CHAPTER IV

CONCLUSION AND RECOMMENDATION

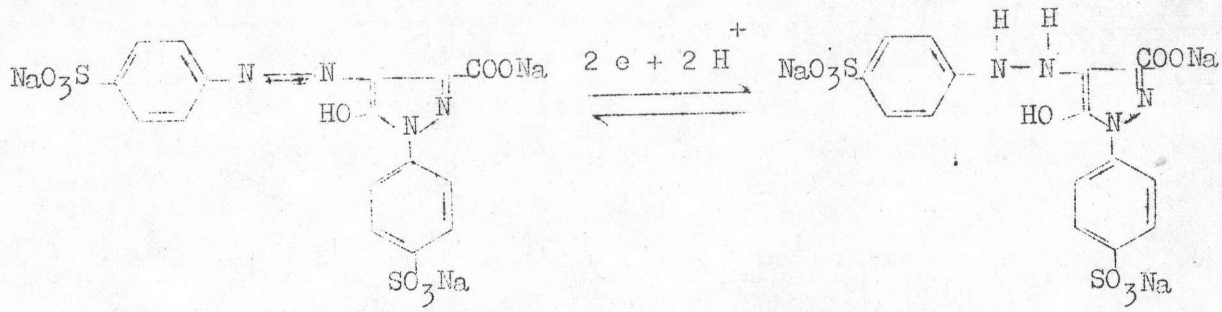
Food dyes studied are Tartrazine, Quinoline Yellow and Brilliant Blue FCF . They are food additives for yellow and blue colors. The use of Quinoline Yellow was terminated whereas Tartrazine and Brilliant Blue FCF are still permitted to use (10) . The dyes used were in high purity, tested by paper chromatography in four solvent systems : system I (1-butanol ,water and acetic acid) , system II (2-methyl-1-propanol , ethanol , water and 0.88 ammonia solution) , system III (phenol and water) and system IV (2-butanone , 2-propanone, water and 0.88 ammonia solution) ; by visible spectrophotometry in both acid and alkali solutions and by IR spectrophotometry in solid KBr pellets .

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 . Their reduction processes were diffusion controlled, proved by the dependence of the i_l on the concentration , the mercury height , the square root of mercury height and on the temperature of the dye solution . Tartrazine provided one reduction wave at any pH in every electrolyte studied. For Brilliant Blue FCF , the two reduction waves were well-defined in every electrolyte for each pH studied except in 0.1 M KCl and 0.1 M KNO_3 at pH range 2.7 to 4.3 the two waves were overlapped . Quinoline Yellow in borate buffer showed one well-defined wave at pH 1.38 - 2.15 and 8.13 - 11.85 but in phosphate buffer two polarographic waves were resulted at any pH in the range of 4.60 - 11.10 . As pH increased the half wave potential of each dye shifted to more negative value and the diffusion current of the dye was also affected by pH in every electrolyte . The pKa of Tartrazine was found to be 4.0 .

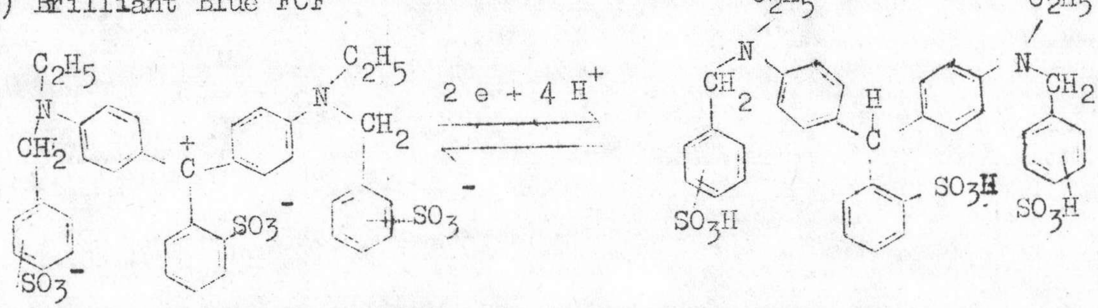
Reversibilities of the electrode processes for these dyes were also tested and it was found that the reversibilities were obtained at pH 4.5 - 12.0 for Tartrazine , pH 1.5 -2.2 for the second wave of Brilliant Blue FCF . At other pH of Tartrazine and Brilliant Blue FCF and at any pH of Quinoline Yellow the electrode processes were irreversible .

From the reversible wave of Tartrazine, the numbers of electron transfer and proton transport were equal to 2 , for Brilliant Blue FCF the reversible wave consumed 2-electron transfer and 4-proton transport . Reduction of Quinoline Yellow provides two reduction steps which the equal numbers of electron transfer and proton transport involved and these reductions were quite slow . Thus, the reduction mechanism of these dyes were suggested to be

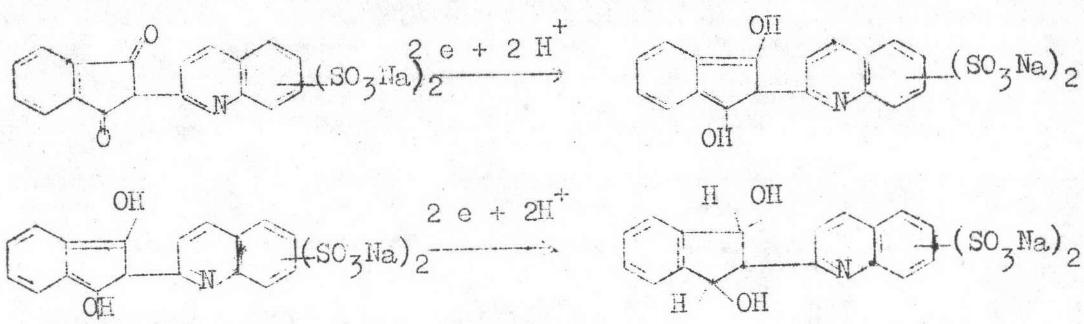
a) Tartrazine



b) Brilliant Blue FCF



c) Quinoline Yellow



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

A linear relationship between the diffusion current and the dye concentration was resulted in the concentration range 10^{-5}-10^{-4} M. Limits of detection were found to be 1.5 x 10^{-5} M for Tartrazine , 1.0 x 10^{-5} M for Brilliant Blue FCF and 2.0 x 10^{-5} M for Quinoline Yellow.

The mixture of Tartrazine and Brilliant Blue FCF was studied by varying composition of each dye. No new product occurred, tested by paper chromatography and visible spectrophotometry. However, the intermolecular bonding might be formed in the mixture solution since a distorted wave of the polarogram was observed . The polarographic analysis of each single dye in the mixture was not suggested.

The identifications of color additives in some beverages by paper chromatographic and visible spectrophotometric methods illustrated that yellow color in Fanta is Tartrazine and one of the dyes for green color in Fanta and Union is Tartrazine.

Finally, graphical determination of Tartrazine in Fanta (pineapple flavor) by polarography with standard addition method showed that the content of Tartrazine was 3.99 - 4.70 mg/dm^3.

The analysis of yellow and blue colors in food and medicine could be other interested projects .