Supplementary Material for

# Complex toxicological interaction between ionic liquid and pesticide to *Vibrio qinghaiensis* sp.-Q67

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Supplementary Material includes the following: Concentration-response models, statistics ($R^2$ and RMSE), effective concentrations ($EC_{10,}$ $EC_{50}$ and $EC_{70}$) and characteristic parameters (ZEP, $EC_{min}$ and $E_{min}$ for J-shape CRCs) of ionic liquids at seven exposure times (Table S1); The concentration-response models ($\alpha$ and $\beta$), statistics ($R^2$ and RMSE) and effective concentrations ($EC_{10,}$ $EC_{50}$ and $EC_{70}$) of two pesticides at seven exposure times (Table S2); Characteristic parameters ($EC_{10,}$ $EC_{50}$ and $EC_{70}$ for all CRCs and ZEP, $EC_{min}$ and $E_{min}$ for J-shape CRCs) of 20 mixture rays at seven exposure times (Figure S1). Concentration-response curves of 5 mixture rays in [emim]Br-MET systems at seven exposure times (Figure S2); Concentration-response curves of 5 mixture rays in [emim]Cl-MET systems at seven exposure times (Figure S3); Concentration-response curves of 5 mixture rays in [emim]Br-

SIM systems at seven exposure times (Figure S4); Concentration-response curves of 5 mixture rays in [emim]Cl-SIM systems at seven exposure times (Figure S5).

**Table S1**

Concentration-response models, statistics ($R^2$ and RMSE), effective concentrations ($EC_{10}$, $EC_{50}$ and $EC_{70}$) and characteristic parameters (ZEP, $EC_{min}$ and $E_{min}$ for J-shape CRCs) of ionic liquids at seven exposure times

| Chemical | Time (h) | Function | $R^2$ | RMSE | $EC_{10}$ (mol/L) | $EC_{50}$ (mol/L) | $EC_{70}$ (mol/L) | ZEP | $EC_{min}$ | $E_{min}$ |
|---|---|---|---|---|---|---|---|---|---|---|
| [emim]Br | 0.25 | Logit | 0.9755 | 0.0459 | 8.42E-04 | 7.08E-03 | 1.45E-02 | - | - | - |
| | 2 | Logit | 0.9755 | 0.0563 | 3.00E-03 | 1.52E-02 | 2.52E-02 | - | - | - |
| | 4 | Logit | 0.9506 | 0.1017 | 2.17E-03 | 9.27E-03 | 1.50E-02 | - | - | - |
| | 6 | Logit | 0.9708 | 0.0715 | 2.69E-03 | 7.48E-03 | 1.05E-02 | - | - | - |
| | 8 | Logistic | 0.9848 | 0.0623 | 3.49E-03 | 7.28E-03 | 1.03E-02 | 0.0028 | 0.0015 | -8.7610 |
| | 10 | Logistic | 0.9914 | 0.0498 | 4.42E-03 | 8.14E-03 | 1.11E-02 | 0.0036 | 0.0017 | -14.8817 |
| | 12 | Logistic | 0.9948 | 0.0378 | 4.86E-03 | 9.11E-03 | 1.25E-02 | 0.0039 | 0.0018 | -14.2030 |
| [emim]Cl | 0.25 | Logit | 0.9784 | 0.0450 | 6.36E-04 | 7.27E-03 | 1.48E-02 | - | - | - |
| | 2 | Logit | 0.9823 | 0.0577 | 3.63E-03 | 1.70E-02 | 2.77E-02 | - | - | - |
| | 4 | Logit | 0.9619 | 0.1007 | 2.23E-03 | 9.36E-03 | 1.51E-02 | - | - | - |
| | 6 | Logit | 0.9789 | 0.0992 | 2.99E-03 | 7.78E-03 | 1.05E-02 | - | - | - |
| | 8 | Logistic | 0.9890 | 0.0571 | 3.85E-03 | 7.65E-03 | 1.08E-02 | 0.0030 | 0.0015 | -11.7519 |
| | 10 | Logistic | 0.9935 | 0.0443 | 4.65E-03 | 8.67E-03 | 1.19E-02 | 0.0037 | 0.0018 | -12.9263 |
| | 12 | Logistic | 0.9946 | 0.0400 | 4.81E-03 | 9.25E-03 | 1.27E-02 | 0.0038 | 0.0018 | -12.1068 |

[a]: $R^2$ refers to coefficient of determination.

[b]: RMSE refers to root mean square error.

[c]: ZEP refers to zero effect point (concentration).

[d]: $E_{min}$ refers to the maximum stimulatory effect or the minimum inhibition.

[e]: $EC_{min}$ refers to the concentration with maximum stimulatory effect.

**Table S2**

The concentration-response models (α and β), statistics ($R^2$ and RMSE) and effective concentrations ($EC_{10}$, $EC_{50}$ and $EC_{70}$) of two pesticides at seven exposure times.

| Chemical | Time (h) | Function | α | β | $R^2$ | RMSE | $EC_{10}$ (mol/L) | $EC_{50}$ (mol/L) | $EC_{70}$ (mol/L) |
|---|---|---|---|---|---|---|---|---|---|
| MET | 0.25 | Weibull | 7.12 | 2.71 | 0.9945 | 0.0196 | 3.49E-04 | 1.73E-03 | 2.76E-03 |
| | 2 | Weibull | 5.84 | 2.12 | 0.9986 | 0.0100 | 1.53E-04 | 1.18E-03 | 2.15E-03 |
| | 4 | Weibull | 6.41 | 2.25 | 0.9990 | 0.0094 | 1.42E-04 | 9.73E-04 | 1.71E-03 |
| | 6 | Weibull | 6.74 | 2.34 | 0.9914 | 0.0303 | 1.44E-04 | 9.18E-04 | 1.58E-03 |
| | 8 | Weibull | 6.73 | 2.3 | 0.9983 | 0.0138 | 1.25E-04 | 8.21E-04 | 1.43E-03 |
| | 10 | Weibull | 7.12 | 2.44 | 0.9927 | 0.0287 | 1.44E-04 | 8.55E-04 | 1.44E-03 |
| | 12 | Weibull | 6.94 | 2.41 | 0.9947 | 0.0237 | 1.54E-04 | 9.30E-04 | 1.58E-03 |
| SIM | 0.25 | Weibull | 6.27 | 1.83 | 0.9927 | 0.0230 | 2.21E-05 | 2.36E-04 | 4.73E-04 |
| | 2 | Weibull | 4.83 | 1.35 | 0.9933 | 0.0195 | 5.69E-06 | 1.41E-04 | 3.63E-04 |
| | 4 | Weibull | 6.11 | 1.79 | 0.9870 | 0.0303 | 2.14E-05 | 2.41E-04 | 4.90E-04 |
| | 6 | Weibull | 6.69 | 1.98 | 0.9901 | 0.0274 | 3.05E-05 | 2.73E-04 | 5.19E-04 |
| | 8 | Weibull | 7.41 | 2.21 | 0.9924 | 0.0249 | 4.25E-05 | 3.03E-04 | 5.38E-04 |
| | 10 | Weibull | 8.54 | 2.56 | 0.9929 | 0.0241 | 6.10E-05 | 3.32E-04 | 5.45E-04 |
| | 12 | Weibull | 9.09 | 2.75 | 0.9949 | 0.0203 | 7.52E-05 | 3.64E-04 | 5.78E-04 |

α: location parameter

β: shape parameter

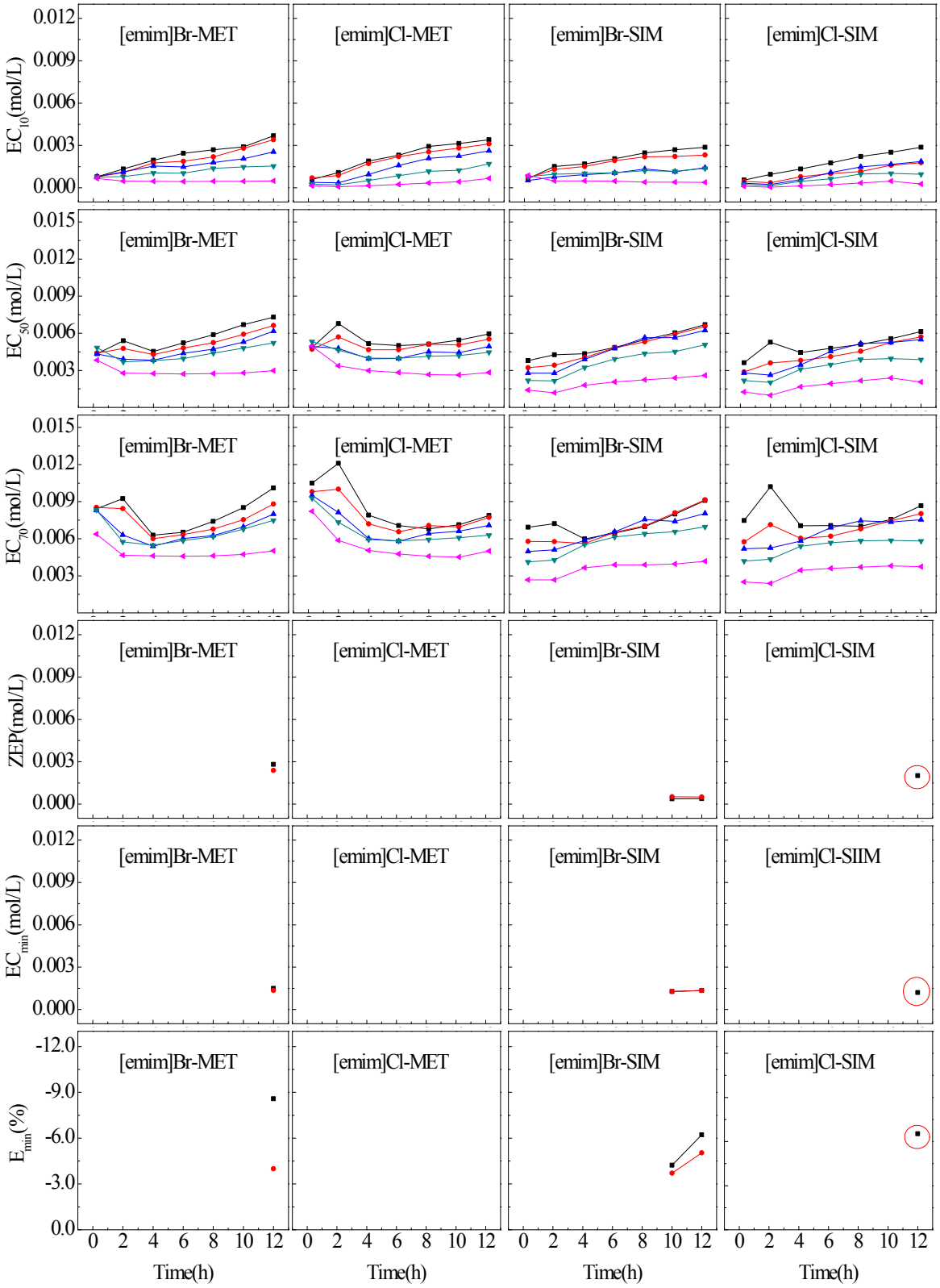


Figure S1 Characteristic parameters ($EC_{10}$, $EC_{50}$ and $EC_{70}$ for all CRCs and ZEP, $EC_{min}$ and $E_{min}$ for J-shape CRCs) of 20 mixture rays at seven exposure times ( ○: R1; ∽: R2; □: R3; ❑: R4; ♦: R5).

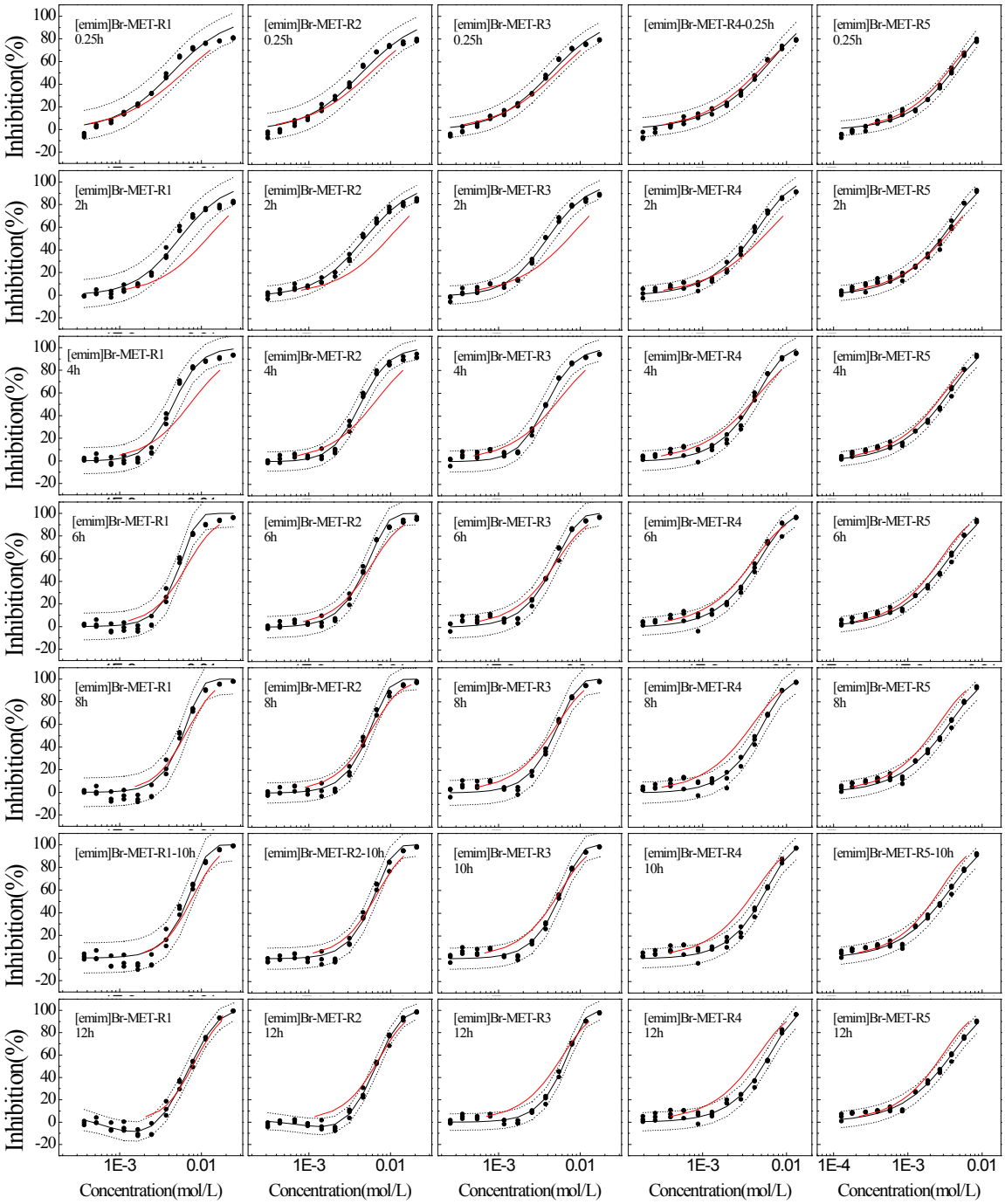


**Figure S2** Concentration-response curves of five mixture rays in [emim]Br-MET systems at seven exposure times (ꝏ: experimental values; —: CRCs fitted; —: CRCs predicted by CA; ···: 95% CIs)

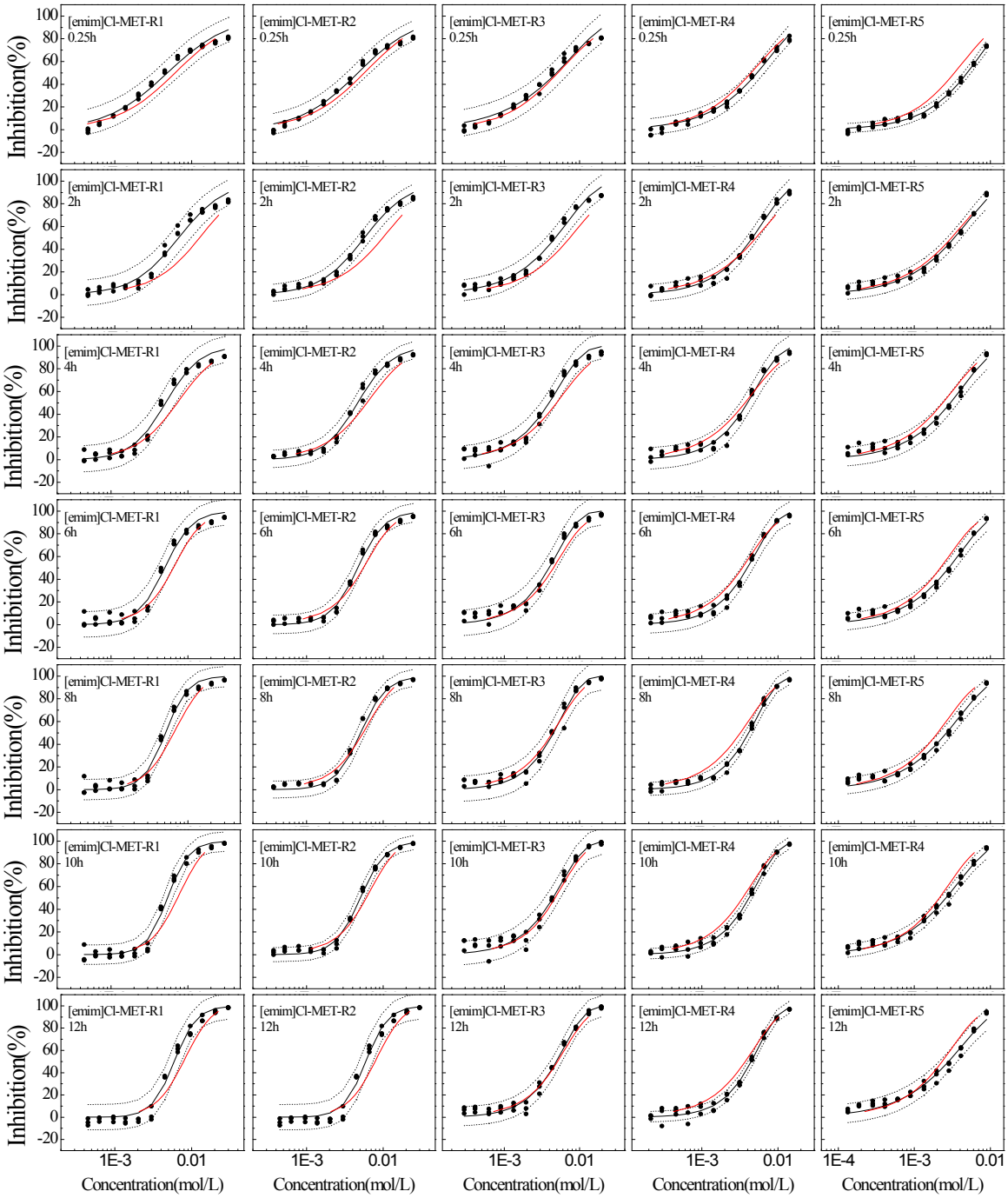


**Figure S3** Concentration-response curves of five mixture rays in [emim]Cl-MET systems at seven exposure times (ꝏ: experimental values; —: CRCs fitted; —: CRCs predicted by CA; ···: 95% CIs)

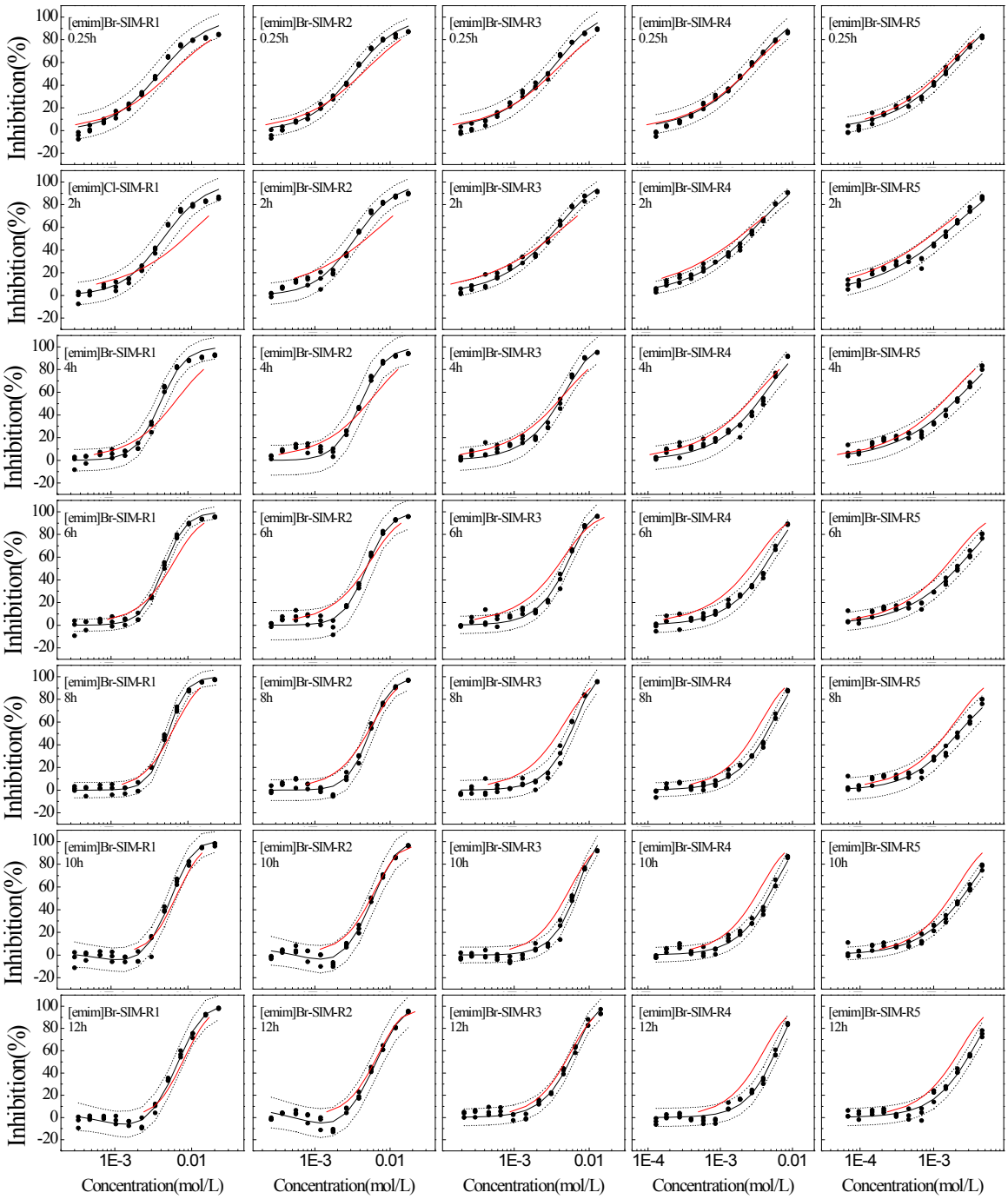


**Figure S4** Concentration-response curves of five mixture rays in [emim]Br-SIM systems at seven exposure times (ꝏ: experimental values; —: CRCs fitted; —: CRCs predicted by CA; ···: 95% CIs)

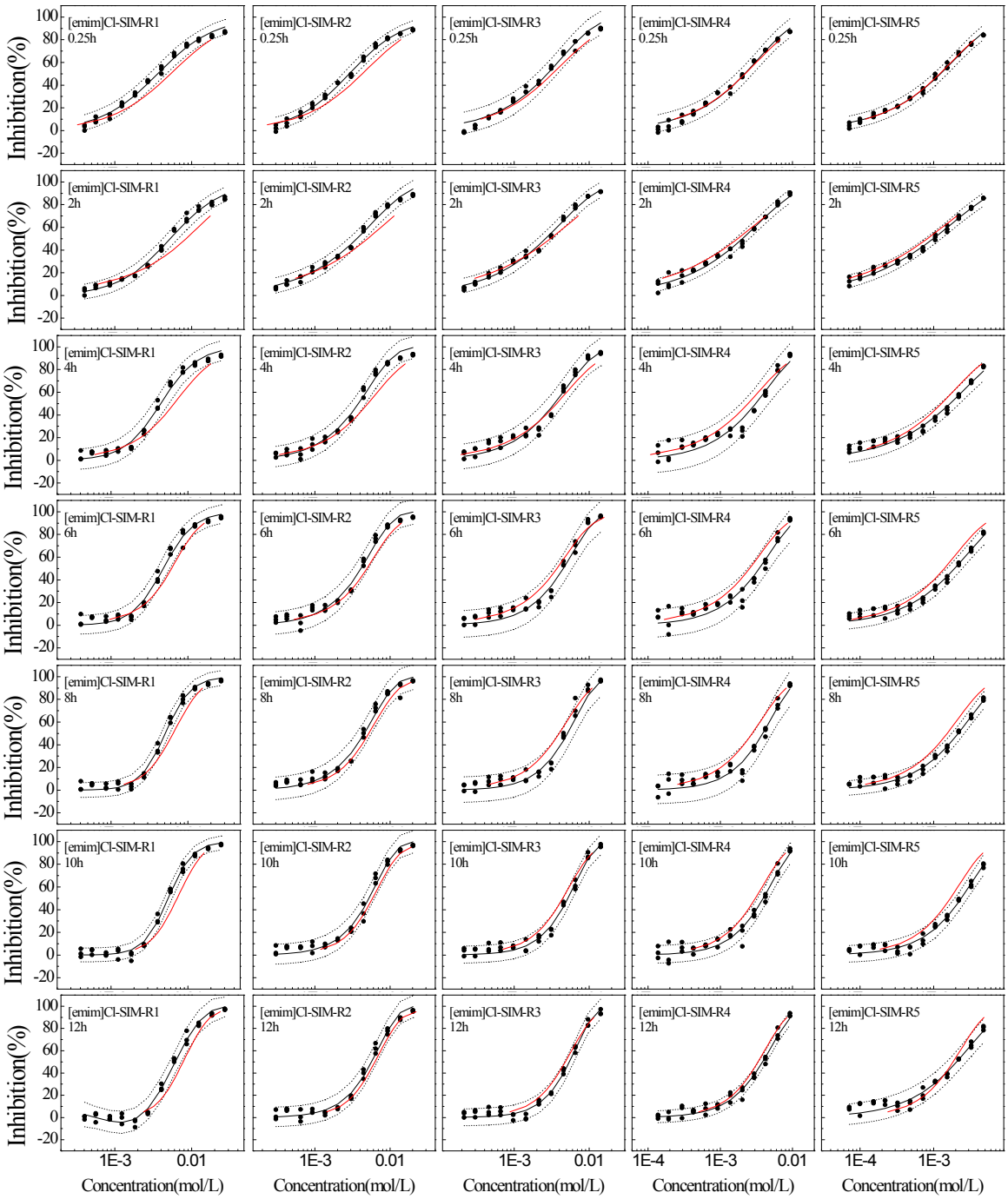


**Figure S5** Concentration-response curves of five mixture rays in [emim]Cl-SIM systems at seven exposure times (ꝏ: experimental values; —: CRCs fitted; —: CRCs predicted by CA; ···: 95% CIs)