

CHAPTER V

CONCLUSION

5.1 Conclusion

This research is related to the synthesis of red azo dyes from cardanol, a naturally occurring compound obtained from extraction of cashew nut shell, and aromatic amines for use as coloring agent in gasoline fuel. These azo dyes were synthesized by coupling cardanol with the diazonium salt of various aromatic amines including benzidine (compound **6**), 1,5-diamino-naphthalene (compound **7**), *o*-phenylenediamine (compound **8**), *m*-phenylenediamine (compound **9**), *p*-phenylenediamine (compound **10**), 2-nitro-1,4-phenylenediamine (compound **11**), 4-amino-*N,N*-dimethyl-aniline (compound **12**), 1-naphthylamine (compound **13**) and 4-nitro-1-naphthylamine (compound **14**); or by stepwise diazotization through the formation of azo intermediate **16** to obtain disazo dyes **17** and **18**. The synthetic dyes **6**, **7**, **12**, **13** and **14** provided yellow color and azo dye **17** and **18** provided red color.

Among these dyes, besides the desirable red color with maximum absorption at 516 nm, azo dye **18** showed high solubility in gasoline fuel and common organic solvents. The practical concentration of **18** that give the most similar gasoline color compared to the commercial one is 6 ppm and 18 ppm when used in pure and crude forms, respectively. The physical properties of gasoline fuel, which were tested according to ASTM methods, are unaffected by the presence of red azo dye **18** in both pure and crude forms. Moreover, the stability of azo dye **18** was found to be satisfactory in gasoline fuel for at least three months. According to above properties, it can be concluded that red azo dye **18** was suitable for being used in commercial gasoline 91 in both pure and crude forms. The ease of production without necessary chromatographic purification, high solubility and stability under using condition, and satisfactory photophysical properties make this azo dye highly competitive to other commercial dyes in the market.

5.2 Suggestion for future work

- Scale-up synthesis of red azo dye **18** for industrial production.
- Preparation of other azo dye from cardanol having various color, such as green azo dye for marine oil and blue azo dye for jet fuel.
- Application of yellow azo dyes, obtained from this research for gasohol 95 production.