

Title:

Water/Biopolymer Interactions: Comparison of NMR with Other Techniques

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For a long time the literature of NMR studies of water in food made use of the concept of bound water. That is water whose dynamical properties and, possibly structure, were affected by proximity to macromolecules. It is now clear that in biopolymer systems where there is a large excess of water this is not correct. Properly interpreted the NMR results indicate that, when water is in excess, it is not affected by to any significant extent by the biopolymer interface. These results are confirmed by computer simulation results. However other types of experiments such as dielectric spectroscopy, fluorescence and colorimetric results seem to indicate that there is an entity that may be called bound water. Modern theoretical developments have suggested that this interpretation is incorrect and that the inference of bound water was due to a misunderstanding of the nature of interactions to which the techniques were responding. It will be argued therefore that properly interpreted all the techniques give similar answers.

It is true however that when biopolymer/water systems are frozen a fraction of the water remains unfrozen. Even though calorimetric and NMR measurements of non-freezing water content are not in good agreement the results imply that some water is in a different environment to the rest of the water. It will be argued that the amount of water remaining unfrozen in a biopolymer system is the result of the non equilibrium conditions that obtain rather than any fundamental significance, although there may be some significance in the water content below which no ice will form.