Article / Book Information

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Title(English)	Assessment and modeling of the regrowth of Escherichia coli in environmental water after chlorine disinfection
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( )	
Type(English)	Outline

論 文 要 約

THESIS OUTLINE

系・コース： Department of, Graduate major in	土木・環境工学　　系 土木工学　　コース	申請学位（専攻分野）： Academic Degree Requested	博士 Doctor of	（Philosophy）
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論文題目 Thesis Title	Assessment and modeling of the regrowth of *Escherichia coli* in environmental water after chlorine disinfection （環境水中における塩素消毒後の大腸菌の再増殖に関する評価とモデリング）

要約
Thesis Outline

Background and objectives of the study

Domestic wastewater is a crucial source of waterborne pathogens and a point source of disseminating antibiotic resistance through discharge or reuse. Therefore, thorough disinfection for eliminating the microbial risk is essential to public health and the environment. However, bacterial regrowth after wastewater disinfection has been frequently reported, making the disinfection effect temporary. Thus, the assessment of bacterial regrowth after disinfection is needed. The literature review identified two research gaps: (1) the irrelevance of the tested conditions in the laboratory to the natural environment; (2) the adoption of the conventional culture-dependent method for bacterial quantification. Therefore, this study aims to assess and model the regrowth of *Escherichia coli* (*E. coli*) in environmental water after chlorine disinfection. Specific objectives are (1) to develop and verify a culture-independent method for quantifying viable *E. coli* in environmental water, (2) to assess the regrowth of *E. coli* in environmental water after chlorination, and (3) to model the regrowth pattern of *E. coli* after chlorination. Overall, this study would contribute to the scientific knowledge of post-chlorination regrowth in environmental water, specifically the regrowth mechanism and the influential factors. Gaining in-depth knowledge on the fate of bacteria after disinfection through this study would allow rational assessment of the chlorine disinfection process, help decision-makers to select the best operation mode, and provide a scientific basis for potential advances in water disinfection.

Structure of the study

The thesis consists of six chapters (**Figure 1**). A brief overview of each chapter is given below.

- Chapter 1. Introduction

  This chapter discusses the background and objectives of the thesis.

- Chapter 2. Regrowth of bacteria after disinfection: current knowledge and future prospects

  This chapter presents the current knowledge and identifies research gaps on bacteria regrowth after

disinfection.

- Chapter 3. Development of fluorescence-based method for quantifying viable *E. coli* in river water and treated wastewater

  This chapter proposes and verifies a fluorescence spectroscopy protocol for quantifying viable bacteria in environmental water using Live/Dead BacLight Kit and a reference bacterial strain (*E. coli*).

- Chapter 4. Assessment of the regrowth of *E. coli* in environmental water after chlorine disinfection

  This chapter focuses on the fate of *E. coli* in various types of water after chlorine disinfection. The multiplex detection method (fluorescence-based viability test and plate count) for bacterial quantification is applied to understand the regrowth mechanism.

- Chapter 5. Modeling the regrowth of *E. coli* after chlorine disinfection

  This chapter applies regrowth model to post-chlorination regrowth process, and proposes an integrated disinfection-regrowth model framework for bacterial regrowth evaluation. Model demonstration with literature data the experimental data from Chapter 5 is conducted.

- Chapter 6. Conclusions and recommendations

  This chapter outlines the key findings in this study and provides recommendation for future studies.
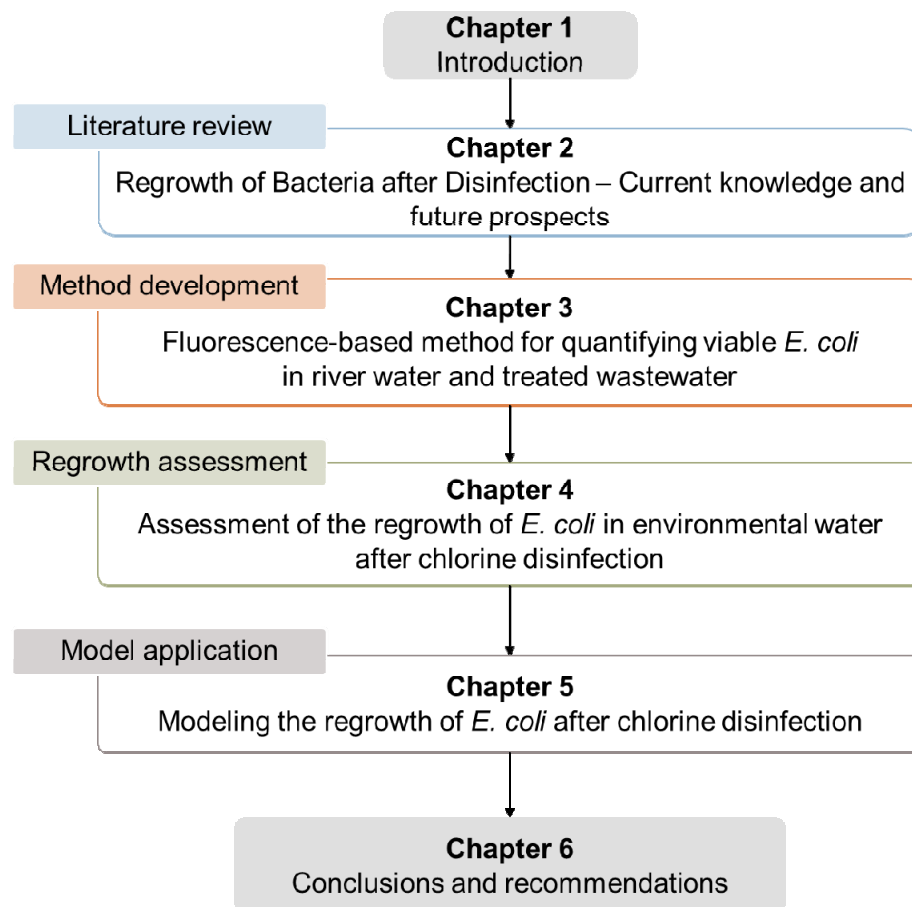

Figure 1 Overall thesis structure