

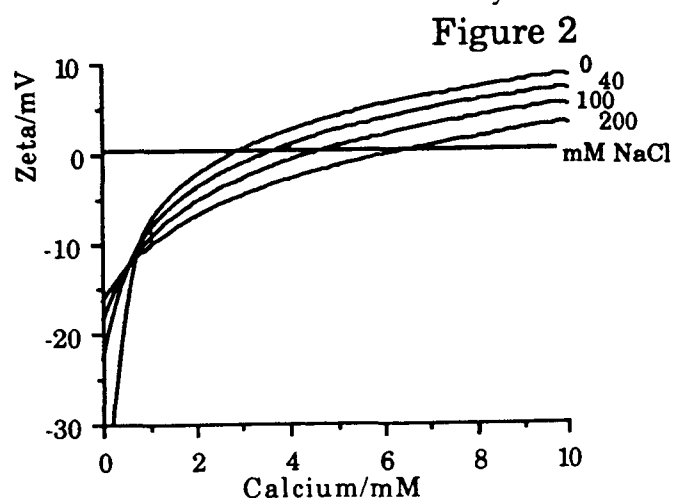
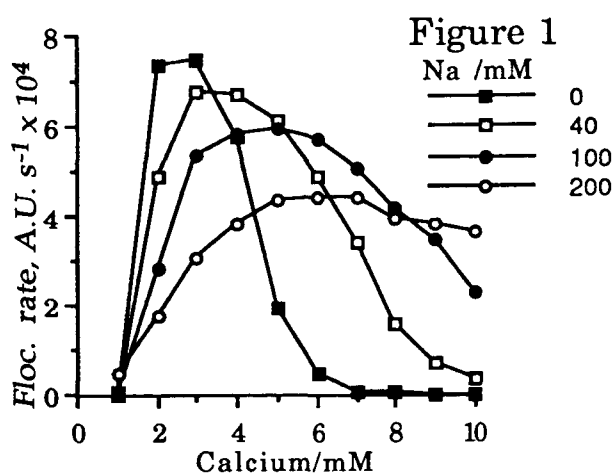
FLOCCULATION OF FAT EMULSIONS IN MIXED ELECTROLYTE SYSTEMS

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The flocculation of fat emulsions by individual monovalent and divalent electrolytes is a well-understood process. However, total parenteral nutrition mixtures contain a mixture of electrolytes, which leads to complex stability behaviour. We are currently attempting to develop methods to calculate the stability of fat emulsions in multielectrolyte solutions as a central part of our program to predict TPN mixture stability. We have previously developed a theoretical model of this system (Washington 1990) based on a simple binding site model which accounts for the electrokinetic properties of the system satisfactorily. We have now confirmed the applicability of this model to the TPN stability problem by measuring the flocculation of Intralipid 20% in mixtures of sodium and calcium salts.

The flocculation of Intralipid 20% was measured in multielectrolyte solutions at pH 7 using turbidimetry. The fat emulsion was diluted into electrolyte solutions of calcium concentrations 0-10 mM in the presence of sodium concentrations of 0-100 mM. The increase in turbidity was measured for 2-min period. The flocculation rate vs. calcium concentration at specific sodium concentrations is shown in Fig 1. Addition of sodium causes the peak of flocculation (equivalent to the point of zero charge) and the critical flocculation concentration to both move to higher calcium ion concentrations. This is caused by calcium competing with sodium for surface binding sites. The range of calcium concentrations over which flocculation is observed increases with increasing sodium concentrations. This is in agreement with the electrokinetic data (Fig. 2; zeta potential vs. calcium concentration in the presence of sodium ions). This data was calculated as described by Washington (1990) since the direct measurement of zeta potential in large concentrations of ions poses experimental difficulties. Increasing amounts of monovalent ion compress the double layer and increase the range of calcium concentrations over which the zeta potential is insufficient to stabilize the system.



The data demonstrates the complexity of TPN mixture stability; it is evident that simple models such as the Schultz-Hardy approach, which attempt to sum the (in)stability contributions of individual ions, are not applicable to this system. The data agrees well with the simple electrokinetic predictions and suggests that computational approaches to TPN mixture stability prediction may ultimately prove fruitful.