CHAPTER V
CONCLUSION

This research involves the synthesis of marker dyes for diesel oil from salicylaldehyde and amines. In the synthetic procedure, there were two steps consisting of the preparation of imine compounds and the synthesis of azo dyes. In the first step, salicylaldehyde was reacted with primary amines e.g. ethylenediamine, diethylenetriamine, and triethylenetetramine, to obtain diimine compounds as products. The second step was diazotization and the coupling of diimines with diazonium salts of aniline derivatives, which included *p*-nitroaniline, 2-chloro-4-nitroaniline, 4-chloro-2-nitroaniline, and 2-methoxy-4-nitroaniline, yielding the azo dyes. These synthetic azo dyes were characterized by FT-IR, MS, ^{1}H, and ^{13}C NMR spectroscopic techniques. A detection procedure of marked diesel was carried out by the extraction with 20% ethylenediamine in propylene glycol solution. The marker dyes could be added into diesel oil at a usable level of 5 parts per million (ppm) and extracted with 20% ethylenediamine in a suitable volume ratio of marked diesel oil to extracted solution. On the other hand, they could be used at their suitable concentration levels and detected by extracting 6 parts of marked diesel oil into 1 part of the extracted solution. These synthetic marker dyes provided clearly distinctive colors in the extracted phase to diesel oil after being shaken at least 50 seconds and provided precisely quantitative determination to be carried out. The percentage recovery of marker dye in the extracted phase was 97.4%. Moreover, they did not have any effects on the physical properties of marked diesel oil according to ASTM test methods and could be stable in diesel oil for at least three months of storage. Accordingly, it was concluded that these synthetic marker dyes were suitable to be used as marker dyes in diesel oil.