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Influence of clay on drug permeability and mechanical properties of sodium caseinate films

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Caseins are major milk proteins. They are amphiphilic molecules that are able to self-association into micelle structures by hydrophobic interaction. Sodium caseinates (NaCas), a salt of casein, possessed film-forming properties when adding water soluble plasticizer such as glycerin [1]. Moreover, physical properties of the NaCas films could be modified by incorporating insoluble materials, such as oil and wax [2]. Magnesium aluminum silica (MAS), a pharmaceutical clay, has been used to reinforce and alter drug permeability of polymeric films [3]. Therefore, the aim of this study was to investigate effect of MAS on drug permeability and mechanical properties of NaCas films.

NaCas-MAS films were prepared by a casting/solvent evaporation method. NaCas (5% w/v) was dispersed in distilled water, and then the dispersion was blended with glycerin (30 %w/w based on NaCas content). The NaCas dispersion was mixed with MAS dispersion to achieve NaCas-MAS ratios of 1:0, 1:0.05, 1:0.10 and 1:0.15 by weight. Permeability of acetaminophen (ACT) was studies using a side-by-side diffusion cell and 0.1 N HCl was used as a permeation medium at 37 °C. Besides, mechanical properties, puncture strength and %elongation, of the films were measured using a Texture Analyzer. The results showed that a continuous film was obtained in all MAS contents added. The NaCas-MAS films presented lower puncture strength and %elongation than the NaCas film. The puncture strength and %elongation of the composite films decreased with increasing MAS ratio. Moreover, the permeation profile of ACT through the NaCas films showed a steady state with lag time (Fig. 1), and could be described using Fick's first law. The ACT permeation fluxes decreased with increasing MAS ratio in the films, whereas longer lag time was found. This resulted in a decrease of permeability value when increasing MAS ratio.

This is likely to be due to lower water uptake of the NaCas film when adding MAS that may provide higher tortuosity of water-filled channels in the film matrix. In conclusion, incorporation of MAS into the NaCas film caused decrease of film strength and flexibility. However, the NaCas-MAS films could retard drug permeation, which may be applied for fabricating drug delivery systems and using in tablet film coatings.

Keywords: Sodium caseinate; Films; Clay; Drug permeability; Mechanical properties

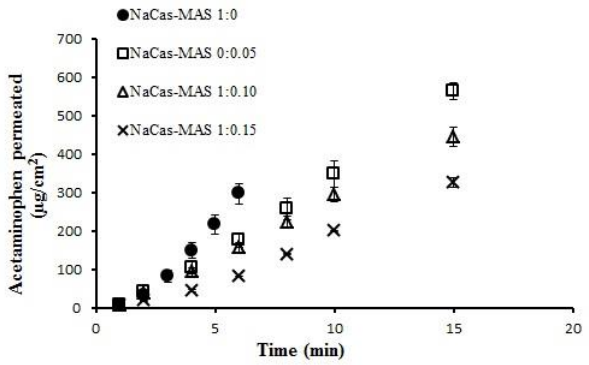

Fig. 1. Permeation profiles of ACT across NaCas-MAS films in 0.1 N HCl.

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