学 位 論 文 概 要

題　目　　Carbon nanotube as support for the catalyst in supercritical water gasification
（超臨界水ガス化における触媒担体としてのカーボンナノチューブ）

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The below thesis structure comprises 8 chapters that can be used to briefly understand the main point of each part.

Chapter 1 (Introduction). This chapter presents the biomass resources that can be used in several ways to provide renewable energy. The fundamental research on biomass technologies, for instance, biomass gasification and supercritical water gasification technique. This chapter also explains the various types of biomass feedstock and the importance of catalysts for biomass gasification.

Chapter 2 (Literature Review). This chapter is mainly divided into three main parts. First, it explores the various types of biomass components and the pathways through which thermal conversion occurs, such as combustion, gasification, and pyrolysis. Understanding these pathways can help achieve valuable products by choosing the right conversion method for biomass. The second section focuses on the operation parameters (like concentration, residence time, and catalyst) and how they influence the final products of biomass when subjected to supercritical water conditions. This information is crucial for grasping how biomass components behave in supercritical water, aiding in result predictions. Lastly, the chapter discusses catalysts suitable for biomass gasification. It also discusses different catalyst supports, with a particular emphasis on carbon nanotubes (CNTs) and the unique features that make CNTs promising as catalyst supports.

Chapter 3 (Objectives) This chapter highlights the novelty aspects and the importance of the research conducted.

Chapter 4 (Experimental Method). In this chapter, the key concept crucial for understanding the functioning of experimental methods is introduced. Materials, experimental procedures, experimental conditions, and methods for analyzing the products are described.

Chapter 5 (Gasification characteristics of carbon nanotube in supercritical water). In this chapter, the decomposition rate and quantitative stability of the CNT in SCW are demonstrated. For this purpose, CNTs were treated in SCW under severe conditions. The gasification kinetics of CNTs were investigated using a packed bed reactor at 25 MPa and temperatures ranging from 600 °C to 700 °C.

Chapter 6 (Carbon nanotube as catalyst support in supercritical water). In this chapter, the method of creating the Ru/CNT catalyst is elucidated. Ruthenium (Ru) is chosen as the primary catalyst for CNT support for various reasons. The effectiveness of the Ru/CNT catalyst in SCWG is investigated. The catalyst is characterized by various equipment. For this purpose, 5 wt% glucose is fed at 2 mL/min and gasified in a packed bed reactor containing Ru/CNT catalyst at 600 ℃ and 25 MPa. Catalyst stability in SCW is investigated by an experiment over 6.5 h at 600 ℃ and 25 MPa. The CGE result obtained by using the Ru/CNT catalyst is compared with those achieved without any catalyst and with CNT alone without Ruthenium impregnation.

Chapter 7 (Reaction characteristics of homogeneous and heterogenous reactions for glucose gasification in supercritical water using ruthenium catalyst supported on carbon nanotube). This chapter clarifies the homogeneous and heterogeneous reactions. Models are created to determine the reaction rates of these reactions. Furthermore, a reaction model is developed based on changing weight hourly space velocity (WHSV) or space time. For this purpose, adjustments are made to the glucose concentration, reaction temperature and WHSV.

Chapter 8: Conclusion. This chapter concludes the thesis by offering final thoughts.

Appendix A: it shows comparison of changing the catalyst mass and changing the flowrates at same space time.