CHAPTER 3

METHODOLOGY

3.1   INTRODUCTION

This chapter discusses the adopted methods and procedures in this study. Experimental and numerical work was performed in order to determine the blended fuel properties, diesel engine characteristics operating on different blended fuels, and particulate matter (PM) characteristics. The experimental setup and facilities utilised for the fuel property measurement, PM measurement, engine testing, and data acquisition system are presented. The modelling of the engine cyclic variation has also been presented in the numerical work procedures. In addition, a detailed explanation has been given on the operating test conditions and PM analysis. The engine cyclic variation modelling based on the in-cylinder pressure time series using the coefficient of variations and wavelet analysis approaches are also presented.

3.2   STRATEGY OF FRAMEWORK

Figure 3.1 illustrates the flowchart of the framework strategy for the current research methodology. There are two main components of the experimental work—PM characteristic measurement and engine testing—in addition to the engine cyclic variation modelling. According to this framework, the results are clarified in a logical manner.
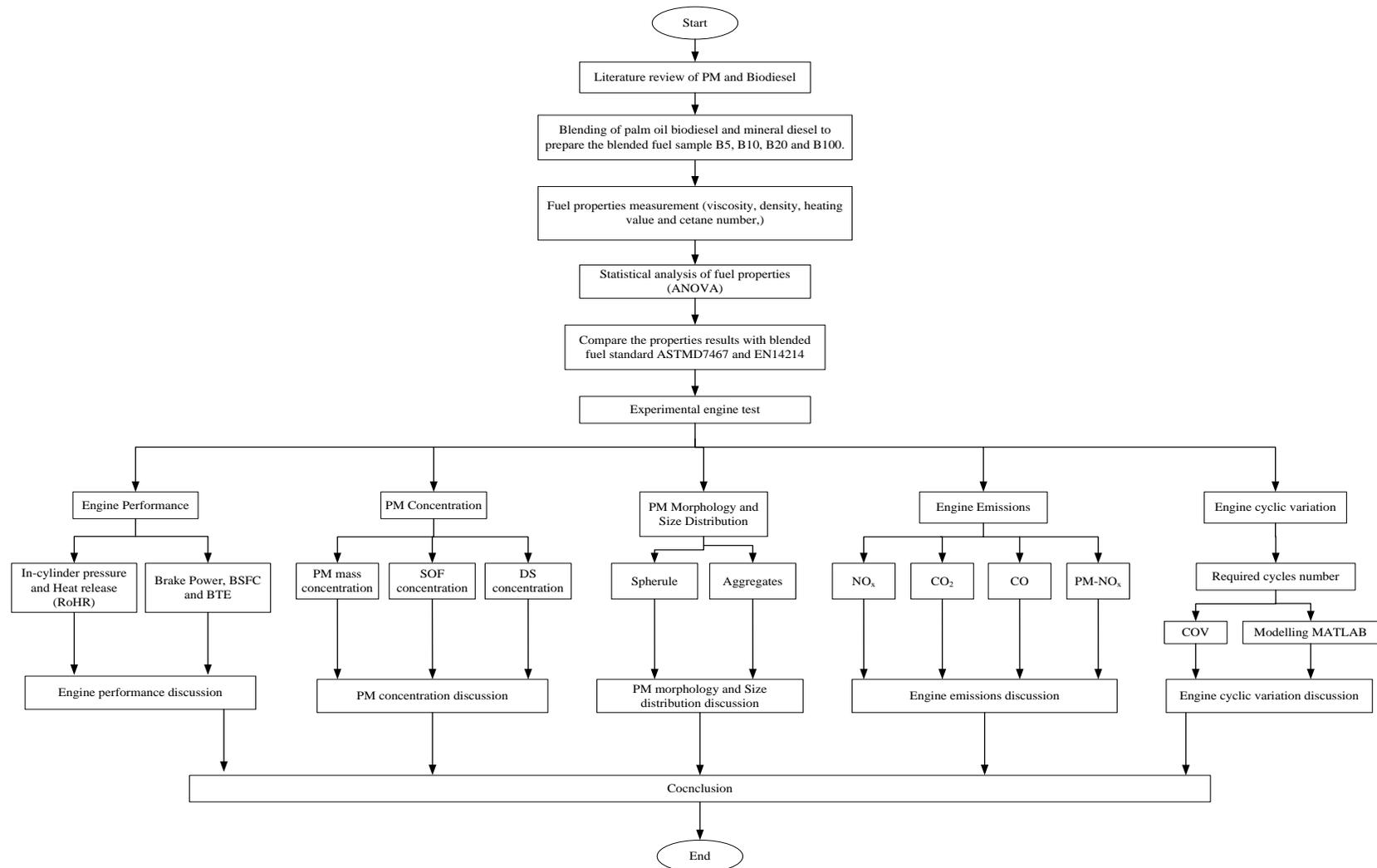
Figure 3.1: Flowchart of analysis

3.3   ENGINE TESTING APPARATUS

This section describes the setup of the experimental facilities. The experimental setup includes the experimental engine test rig and the instrumentation for measurement, including the in-cylinder pressure, fuel flow, engine speed, and engine torque. Moreover, a brief description of the data acquisition system and sensor integration is also provided.

A detailed schematic diagram of the experimental setup of the main components is presented in Figure 3.2. The experimental tests were conducted in the Engine Performance Laboratory, Faculty of Mechanical Engineering, Universiti Malaysia Pahang. Figure 3.3 shows the various components of the experimental engine test rig.