INTRODUCTION

The lipoproteins of milk mainly exist at the fat/plasma interface in the form of a membrane known as milk fat globule membrane (MFGM). The membrane envelopes the fat globules which are mainly composed of triglycerides and helps to emulsify the fat globules in milk.

Various classes of lipids constitute 40 - 60% of bovine MFGM. Lipids of MFGM are both polar and non-polar in nature. The proteins which constitute nearly 50% of the membrane have distinct differences in their properties from those of other milk proteins. These proteins have the properties of both hydrophobic and hydrophilic colloids. The proteins exist in the membrane in association with lipids. High molecular weight proteins and glycoproteins, which are characteristic of plasma membrane, are components of MFGM. The proteins of bovine MFGM have been electrophoretically characterized and their molecular weights have been estimated by various workers.

Electron microscopic and X-ray crystallographic studies on MFGM have shown that bovine MFGM fragments are 100 Å to 200 Å wide and up to 4.5 µ in length. Various postulations on the structure of MFGM have been reported. King (1955) postulated MFGM as a monolayer of polar lipids, oriented on the fat globule surface and
joined to one or more layers of extended protein molecules through electrostatic interactions. The fact that some of the lipoproteins which are rich in enzymatic activities can be easily solubilised from MFGM has led to the hypothesis that the membrane consists of an innermost layer to which soluble lipoproteins are adsorbed. But recent studies on the organisation of proteins on MFGM by using proteolytic enzymes and isotopic labelling techniques have shown that MFGM is not intact. The above observations do not support the idea of the presence of well defined inner and outer membranes in MFGM.

Activities of a number of enzymes are associated with bovine MFGM. The presence of high activities of ATPase and 5' nucleotidase, which are used as marker enzymes for plasma membrane, in MFGM is of interest with regard to the origin of MFGM.

The electron microscopic and biochemical studies on MFGM have led to the conclusion that the fat globules arise directly from the secretory cell plasma during milk secretion. The membrane represents a physiological source of plasma membrane and hence has been suggested as a model for the study of lipid-lipid and lipid-protein interactions in plasma membrane of acinar cells of mammary gland. Since they can be easily isolated, bovine MFGM is one among the most widely studied of all biological membranes. Hence, plethora of data on the composition and structure of bovine MFGM are available.
Buffalo is the main milk animal contributing nearly 60% of the total milk production in India. Basic studies on composition and properties of plasma proteins of buffalo milk have helped to develop the technical know-how for the manufacture of different dairy products from buffalo milk. The average size of fat globules in buffalo milk is twice that of fat globules in cow milk. The stability of milk and some milk products may depend on the changes that MFGM may undergo during various processing conditions. Since various dairy products are manufactured from buffalo milk, some basic studies on buffalo MFGM are indispensable for the perfect prescription of buffalo milk technology.

Very limited studies on buffalo MFGM have only been reported. Delipidated MFGM proteins of buffalo have been shown to be similar to delipidated MFGM proteins of cow in chemical composition, amino acid composition and electrophoretic pattern. The above studies were conducted on MFGM proteins which had been previously treated with ethanol, acetone and ether. Since treatment of MFGM with organic solvents results in complete disruption of membrane structure, the studies on membrane proteins will be more ideally conducted on the lipoproteins, rather than on delipidated proteins. In this present investigation, an attempt has been made in this direction.
Membrane proteins are generally difficult to be solubilised. Partial solubilisation studies of membrane proteins in aqueous solutions by changing pH or ionic strength of medium or in presence of detergents have helped to characterise the proteins of erythrocyte membrane which is one of the most extensively studied biomembranes. A similar approach has been made to solubilise buffalo MFOM proteins in the present investigation. Estimation of levels of some enzymes associated with buffalo MFOM and solubilisation of these enzymes in presence of various membrane solubilising agents with a view to have some idea on the organisation of these enzymes on MFOM constitute another facet of this investigation. Some of the properties of 5'-nucleotidase, which is used as a marker enzyme for plasma membrane, from buffalo MFOM have also been investigated in order to know whether the properties of this minor protein component from cow and buffalo MFOM are similar.