CHAPTER 1
INTRODUCTION

1.1 Background

Silicon has become one of the most applied materials in many different fields. Starting from renewable energies, batteries, drug deliveries, and many other applications. Silicones are applied in many of these fields because of their many advantages, including semiconductors, biodegradability, and luminescent properties. Silicones used for these many applications come in many forms, from silicone nanoparticles, silicone composites, and even silicon nanocrystals. In this thesis, the silicon to be synthesized will be the silicon nanoparticles applied in the field of theranostic treatments.

In prior research mentioned in reference from and reference from [1], the synthesis of the silicon nanoparticles is done with APTES as the precursors with the addition of a reducing agent to produce which is made from a bottom-up method. In this thesis, the production of the silicon nanoparticles will also be synthesized using curcumin in addition of glucose as their reducing agent and compared with the production using only glucose in the procedure.

Currently, silicon has become one of the main resources used in many different applications as silicon is not only an abundant material in the world but also comes with many great benefits. For drug delivery applications, they serve well in this application as they not only load drugs well but also can benefit as a controlled release

procedure to a specific area either in vitro or in-viv9o according to Jo, Ryu [2]. Secondly, silicon also has fluorescent properties, which can be applied to diagnose a certain area. In this thesis, this application will be combined and tested to see that with the use of silicon nanoparticles, application as not only a diagnosis but also as a drug release can be observed and analyzed which then will give us a more effective analysis treatment known as the theranostic treatment. For this thesis, the drug to be used will be Ibuprofen. In prior research, a similar NSAI drugs; Ibuprofen is used in mesoporous silica as a test for drug delivery system ([3]) as they are one of the most commonly tested and has similar treatment to the currently tested drugs. As a drug delivery carrier, silica nanoparticle was found to be non-cytotoxic to the cell and has a slow biodegradable rate which can be secreted normally through the body metabolism out of the blood and during in vitro and in vivo test, particle was found to non-toxic as they do not provide any abnormalities to the blood fluids over the 28 days period.

Two main methods of synthesizing silicon nanocrystals and nanoparticles are the top-down and the bottom-up methods ([4]). The top-down method creates nanoparticle silicon by breaking down a large silicone precursor into a smaller nano-sized version of silicone while the bottom-up method uses a smaller silicone precursor which builds up into the wanted silicon. The method to be used in the synthesis of the silicon will be the bottom-up method as the bottom-up method allows the synthesis of the desired product and uses a more convenient apparatus.

The method used will be similar as the prior research described however a synthesis with a new reducing agent will be added and compared with the recent experiments. Through this method, a new synthesis using curcumin as an addition for reducing agent can be observed and tested.

1.2 Problem Statement

Currently, with the many benefits of silicon's application as a possible drug carrier. Addition of materials such as curcumin which has an ability as a reducing agent and stabilizing agent has yet to be researched. To further understand the benefits of this material, this thesis will introduce how it is synthesized and applied in their fields as a drug carrier.

1.3 Research Aim

- Synthesis of Silicon nanoparticles by the bottom-up method using TEOS as a precursor with the addition of glucose (SP-G) and curcumin (SP-GC)
- Characterization of Silicon nanoparticles (SP-GC) using X-Ray Diffraction (XRD) spectroscopy
- Application and comparison between Silicon nanoparticles (SP-G and SP-GC) as a drug loader and drug release for NSAI drugs (Sodium Diclofenac).