CHAPTER I

INTRODUCTION

1.1 Introduction

At present, humans get many profits from petroleum. These include transportation, energy, food, medicine and daily equipment. Therefore, the living of human necessarily associates with using of petroleum. Thus, there are always searching, exploration and drilling the new petroleum sources. However, if humans don't know well about petroleum and use it incorrectly, it will be disadvantage. In this research, it says about one product from petroleum. It is "Diesel Fuel". It has also important properties and additives for it [1].

Diesel fuel is obtained from crude oil, which is a mixture of hydrocarbons such as benzene, pentane, hexane, heptane, toluene, propane and butane. Diesel fuels are middle distillates, generally boiling within the range of 170-390°C. Blending two or more refinery streams such as light gas oil (LGO) normally produces them, heavy gas oil (HGO) and kerosene. In a complex refinery with several downstream cracking capabilities, more middle-distillate stream may be available for blending. The proportions of the different components in the finished blend will be determined by their individual characteristics and the requirements of the diesel fuel specification such as distillation, viscosity, cetane, cold properties, etc[2].

Diesel engine has now extended over a much wider range of applications than any other engines currently in use. Within the past eighty years diesel engines have been used wherever engine power has been required. They are found driving small and large electric power generating and pumping units; in the main propulsion of ships and their auxiliaries; in large and small road vehicles; they are used for off road agricultural and civil engineering vehicles and machinery and also for railway locomotives. Whilst few examples now exist, diesel engines usually power the lighter than air airships and in the past have seen application in winged aircraft. They find no favour today for this latter purpose because other engine types have far higher power to weight ratios. It must also be said that diesel engines are not unique to any one part of the world. They will be found everywhere where man needs to augment his own work capability [3]. Therefore, the demand for diesel fuel has been increased. The consumptions of diesel fuel are being continuously increased as shown in Figure 1.1 [4].

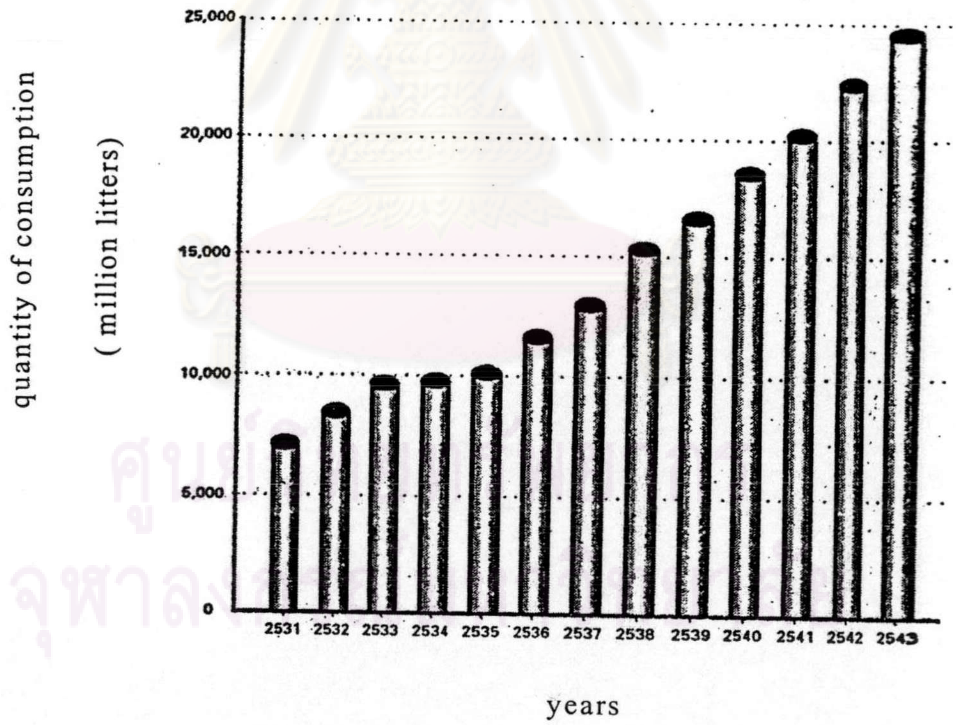

Figure 1.1 The quantity of high speed diesel consumption in Thailand.

For diesel fuel, ignition quality is important operational parameter. It is expressed in term of cetane number, which number has been developed on a basis very similar to that adopted for measuring the ignition quality of gasoline in term of octane number. If ignition delays too long, the amount of fuel in the chamber increases and upon ignition results in a rough running engine and increases smoke. A short ignition delay results in smooth engine operation and decreases smoke. So a high cetane number indicates a low ignition delay period, and hence better performance as a diesel fuel.

Thus an increase in cetane number of diesel fuel corresponds to a decrease in the ignition delay period can be performed into two methods.

1. Cracking of diesel fuel having low cetane number, such as by thermal cracking, catalytic cracking and hydrocracking.

2. Addition cetane improver, which will decrease ignition delay period so that result of the diesel engines is more easily start. Many types of additives have been used to raise the cetane number of diesel fuel. Such additives usually contain nitrogen or sulfur, both of which are known cetane improvers under certain circumstances. These include peroxides, nitrites, nitrates, nitrosocarbamates, tetrazoles, and the like.

Refer to the two methods as above, it was found that the cracking of diesel fuel process needed high cost and had not obtained the sufficient cetane number. Being the advantage cost over cracking of diesel fuel and higher cetane number needs, addition of cetane improver was substitutionally considered.

Cetane improvers have been used for many years to improve the ignition quality of diesel fuels [5]. The cetane-improving agents of the present invention can be incorporated in the hydrocarbon – based fuels disclosed here in any suitable manner. These materials are normally soluble in paraffinic as well as aromatic hydrocarbons, therefore, can be incorporated directly in the fuels [6].

Cetane improvers are special chemicals, which improve cetane number of diesel fuel similar to ethanol and MTBE improve the octane rating of gasoline. At concentrations less than 0.15%, cetane improvers can reduce ignition delay times of diesel fuels. Fundamentally, the cetane improver concentration is another degree of freedom in designing a diesel fuel. In practice, this degree of freedom is often capable of simultaneously decreasing NO_x, hydrocarbon and particular emissions [7]. The use of cetane improvers is increasing due to the increased demand for diesel fuel.

From these previous works, it is found that cycloalkyl nitrate compounds of cycloaliphatic alcohols [8,10] and tetrahydrofurfuryl nitrate of tetrahydrofurfuryl alcohol [9] are especially well suited as additives of diesel fuels. These compounds are increased the ignition quality of the diesel fuels and trend to get the high cetane number. Accordingly, in this research, it is anticipated that these compounds can effectively increase the cetane number.

1.2 Objectives and Scope of the Research

1.2.1 Objectives

1. To synthesize cycloalkyl nitrate compounds from cycloaliphatic mono alcohols and tetrahydrofurfuryl nitrate from tetrahydrofurfuryl alcohol for using as cetane improvers in diesel fuel.
2. To study the properties of synthesized nitrate compounds blended with base diesel as cetane improvers.

1.2.2 Scope of the Research

1. Literature survey of the relevant research works.
2. Preparation of apparatus and chemical substance.

3. Synthesis of cycloalkyl nitrate compounds form cycloaliphatic alcohols and tetrahydrofurfuryl nitrate from tetrahydrofurfuryl alcohol such as cyclohexylmethanol, 2-cyclohexylethanol, 1,4-cyclohexanedimethanol, tetrahydrofurfuryl alcohol by nitration reaction.
4. Characterizing of synthesized nitrate compounds by spectroscopic methods such as FT-IR and FT-NMR.
5. Determination of cetane index, cetane number and important physical properties of diesel fuel blended with synthesized nitrate compounds.
6. Summarizing of the results.