

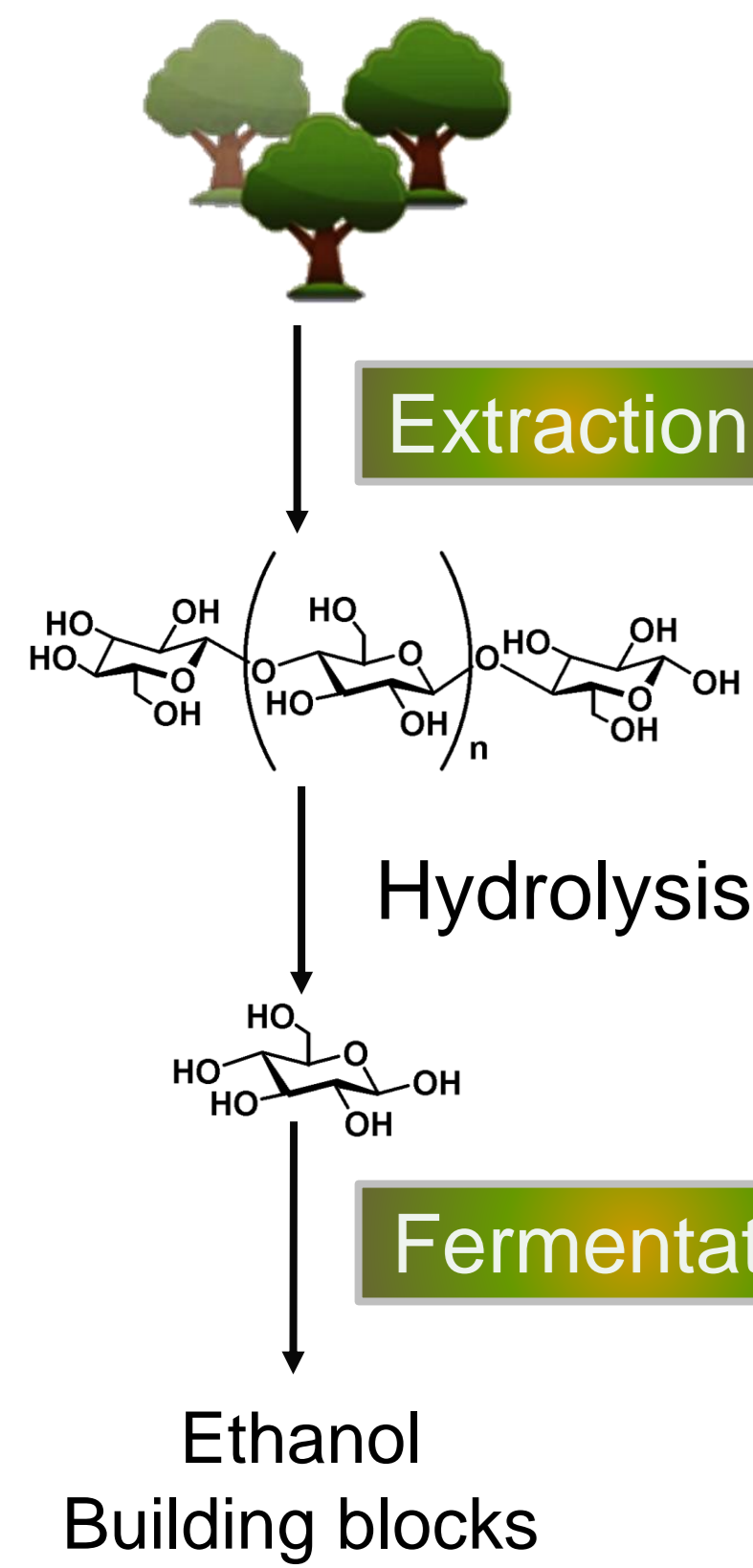
Efficient one-pot conversion of biomass to ethanol in liquid zwitterion/DMSO mixtures

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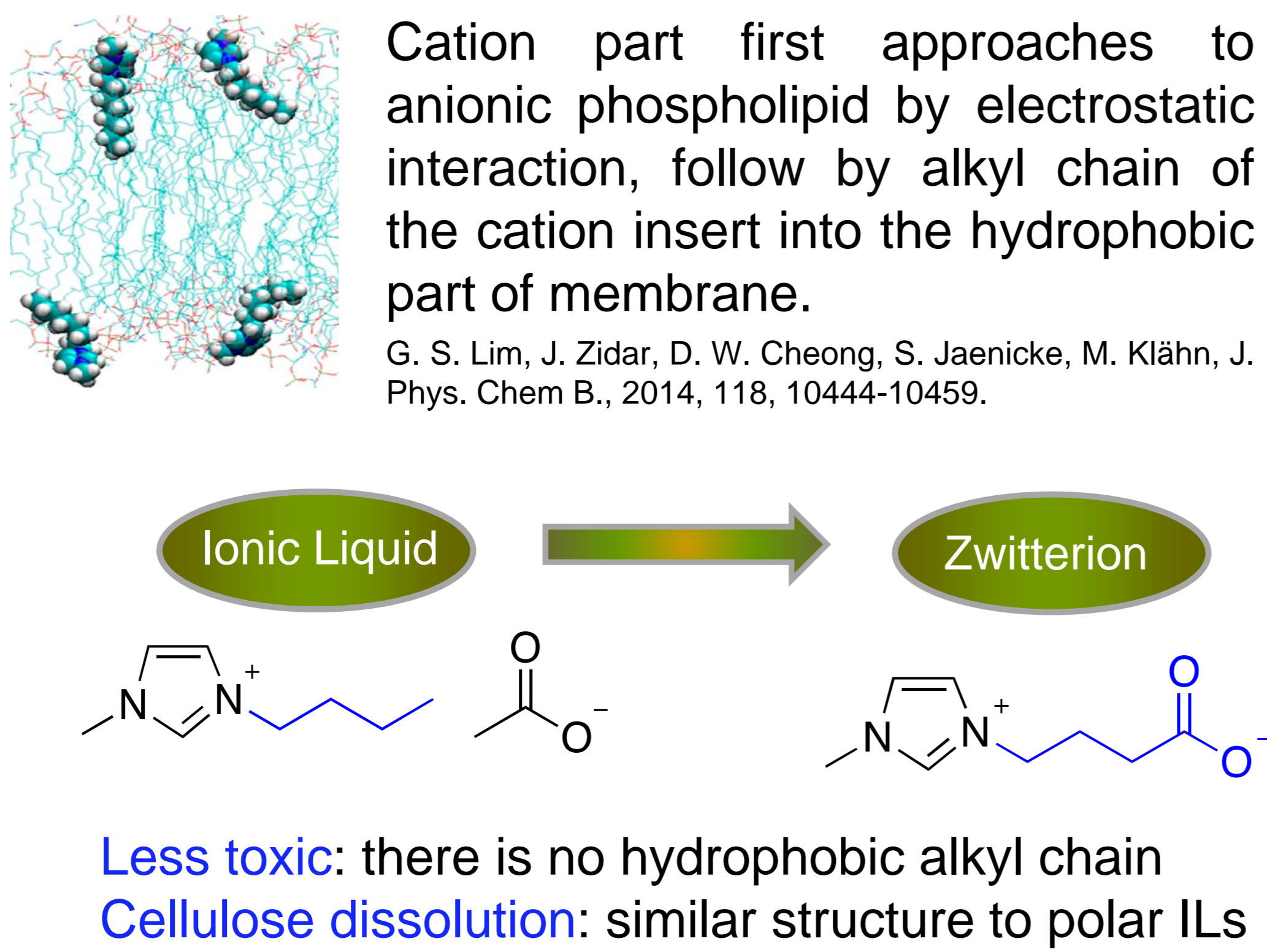
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1. Introduction

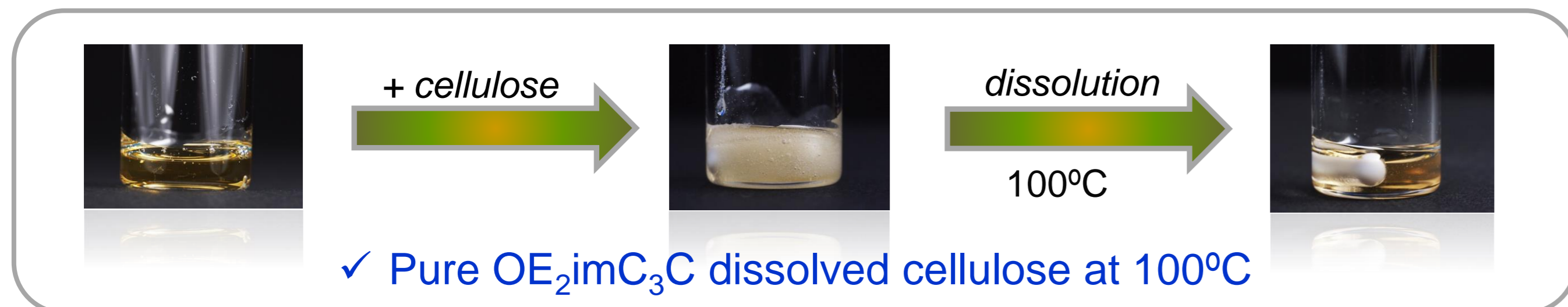
Biomass conversion



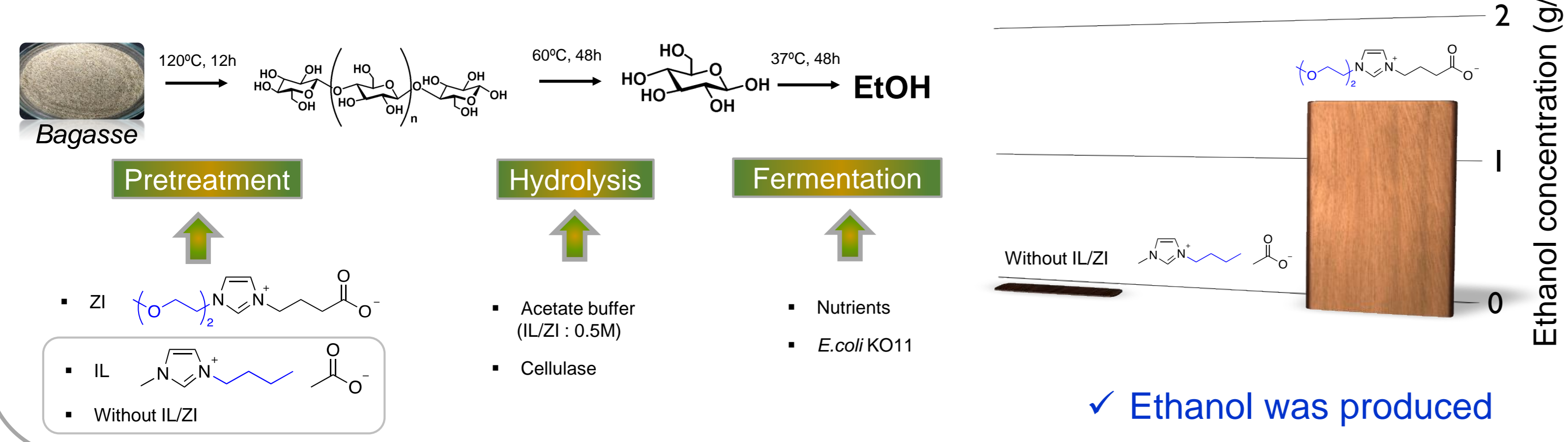
Toxicity of ILs to microorganisms



Zwitterion: OE₂imC₃C



One-pot conversion biomass



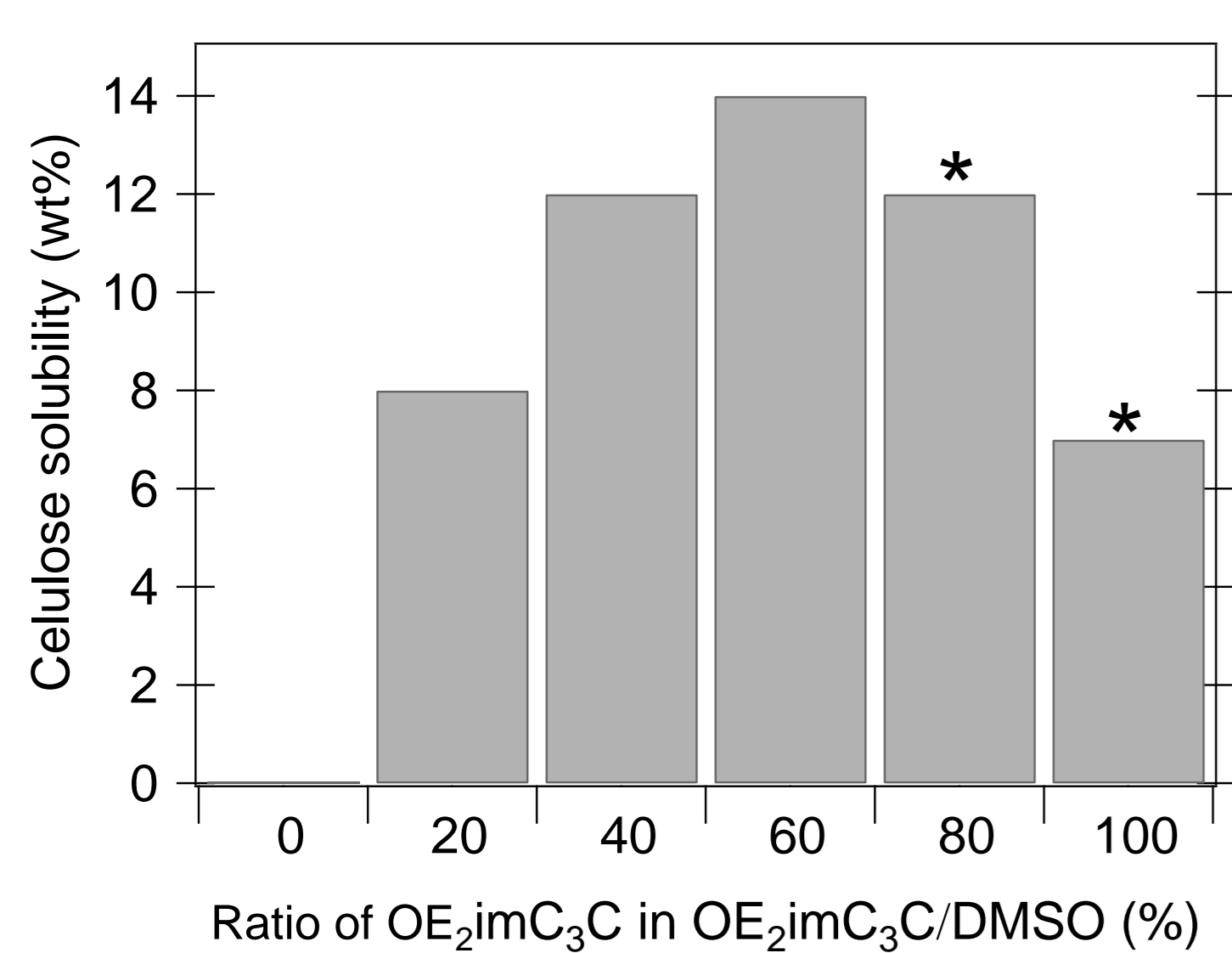
- Disadvantage

- ✓ High viscosity

This study

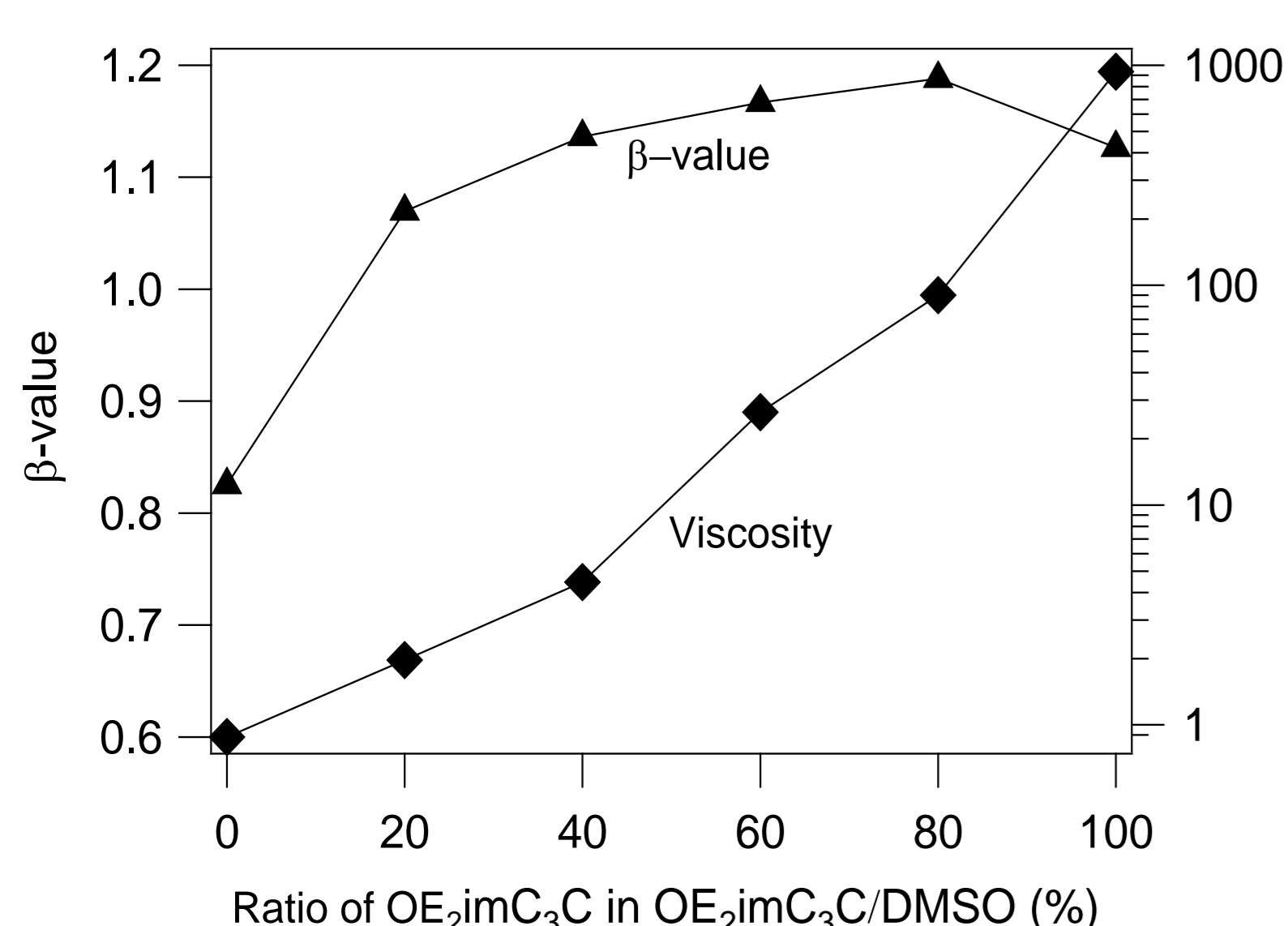
Dimethyl sulfoxide (DMSO) was added to decrease viscosity, and toxicity

2. Dissolution of Cellulose



Addition of DMSO → Accelerate cellulose dissolution

✓ OE₂imC₃C/DMSO (60/40) was the best

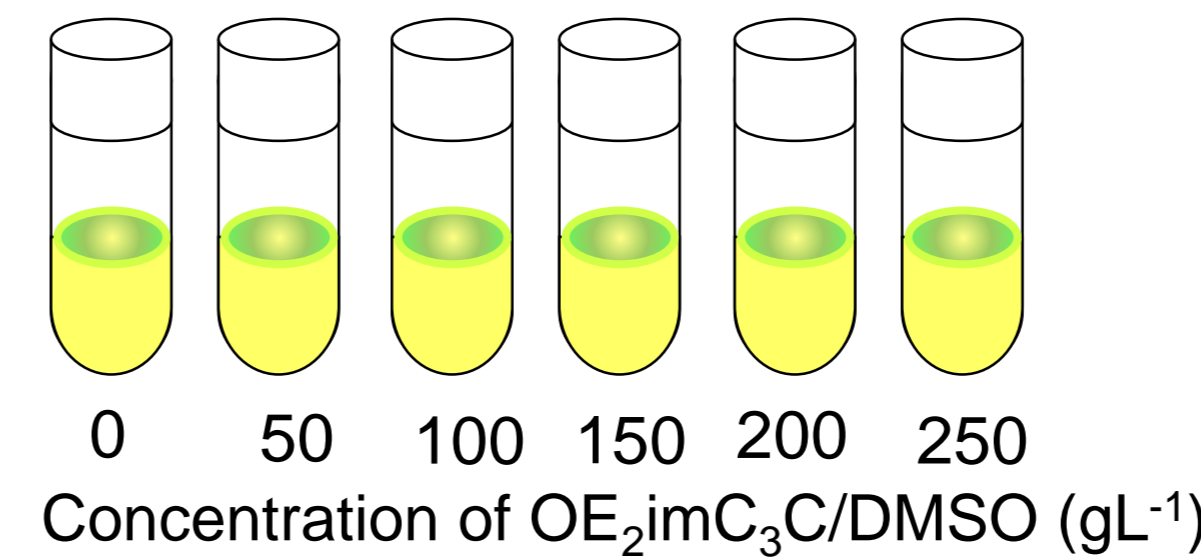


- Decreasing of viscosity was confirmed as the reason of acceleration of cellulose dissolution when DMSO ratio below 40%.
- Decreasing of β-value was confirmed as the reason of decreasing of cellulose dissolution when DMSO ratio over 40%.
- ❖ Hydrogen basicity: β-value of Kamlet–Taft parameters

3. Toxicity of OE₂imC₃C/DMSO

Effective Concentration-50 (EC₅₀) Assay

Inoculation with initial OD₆₀₀ = 0.1 (turbidity at 600 nm; concentration of *E. coli* KO11)



24h incubation → OD₆₀₀ measurement

Relative OD₆₀₀ at 24h

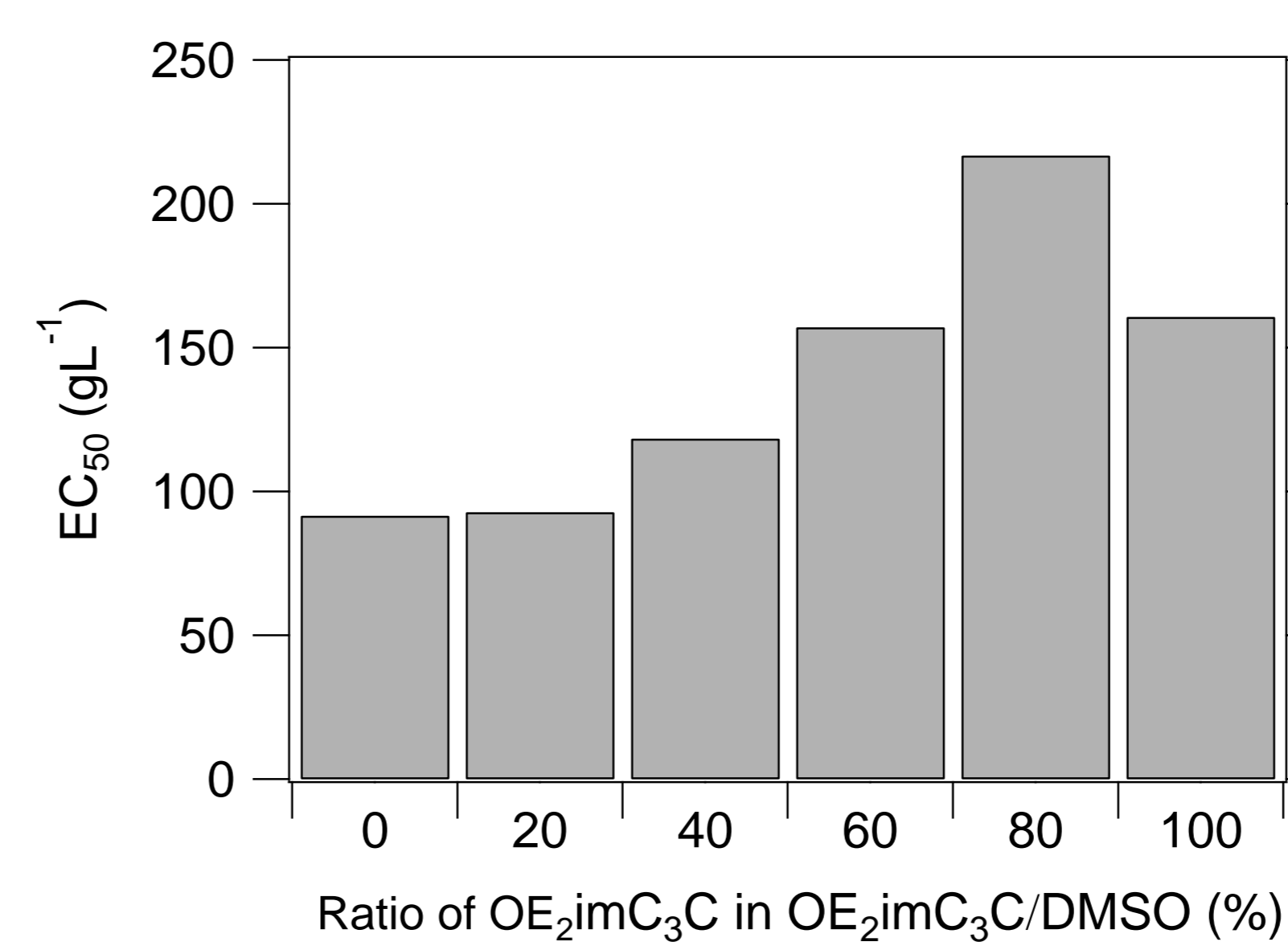
$$= \frac{\text{OD}_{600} \text{ of OE}_2\text{imC}_3\text{C/DMSO solutions}}{\text{OD}_{600} \text{ of the solution of 0 g/L}^{-1}}$$

EC₅₀

Refer to the concentration of OE₂imC₃C/DMSO (g/L⁻¹) which has the relative OD₆₀₀ 0.5 point.

- Low EC₅₀: more toxic
- High EC₅₀: less toxic

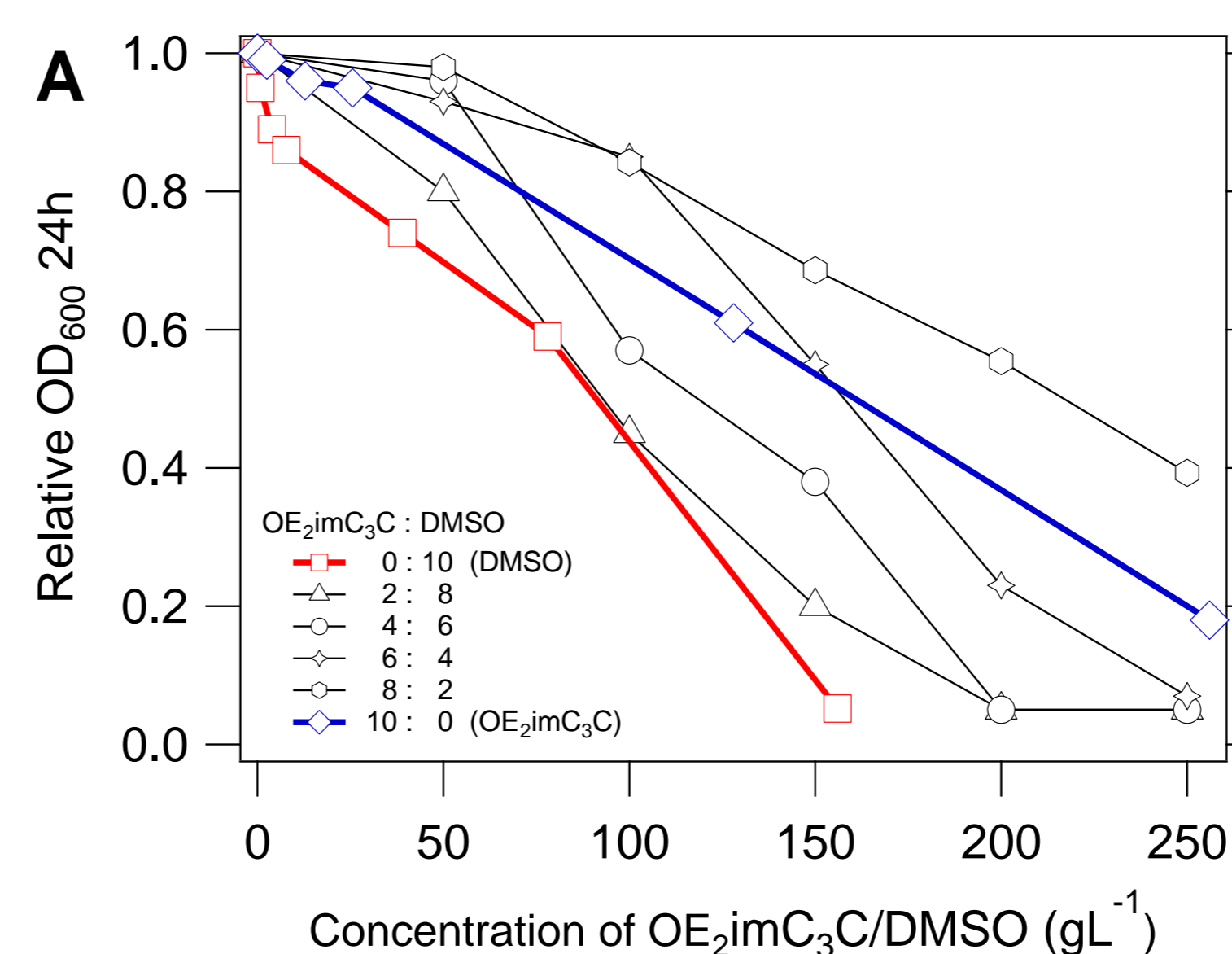
Effective Concentration-50 (EC₅₀)



➤ Toxicity of OE₂imC₃C to *E. coli* was lower than DMSO.

- ✓ Toxicity of OE₂imC₃C/DMSO (80/20) lower than those of pure OE₂imC₃C and DMSO.

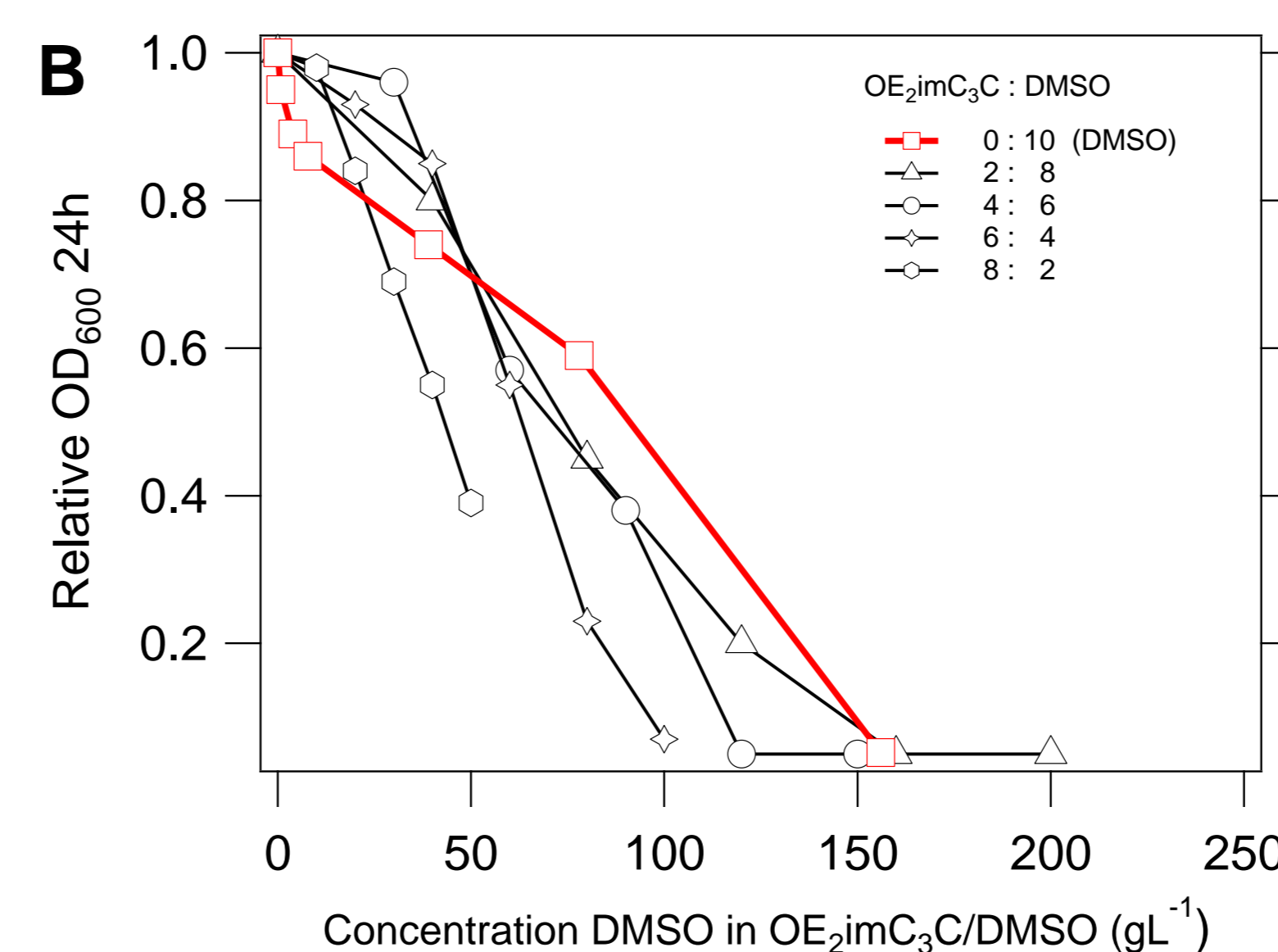
Growth of *E. coli* in Solution



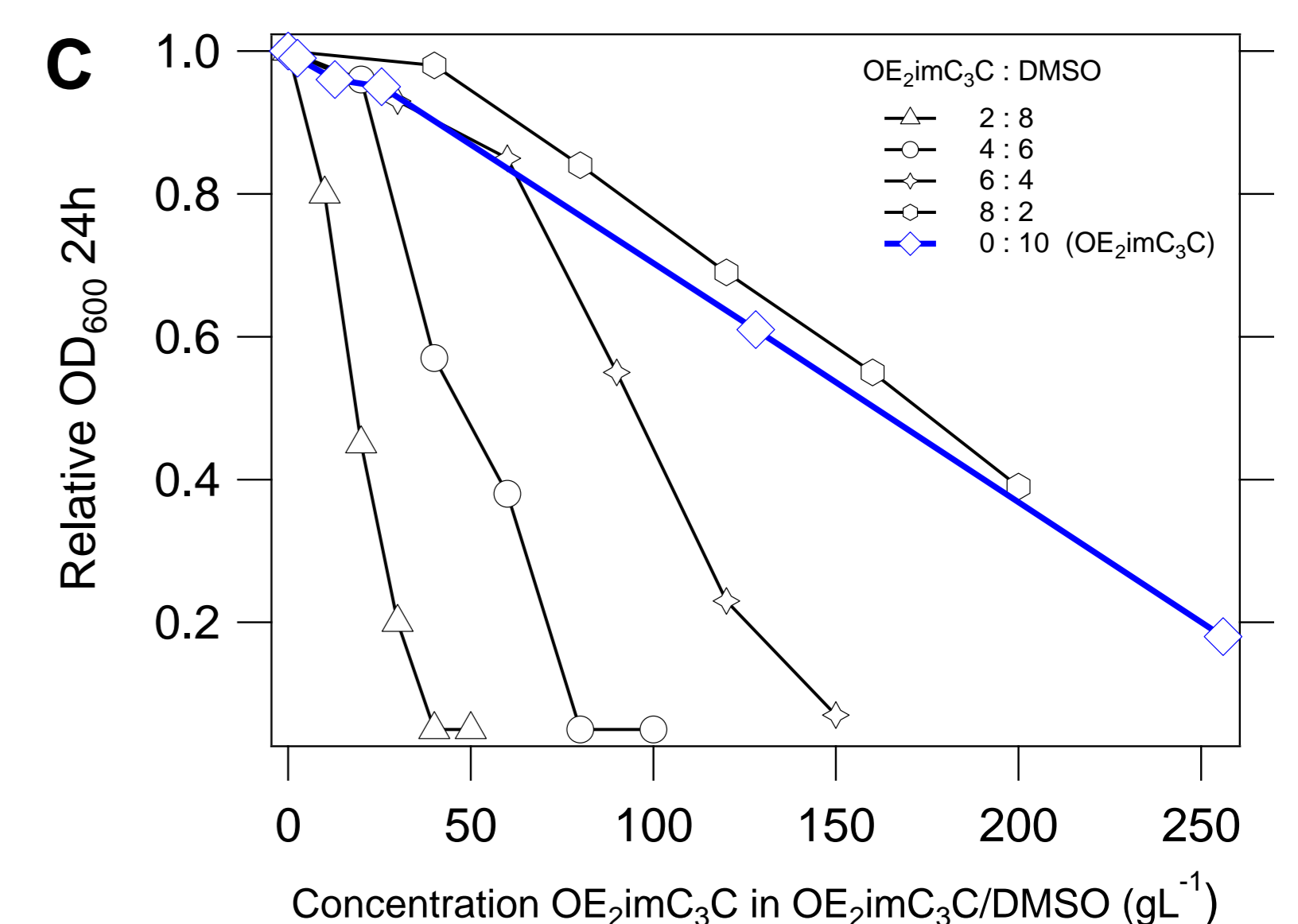
When we plotted the relation between concentration of OE₂imC₃C in the mixture and relative OD₆₀₀ (Figure C), the trend in the mixture (80/20) and pure OE₂imC₃C was similar.

- DMSO does not involve to this toxicity. Presumably OE₂imC₃C and DMSO independently inhibit the growth of *E. coli* via different mechanisms.
- Consequently the mixture has low toxicity

Influence of DMSO



Influence of OE₂imC₃C



4. Conclusion

- ✓ Co-solvent DMSO accelerated cellulose dissolution into OE₂imC₃C. OE₂imC₃C/DMSO (60/40) mixture has the highest ability to dissolve cellulose.
- ✓ Addition of DMSO was expected to increase toxicity, however addition of 20% DMSO into OE₂imC₃C decreased the toxicity.

Acknowledgement

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