CHAPTER I
INTRODUCTION

I.1. Backgrounds

    Composite is a material that consist of two or more material that have different chemical or physical properties that when combined will produce a new material with preferred properties (Hashin, 1983). New materials expected to be lighter, stronger, and more resistance to heat and pH. Some composite materials also possess excellent adsorption and desorption capability and therefore it can be used as the adsorbent for adsorption purpose or as drug delivery carrier (Boddu *et al.*, 2008).

    In medical sector, several composite materials have been used for drug carrier which can control the release of drug and helps drug to sustain at certain pH. Nanocrystalline cellulose-chitosan composite has been studied to produce drug carrier. Nanocrystalline cellulose (NCC) derived from the most abundant materials, cellulose, has been chosen because of its high surface area to mass ratio, resist to pH. Chitosan derived from the second most abundant materials, chitin, has been used in medical sector because of its muco-adhesive ability. However, each material have a disadvantage. When using NCC, the probability of drug released at certain spot than at the preferred spot is high, so the effect of the drug was minimalized. On other hand, chitosan will spread the drug, so that the drug could attach at preferred spot, but since the drug was spread, the effect of the drug also minimalized. Therefore, the production of composite material is required to enhance the ability of drug carrier to its maximum.

    In this study, the composite material was made from chitosan and nanocrystalline cellulose. The Chitosan-nanocrystalline cellulose composite

will be used as drug delivery carrier. Chitosan has been in used in pharmaceutical industries due to its biodegradability, good biocompatibility, lack of toxic (Gong *et al.*, 2006) and good absorbent (Wan Ngah *et al*., 2011). Beside its ability as adsorbent, it has muco-adhesive ability which help the composite to attach at mucous surface. While nanocrystalline cellulose has been used as reinforcing elements due to its ability to improve the chemical and physical properties of other materials. NCC also possesses high resistance of pH and good adsorption capacity. These materials completing each other. As an adsorbent, nanocrystalline cellulose did not have muco-adhesive ability but resist to pH, whilst chitosan has muco-adhesive ability but did not have resistance to pH.

In general, drug carrier should have high adsorption and desorption ability. It has been known that NCC have high ratio of surface to weight and chitosan have muco-adhesive ability which can be applied as drug carrier. The combination of both materials as composite also enhance the adsorption and desorption capability for this nanocomposites, so this research is promising to be used as guidance for future application.

I.2. Objectives

1. To study the preparation of nanocrystalline cellulose from *Cerbera manghas.*
2. To investigate the preparation of nanocomposites from nanocrystalline cellulose and chitosan.
3. To observe the kinetics of adsorption process of amoxicillin.
4. To observe the kinetics of desorption process of amoxicillin from nanocomposites into SBF solution.

I.3.   **Problems Limitation**

1. The *Cerbera manghas* fruit from Pondok Mutiara Residence, Sidoarjo.

2. The nanocrystalline cellulose with the most promising characteristic were used to prepare the nanocomposites.

3. Amoxicillin was used as adsorbate.

4. Simulated Body Fluid (SBF) solution composed of NaCl, NaHCO$_3$, KCl, K$_2$HPO$_4$.3H$_2$O, MgCl$_2$.6H$_2$O, CaCl$_2$, Na$_2$SO$_4$, tris (CH$_2$OH)$_3$CNH$_2$ and HCl was used to represent human body fluid for desorption process.