8. SUMMARY

1. Equilibria of cinchona alkaloid sulfates with sulfonic acid resins in different ionic forms :

The exchange equilibrium between quinidine and cinchonine sulfates in dilute aqueous solution and cation exchange resins has been studied. The variables studied include the relative degree of crosslinking of the resin, the structure of the resin matrix and the ratio of the resin concentration to the alkaloid sulfate concentration. For resins X2, X4 and X8 in the alkali metal form, lithium, sodium and potassium, P_R , the fraction of the resin capacity exchanged at equilibrium, is in the order Li $\geqslant$ Na $\geqslant$ K for both the alkaloid sulfates. For reins in bivalent ionic form, magnesium and zinc, the order is Mg $\geqslant$ Zn. For the resins in ionic form of ions of different valance, the order is monovalent > bivalent > tervalent. The value of P_R for both the alkaloid sulfates decreases as the degree of crosslinking increases for each ionic form of the resins.

2. Ultraviolet absorption spectra of cinchona alkaloids :

The ultraviolet absorption spectra of quinidine and cinchonine in twelve aliphatic alcohols have been studied. The spectra of quinidine and cinchonine distinctly differ. The maxima and minima are not

significantly affected by change of the alcohol, but the value of the extinction coefficient, ϵ , is, in some cases, affected to some extent. At 332 mμ the value of ϵ for cinchonine is quite small, about 2 - 4 percent of ϵ for quinidine. Hence the absorption at 332 mμ enables the estimation of quinidine in the presence of cinchonine.

3. Equilibrium uptake of cinchona alkaloid bases from solutions in aliphatic alcohols :

The equilibrium uptake of quinidine and cinchonine on sulfomic acid cation exchange resins in six aliphatic alcohols has been studied. The value of the equilibrium uptake for quinidine is less than that for cinchonine in methyl alcohol, almost equal to that for cinchonine in ethyl alcohol and n-propyl alcohol and again less than that for cinchonine in n-butyl alcohol, tert-amyl alcohol and n-hexyl alcohol. With increase in the crosslinking, the value of the equilibrium uptake of each base decreases in each alcohol. The value of P_R decreases or remains almost constant with increase in the size of the counter ions and first decreases and then again either increases or remains almost unchanged with increase in the chain length of the solvent molecule.

4. Column studies with quinidine and cinchonine sulfates :

The exchange with quinidine sulfate and cinchonine sulfate from aqueous and N/100 sulfuric acid solution on a column of resin IR-200 in hydrogen form, sodium form and ammonium form has been studied. The elution of quinidine and cinchonine from the column of resin IR-200 in hydrogen

form and sodium form has been studied with distilled ethyl alcohol (after freeing the alkaloid base with N sodium hydroxide solution). The elution of quinidine and cinchonine from the same resin column in hydrogen form and ammonium form has been studied with N/10 and N/25 ammonical alcohol. It was found that for the resin IR-200 N/100 sulfuric acid may be used as extraction solvent for the alkaloid containing material without considerable decrease in the amount exchanged. When the resin is in sodium form or ammonium form the solution medium has little effect on the amount of the alkaloid exchanged. The resin IR-200 is quite stable to the conditions encountered and the column may be used in the ammonium form ; N/100 sulfuric acid may be used as the extraction solvent for the alkaloid containing material and N/10 ammonical alcohol as the eluent for the recovery of the alkaloids from the raw material.

5. Extraction of the alkaloids from cinchona febrifuge and totaquina :

Studies have been made to extract the alkaloids from cinchona febrifuge and totaquina using columns of resin IR-200 in hydrogen form, sodium form and ammonium form with N/100 sulfuric acid as the extraction solvent and sodium hydroxide followed by distilled ethyl alcohol, N/10 ammonical ethyl alcohol and 50 % aqueous ethyl alcohol followed by N/10 ammonical ethyl alcohol as eluents. However, the color of the alkaloid material obtained decreases in the order of the eluents as given above. It is also found that when excess

of alkaloid containing material (cinchona febrifuge or totaquina) was taken relative to the resin capacity an yield of 20 % of the resin capacity may be expected with a single column. It is suggested that the resin IR-200 in ammonium form may be used for the exchange cycle with N/100 sulfuric acid as the extraction solvent for the alkaloid containing materials. After the exchange run the column may be washed with 50 % aqueous ethyl alcohol and then eluted with N/10 ammonical ethyl alcohol. A series of four columns may be used in such a way that at any time three columns are in the exchange rum and the exhausted fourth one under elution. In this way the process may be made continuous. and a yield of about

6. Column studies of quinidine and cinchonine with carboxylic acid cation exchange resin :

Column studies of quinidine and cinchonine with carboxylic acid cation exchange resin Amberlite IRC-50 (X=2.5) have been carried out. It is observed that the column behavior of quinidine and cinchonine with this resin under the conditions studied is essentially the same.