CHAPTER I
INTRODUCTION

I.1. Background

Nanoparticles are particles that have a range of diameter between 1-100 nm. HKUST-1 is one of the nanoparticles classified as metal organic framework (MOF). The nucleation process and crystal growth of HKUST-1 is too fast which can result in intergrown crystals. Both processes can be controlled using a modulator so that crystal growth can be suppressed. The most commonly used modulator in the synthesis of HKUST-1 is acetic acid. In addition to acetic acid, formic acid can also be used as a substitute in the MOFs synthesis. Acetic acid and formic acid is a monocarboxylic acid group which has an inhibitory effect on crystal nucleation. In the solvothermal synthesis of HKUST-1, DMF solvent will be degraded to dimethylamine and formic acid at high temperatures. Moreover, formic acid is the simplest form of carboxylic acid which makes formic acid easier to handle (e.g. removing the formic acid after the synthesis process). This is the basis for using formic acid as a modulator in this study.

Doripenem is a beta-lactam antibiotic belonging to the carbapenem family which functions to treat infections in the body's system. In its application doripenem is given as much as 500 mg by infusion for a duration of 8 hours. However, the dose of doripenem in treating infections is not fully used so there is doripenem that is secreted by the body [1]. In dealing with this problem, a method is needed to slow the rate of the dose of the doripenem given for more effective treatment. One way to slow down the dose rate of doripenem is to use a drug carrier. The drug carrier usually used is a porous solid such as zeolite, silica, and metal organic framework. Metal organic framework (MOF) was chosen as a drug carrier because of its high porosity,

controllable volume and simpler operating system compared to other porous solids [2]. One of the selected MOF types is HKUST-1. HKUST-1 was chosen because it has better biocompatibility when compared to other MOFs such as UiO-AZB [3]. HKUST-1 as a drug carrier has been used in previous studies for various types of drugs. However, HKUST-1 has the potential to be developed by adding a modulator with the hope that HKUST-1 has the appropriate absorption capacity as a drug carrier of doripenem [4].

I.2. Research Purposes

1. To study the effect of formic acid (FA) in HKUST-1 synthesis.
2. Examine the effect of formic acid modulated HKUST-1 on drug loading and release of doripenem.
3. Compare HKUST-1, HKUST-1@AcOH, and HKUST-1@FA on doripenem's absorption and release potential.

I.3. Problem Boundaries

1. Effect of formic acid on the morphology and size of synthesized MOF can be determined from XRD and SEM analysis of HKUST-1@FA.
2. The comparison of the HKUST-1@AcOH and HKUST-1@FA on their adsorption and release potential can be determined by isotherm adsorption, kinetic adsorption, and release of doripenem.