INTRODUCTION

1.1 BACKGROUND OF STUDY

Heat treatment is a combination of controlled heating and cooling a metal or alloy to achieve desired physical and mechanical properties such as hardness, ductility, toughness, ultimate tensile strength, yield strength and the percentage of elongation. In order to modify the microstructure and desired mechanical properties, there are common heat treatments that often been used which are annealing, normalizing, hardening and tempering. The purpose of heat treatment process is to increase the strength or hardness of material, increase toughness, improving the ductility and make improvement in machinability.

The most common heat treatment that applied in order to soften the metal is annealing. In annealing, a metal is exposed to an elevated temperature in a certain time for the material structure to transform into austenite. Then, the metal will slowly cooled down to room temperature. The purpose of this type of heat treatment is to increase the softness, machinability and formability, to relieve internal stress and refinement of grain structure.
In normalizing, metal is heated to austenite temperature range and followed by left in air for cooling. The purpose of this treatment is to obtain a mainly pearlite matrix. It usually shows the strength and hardness which is higher than in as received condition. It also used to refine grains and the small grain size structure will improve the strength and hardness of the metal.

For hardening, it consists of heating a metal above the critical temperature followed by quench to a room temperature. The quenching media that often used are water, oil and brine; depend on the cooling rate needed. The main purpose of hardening is to increase the strength, hardness and toughness, wear resistance of the metal. The faster the cooling rate, the stronger and harder the metal, so the brittleness of metal will also increase, due to the martensite structure.

Next, tempering is a process of reheating a hardened metal to impart some toughness. The tempering temperature is depending on the material and it converts martensite to bainite. In the hardened, a metal is not only very hard but also brittle caused by a predominance of martensite. To remove this brittleness, tempering process need to be done to lower the brittleness and give good effect to the other mechanical properties.

In this project, there are four type of heat treatment will be perform which are annealing, normalizing, hardening and tempering. The purpose of using these treatments is to modify the mechanical properties of the metal based on the type of heat treatment performed. For this heat treatment process, the material SKD61 medium carbon steel will be used and it will be heated at austenite temperature and will be cooled in three different cooling medium.
1.2 PROBLEM STATEMENT

There are many previous researches that focus on the heat treatment of the medium carbon steel. Based on the literature review, the common method to improve mechanical properties of metal is by heat treatment process. However, to choose the cooling medium and the tempering temperature to ensure it is compatible with their application still remain a challenge. The quality of heat treatment for the metal parts depends on many factors, including thermal schedule and cooling medium. This research is conducted to study the improvement of mechanical properties after the heat treatment process and observation on hardness and flexural testing.

1.3 OBJECTIVE

The objectives of this research are:

1. To perform heat treatment process on the SKD61 using various cooling medium
2. To investigate the hardness and flexural properties of heat treated SKD61 medium carbon steel through hardness test and flexural test.
3. To observe the fractured surface of SKD61 using Field Emission Scanning Electron Microscope (FESEM)