

CHAPTER 1

INTRODUCTION

Hydroxylapatite, also called hydroxyapatite, is a mineral. It is a naturally occurring form of calcium apatite with the formula $\text{Ca}_5(\text{PO}_4)_3(\text{OH})$, but is usually written $\text{Ca}_{10}(\text{PO}_4)_6(\text{OH})_2$ to denote that the crystal unit cell comprises two molecules. Hydroxylapatite is the hydroxyl endmember of the complex apatite group. The OH⁻ ion can be replaced by fluoride, chloride or carbonate. It crystallizes in the hexagonal crystal system. It has a specific gravity of 3.08 and is 5 on the Mohs hardness scale. Pure hydroxylapatite powder is white. Naturally occurring apatites can however also have brown, yellow or green colorations..

Hydroxylapatite can be found in teeth and bones, within the human body. Therefore, it can be used as a filler to replace amputated bone or as a coating to promote bone ingrowth into prosthetic implants. Although many other phases exist with similar or even identical chemical makeup, the body responds much differently to them.

Many modern implants, e.g hip replacements and dental implants, are coated with hydroxyapatite. It has been suggested that this may promote osseointegration and there is good evidence for this. Because of its poor mechanical strength must of

the time it is needed to use it as a coating of any other materials such as Titanium alloys, Cobalt alloys and medical grade Stainless steel.

There are various ways for coating HAp on to different materials each method of coating has its own advantage and disadvantages; The method of coating is depend on the usage of the implant, accuracy, amount of HAp that was needed to coat and the cost of the method as well. Some of these methods are summarized in table 2.1. in chapter 2.

One of the most new methods for coating HAp on to the metallic materials is coating by investment casting method, also called lost-wax casting, is one of the oldest known metal-forming techniques. From 5,000 years ago, when beeswax formed the pattern, to today's high-technology waxes, refractory materials and specialist alloys, the castings allow the production of components with accuracy, repeatability, versatility and integrity in a variety of metals and high-performance alloys. Lost foam casting is a modern form of investment casting that eliminates certain steps in the process. Investment casting consist of 3 main stage, at first making the wax and preparing ceramic shell on it, second dewaxing the moulds and finally fire the dewaxed moulds.

This method of coating firstly used to coat HAp on to Cobalt alloys [J.C. Escobedo, et. al. 2006]. This method of coating has its own advantages and disadvantages. This method is very cheap regarding to other coating methods and it is very simple as well. Also according to using simple methods control of the elements which are involved in the finale results is easier than other coating methods like plasma spraying or electro chemical methods for coating.

In this project finding the best dewaxing temperature for moulds aimed. And investigation to find out what is the best viscosity of HAp-water mixture for coating the inner layer of investment casting moulds was targeted as well.

This report started from introduction on tissue engineering and highlight its history and importance through human life also mentioned the materials and methods that used and being in the process from past until now.

Afterward the properties, composition and classification of bioceramics discussed in detail especially for hydroxyapatite. Also the related works, investigations and applying of several bioceramics issued in several tables.

At 3rd chapter methodology and experimental procedure discussed, 4th and 5th chapter talked about on results and conclusion as well.