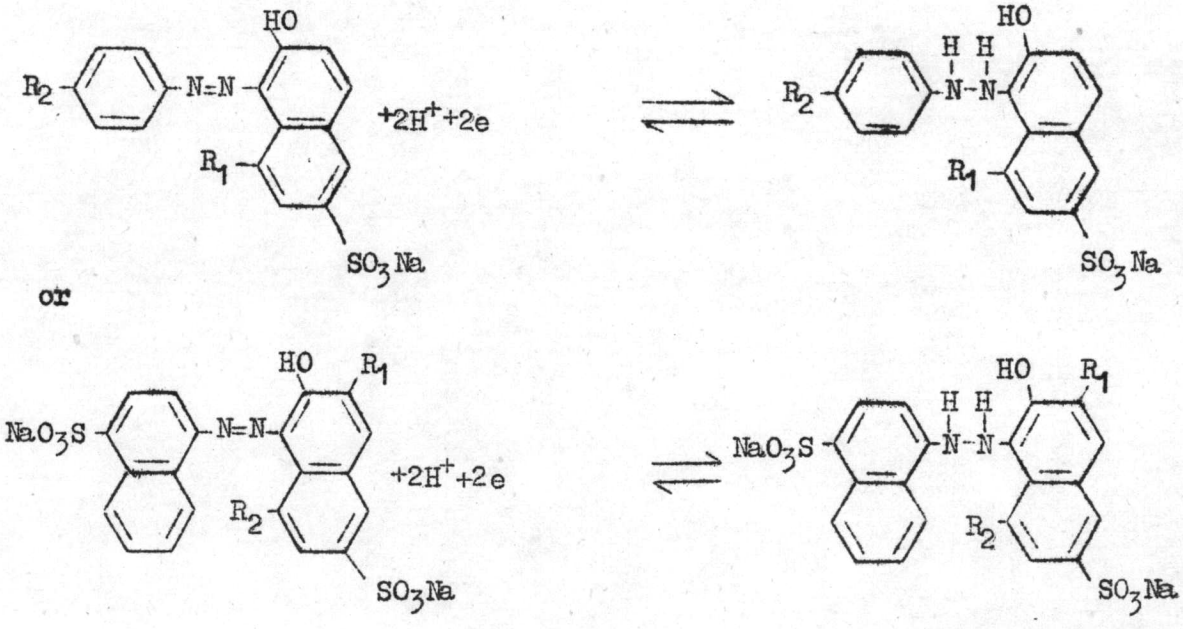
CHAPTER V

CONCLUSION AND RECOMMENDATION

Food dyes studied are Amaranth, Ponceau 4R, Sunset Yellow FCF, Orange RN and Orange G. They are food additives of red and orange colors. The uses of Amaranth and Orange RN were terminated whereas Ponceau 4R and Sunset Yellow FCF are still permitted to use (6). Polarographic behaviors of these dyes were studied in 0.1 M $(C_2H_5)_4NCl$, 0.1 M KCl and 0.1 M KNO_3 at pH 1-12. The dyes used were in high purity, tested by paper chromatography in three solvent systems: the solution of 2% NaCl in 50% ethanol; the mixture of 2-methylpropan-1-ol, ethanol and water in the ratio of 1:2:1, respectively, and 2.5% NaCl aqueous solution and by spectrophotometry in both acid and alkali solutions. One single reduction wave of the dye, except Orange G, was obtained in every supporting electrolyte studied. For Orange G, the first reduction wave appeared in pH lower than 3.6, the second wave occurred in pH higher than 3.6. Well-defined waves were provided in pH 4.0-12.0 for Amaranth, pH 1.4-12.0 for Ponceau 4R, pH 3.5-12.0 for Sunset Yellow FCF, pH 2.4-12.0 for Orange RN and pH 3.5-12.0 for Orange G. As pH increased the half wave potential of the dye shifted to more negative potential and the diffusion current of the dye was also affected by pH in every electrolyte. The pKa of Ponceau 4R, Sunset Yellow FCF and Orange RN were found to be 3.60, 5.20 and 5.50, respectively.

Reversibilities of the electrode processes for these dyes were also tested and it was found that the reversibilities were obtained in pH 4 -12 for Amaranth and Ponceau 4R, in pH 5.5-12.0 for Sunset Yellow FCF and Orange RN and in pH 4.5-12.0 for the second wave of Orange G.

From the reversible wave of every dye studied, the number of electron transferred and the number of proton transported are equal to 2. This was meant that the polarographic reductions of Amaranth, Ponceau 4R, Sunset Yellow FCF, Orange RN and Orange G in $(C_2H_5)_4NCl$, KCl and KNO_3 involved 2 electrons and 2 protons, and the reduction reaction should be



where R_1 and R_2 are H or SO_3Na

Further study should be made for confirmation of the polarographic reduction products of these dyes, such as identification of these reduction products by visible-UV spectrophotometry, IR-spectrophotometry, or coulometry at controlled potential.

A linear relationship between the diffusion current and the dye concentration was resulted in the concentration range 10^{-6}-10^{-4}M. Limit of detection was found to be 4.0×10^{-6} M for every dye except Orange RN which was found to be 3.0×10^{-6} M.

The identification of color additives in some beverages by paper chromatographic and visible spectrophotometric methods illustrated that orange color in Bireley's, Fanta and Green Spot is Sunset Yellow FCF but red color in Fanta is not Amaranth or Ponceau 4R.

Finally, graphical determination of Sunset Yellow FCF in Bireley's, Fanta and Green Spot by polarography with standard addition method showed that the contents of Sunset Yellow FCF in Fanta was the lowest, 7.54-8.82 mg/dm^3, and the one in Bireley's was the highest 12.36-13.72 mg/dm^3.

The analysis of red and orange colors in medicine could be another interested project. In addition, polarographic study of other azo dyes should be of interest for elucidating the reduction mechanisms of the food dyes.