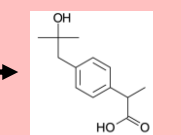
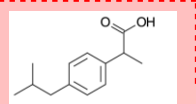
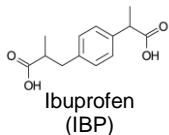
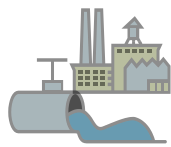


# Development of simple toxicity assay for degradation products of pharmaceuticals

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## Introduction

Sewage treatment plant



Unknown intermediates



- ★ When IBP is degraded by activated sludge, CA-IBP, OH-IBP and other unknown intermediates are formed.
- ★ Their toxicities are not known and their risk has not been considered.

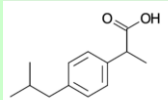
Aim of this study is to apply a simple toxicity assay to find the occurrence of toxic intermediates during degradation of pharmaceuticals without isolating or identifying the intermediates.

## Material & Method

Activated sludge was obtained from Tsuzuki sewage treatment plant.



**Ibuprofen (IBP)**

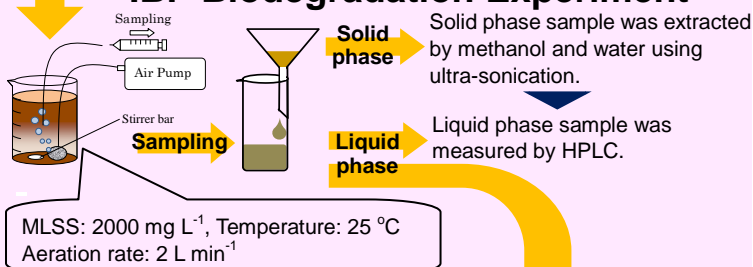


Log  $K_{ow}$ : 3.97  
 MW: 206.3 g mol<sup>-1</sup>

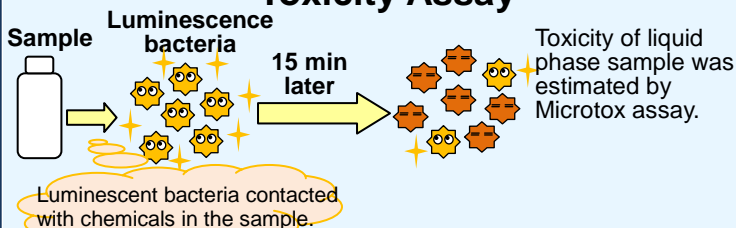
### HPLC Conditions

- **Column & Temperature** Atlantis (4.6 mm × 100 mm, 3 μm Agilent), 25°C
- **Mobile phase** Acetonitrile-water 70:30
- **Flow rate** 2.0 mL min<sup>-1</sup>
- **Detector & Wavelength** UV, 230 nm

### IBP Biodegradation Experiment



### Toxicity Assay



- Luminescence bacteria are inhibited by chemicals in the sample.
- Toxicity is evaluated by luminescence inhibition rate.

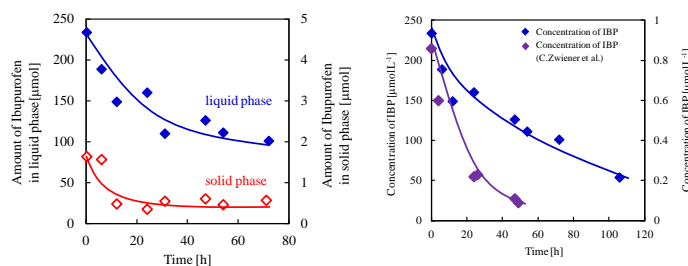
## Conclusions

- 50% of IBP in liquid phase was degraded in 75 h.
- With the IBP biodegradation, the inhibition rate decreased at 40 h and increased at 75 h.
- Biodegradation products may have higher toxicity than IBP.
- Toxicity of biodegradation products should be considered.

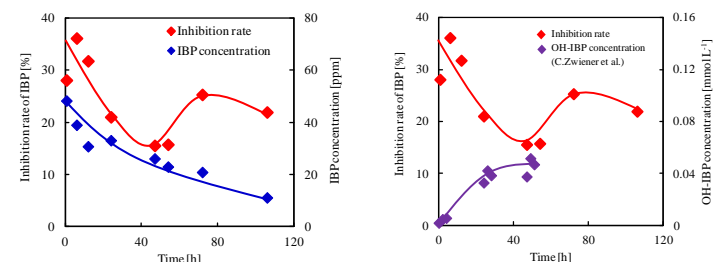
### Future Work

- ✧ To identify biodegradation products having higher toxicity.
- ✧ To apply the simple toxicity assay to other pharmaceuticals.

## Results & Discussion



- IBP in liquid phase was degraded 51% by activated sludge in 75 h.
- Constant solid phase concentration was achieved within 15 hours.
- As compared with the literature, IBP biodegradation rate in this study was slower.
- It may be attributed that activated sludge used in this study was not acclimated to IBP biodegradation.



- The inhibition rate at 30 min was 30%.
- With the IBP biodegradation, the inhibition rate decreased.
- In 40 hours, the inhibition rate decreased to 15%.
- Then, the inhibition rate increased to 30% at 75 h.
- According to the literature, OH-IBP concentration increased during IBP biodegradation.
- Some of biodegradation products may have higher toxicities than IBP.

### Reference

Zwiener, C., Seeger, S., Glauner, T. and Frimmel, F.H. (2002) Metabolites from the biodegradation of pharmaceutical residues of ibuprofen in biofilm reactors and batch experiments. *Anal Bioanal Chem* 372(4), 569-575.