 | 13.71 | 0.54 | 99.46 |
| 20% $K_2CO_3$+20% $K_2HPO_4$ | 95.02 | 4.98 | 0.33 | 99.67 |
| 20% $K_2CO_3$+20% $Mg(NO_3)_2$ | 76.43 | 23.57 | 8.36 | 91.64 |
| 20% $Na_2CO_3$+20% $Na_2CO_3$ | 70.64 | 29.36 | 14.76 | 85.24 |
| 20% $Na_2CO_3$+20%$Na_2SO_4$ | 70.53 | 29.47 | 14.92 | 85.08 |
| 20% $Na_2CO_3$+20% $K_2C_2O_4$ | 72.09 | 27.91 | 11.56 | 88.44 |
| 20% $Na_2CO_3$+20% $KH_2PO_4$ | 72.21 | 27.79 | 10.98 | 89.02 |
| 20% $Na_2CO_3$+20% $NH_4H_2PO_4$ | 72.13 | 27.87 | 11.53 | 88.47 |
| 20% $Na_2CO_3$+20%$K_2HPO_4$ | 91.42 | 8.58 | 0.35 | 99.65 |
| 20% $Na_2CO_3$+20% $Mg(NO_3)_2$ | 70.36 | 29.64 | 15.34 | 84.66 |
| 20% $Na_2SO_4$+20% $Na_2SO_4$ | 70.44 | 29.56 | 15.32 | 84.68 |
| 20% $Na_2SO_4$+20% $K_2C_2O_4$ | 73.31 | 26.69 | 9.72 | 90.28 |
| 20% $Na_2SO_4$+20% $KH_2PO_4$ | 74.62 | 25.38 | 8.57 | 91.43 |
| 20% $Na_2SO_4$+20% $NH_4H_2PO_4$ | 75.16 | 24.84 | 8.32 | 91.68 |
| 20% $Na_2SO_4$+20% $KH_2PO_4$ | 91.28 | 8.72 | 0.36 | 99.64 |
| 20% $Na_2SO_4$+20% $Mg(NO_3)$ | 70.42 | 29.58 | 15.37 | 84.63 |
| 20% $K_2C_2O_4$+20% $K_2C_2O_4$ | 70.60 | 29.4 | 16.16 | 83.84 |
| 20% $K_2C_2O_4$+20%$KH_2PO_4$ | 71.48 | 28.52 | 14.89 | 85.11 |
| 20% $K_2C_2O_4$+20%$NH_4H_2PO_4$ | 72.03 | 27.97 | 11.13 | 88.87 |

| | | | | |
|---|---|---|---|---|
| 20% $K_2C_2O_4$+20%$K_2HPO_4$ | 83.12 | 16.88 | 0.73 | 99.27 |
| 20% $K_2C_2O_4$+20%$Mg(NO_3)_2$ | 70.20 | 29.80 | 15.38 | 84.62 |
| 20% $KH_2PO_4$+20% $KH_2PO_4$ | 70.68 | 29.32 | 14.72 | 85.28 |
| 20% $KH_2PO_4$+20% $NH_4H_2PO_4$ | 72.51 | 27.49 | 10.45 | 89.55 |
| 20% $KH_2PO_4$+20% $K_2HPO_4$ | 80.93 | 19.07 | 1.02 | 98.98 |
| 20% $KH_2PO_4$+20% $Mg(NO_3)_2$ | 70.42 | 29.58 | 14.34 | 85.66 |
| 20%$NH_4H_2PO_4$+20%$NH_4H_2PO_4$ | 71.63 | 28.37 | 14.56 | 85.44 |
| 20% $NH_4H_2PO_4$+20%$K_2HPO_4$ | 78.71 | 21.29 | 1.45 | 98.55 |
| 20% $NH_4H_2PO_4$+20%$Mg(NO_3)_2$ | 71.18 | 28.82 | 14.68 | 85.32 |
| 20%$K_2HPO_4$+20%$K_2HPO_4$ | 93.01 | 6.99 | 0.34 | 99.66 |
| 20%$K_2HPO_4$+20%$Mg(NO_3)_2$ | 78.83 | 21.17 | 1.23 | 98.77 |
| 20%$Mg(NO_3)_2$+20%$Mg(NO_3)_2$ | 70.76 | 29.24 | 14.56 | 85.44 |

[a]Standard uncertainties $u$ are $u(T)$= 0.01 K, $u(p)$= 1 kPa, $u$(wt%)= 0.01

**Table S3.** Experimental (liquid-liquid) equilibrium mass fractions of a salt-free basis for (allyl alcohol + water + salt) at the given ($K_2CO_3$ + $K_2HPO_4$) mass fraction of two salts, temperature $T$ = 298.15 K, and pressure $P$= 101.3 kPa (for Table 4)[a]

| salt | organic phase (wt%) | | aqueous phase (wt%) | |
|---|---|---|---|---|
| | allyl alcohol | water | allyl alcohol | water |
| 35% $K_2CO_3$+5% $K_2HPO_4$ | 99.02 | 0.98 | 0.31 | 99.69 |
| 35% $K_2CO_3$+10% $K_2HPO_4$ | 99.61 | 0.39 | 0.28 | 99.72 |
| 35% $K_2CO_3$+15% $K_2HPO_4$ | 99.78 | 0.22 | 0.27 | 99.73 |
| 35% $K_2CO_3$+20% $K_2HPO_4$ | 99.89 | 0.11 | 0.27 | 99.73 |
| 35% $K_2CO_3$+25% $K_2HPO_4$ | 99.92 | 0.08 | 0.27 | 99.73 |

[a]Standard uncertainties $u$ are $u(T)$= 0.01 K, $u(p)$= 1 kPa, $u$(wt%)= 0.01