CHAPTER I
INTRODUCTION

I.1. Background

The efficacy of drug compund that cure illness is based on how the amounts of the active compound that can be absorbed site of action. The drug is effective when it can reach the exceed minimum effective concentration [1]. However, drug availability on illness point is limited by chemical and physical properties of the drug such as poor solubility, poor bio permeability to penetrate to the site of action, rapid metabolism making faster clearance of drug than to be expected [1, 2]. Nanocrystalline cellulose (NCC) as nano controlled drug delivery able to overcome these limitations. Nanoparticle able to help drug circulate ten times better across the body giving the considerable advantage over conventional system [3].

Nanocrystalline cellulose is a nano-size cellulose material. As nanoparticle NCC have several potentials for drug delivery such as non-toxic, low density, high surface area, and high drug adsorption capacity. NCC also have excellence in biocompatibility, can be degradable by the human body and able to stand long enough against the immune system to carry the drug into the site of action [4, 5]. Nanocrystalline cellulose is made from cellulose which can be obtained from biomass waste such as sugarcane bagasse [6], rice husk [7], coconut husk[8], etc. In Indonesia, one of the most abundant biomass waste is oil palm empty fruit bunch (OPEFB), produced about 33.2 million ton in 2016 as a side product of crude oil palm production. OPEFB is also high cellulose bio-waste with composition 37.9% cellulose, 35% hemicellulose, and 24%

total lignin [9]. Most of OPEFB is end up as waste, only small amount of OPEFB is used as fuel in reboiler, and this condition makes the economic value of OPEFB is deficient. Currently, the abundant availability of OPEFB as bio-waste is not well-utilized, and it has potential application as renewable cellulose resources for the production of NCC in industrial scale. Utilization of NCC from OPEFB for drug delivery system will be advanced bio-waste management and add conservative value to OPEFB.

NCC from OEFB has been used as nanocomposites[10] and reinforcing agent[11]. This research will study the new application of NCC from biomass OEFB as a novel controlled drug carrier.The lignocellulosic OPEFB material will be converted into cellulose, and later it will be hydrolyzed with sulfuric acid to produce NCC. The performance of NCC from OPEFB as drug delivery agent will be studied using tetracycline.

I.2. Research of Objectives

1. To study the effect of time and temperature during acid hydrolysis process of NCC production from oil palm empty fruit bunch towards yield of NCC.
2. To study the isotherm and kinetic adsorption of commercial antibiotic drug onto NCC.
3. To study the desorption kinetic of commercial antibiotic drug from NCC.

I.3. Problem Limitations

1. NCC used for adsorption and desorption of antibiotic is NCC produced from the best condition of the process (the highest yield of NCC).
2. Adsorption and desorption of drug studies will use commercial tetracycline antibiotic.
3. Desorption of commercial tetractcline antibiotic will be conducted using PBS (phosphate buffered saline) buffer solution.