CHAPTER I

INTRODUCTION

Because of differing price or tax structures of the different fuels or even the same fuel used for different purposes can lead to abuse of the tax laws, smuggling of untaxed oil and cheating by unscrupulous persons. For example, fuels are sometimes mixed for the purpose of adulterating a higher priced product with a lower price material such as, the addition of hydrocarbon solvent to gasoline, or for the purpose of evading taxation by the addition of low-taxed light heating oil to highly taxed diesel fuel. Government has been losing a lot of revenue from these problems. Marker system is needed to clearly distinguish chemically similar liquid for commercial, safety reasons and tax consideration.

Markers have been employed for marking in petroleum fuel in many countries such as England, France, Germany and Japan ect. Markers that are in use, include quinizarin, furfural, coumarin, diphenylamine and various naphthol derivatives. They have many disadvantages, for example, quinizarin has low solvent solubility. The use of a relatively dilute quinizarin may be difficult to handle, furfural is unstable after a normal storage period of three to six months, diphenylamine and various naphthol may originate in crude oil or arise from the cracking or refining process[1]. According to master's thesis of Silapakampeerapap, S. azo dyes as marker dyes obtained from cashew nut shell extract and nitroanilines was disclosed[2]. Moreover, master's thesis of Thowongs, K. also disclosed azo dyes as marker dyes obtained from cashew nut

shell extract and chloroanilines[3]. Those markers could be used as marker in fuel oil at high treat rate of about 15-30 ppm. On the other hand, the yellow color in the extracted marker may confuse with a yellow extract obtained from unmarked petroleum fuel. Thus, it would be desirable to provide novel markers for petroleum fuel, which may be used at lower level and producing a clearly defined color that identifies effectively the petroleum product.

The objectives of this research

The objectives of this research were as the following:

1. to synthesis novel amino azo dyes as markers for petroleum fuels.
2. to develop a method for detecting the presence of marker in petroleum fuels both qualitative and quantitative determinations in field test and laboratory test and also study the stability of said marker in petroleum fuels.

The scope of this research

1. Synthesis of marker dyes from ethyl-2-aminobenzoate and aniline and aniline derivatives such as o- nitroaniline, m- nitroaniline, p-nitroaniline, 2-chloroaniline, 3-chloroaniline, 4-chloroaniline, o-toluidine, m-toluidine, p-toluidine and 2-chloro-4-nitroaniline.
2. Preparing hexyl-3-aminobenzoate from esterification of 3-aminobenzoic acid and 1-hexanol
3. Synthesis of marker dyes from hexyl-3-aminobenzoate and aniline and

aniline derivatives such as o- nitroaniline, m- nitroaniline, p-nitroaniline, 2-chloroaniline, 3-chloroaniline, 4-chloroaniline, o-toluidine, m-toluidine, p-toluidine and 2-chloro-4-nitroaniline.

4. Characterization of hexyl-3-aminobenzoate and other synthesized marker dyes by FT-IR, ^{1}H-NMR, ^{13}C-NMR spectroscopies and elemental analysis.
5. Developing a method for detecting the presence of said markers in fuel oil by extraction with extraction solution and varying solvent systems to find the suitable solution that gives the strong and different color in extracted phase of marked fuel oil.
6. Developing a quantitative determination to detect the amount of added marker in field test and laboratory.
7. Studying the stability of marker in fuel oil in the usual storage conditions for three months.