Advances in Quaternary Polymethacrylate Films for Pharmaceutical Tablet Coating

Thaned Pongjanyakul

Division of Pharmaceutical Technology, Faculty of Pharmaceutical Sciences, Khon Kaen University, Khon Kaen, THAILAND
E-mail: thaned@kku.ac.th

Thin film technology has been proposed for use in the pharmaceutical industry. Continuous films can be prepared by using both natural and synthetic polymers. The synthetic polymers are frequently used as coating materials for tablets. Among them, quaternary polymethacrylates (QPMs), water-insoluble polymers with positively charged quaternary ammonium groups, have been widely applied in pharmaceutical technology to prepare film coatings for drug delivery systems. QPM in the form of aqueous dispersions has been used for film coatings over organic solutions for environmental protection and to reduce the hazardous nature of organic solvents. The QPM colloidal dispersions show a milky liquid with 30 %w/w solid content. The QPM film formation mechanism is water evaporation and polymer deformation to form a continuous film. The important additives to improve film properties are plasticizers and anti-tacking agents. In addition, the curing process at a high temperature can enhance the fusion of QPM particles to form a homogenous film. The characteristics of the QPM films can be modified by polymer blending. Mixing of the QPMs with different percent quaternary ammonium groups can modulate drug permeability and drug release from the coated tablets. The QPM blended with sodium alginate (SA), a negatively charged polysaccharide, can increase film strength and reduce tackiness in both dry and wet states. Moreover, an increase of SA in the films retards drug permeation across the films and drug release from the coated tablets. Furthermore, the clay addition is an alternative approach for modifying the QPM film properties. Incorporation of magnesium aluminum silicate (MAS), a negatively charged clay with a silicate layer structure, into the QPM films results in a decrease in puncture strength in the dry state but increases puncture strength in the wet state. Additionally, the tackiness of the QPM-MAS films reduces with increasing MAS ratios. MAS added also retards water uptake property and drug permeability of the blended films. The tablets coated with QPM-MAS films in the ratios of 4:0.5 and 4:0.75 do not stick together after 3 months of storage, in contrast to the QPM-coated tablets. An increase in MAS ratios causes a longer lag time and slower drug release of the coated tablets. The curing process also affects drug release from the QPM-coated tablets, but the QPM-MAS-coated tablets present indifference to drug release after curing. For stability studies, the QPM-MAS-coated tablets stored without packaging present a better appearance than the QPM-coated tablets under accelerated condition for 4 months. Temperature and humidity strongly influence further fusion of the QPM particles in the coated films, resulting in a decrease in water uptake and drug release rate of the coated tablets. In conclusion, the QPM film properties can be improved by adding a plasticizer and anti-tacking agent, and the curing process is important for complete film formation. The incorporation of negatively charged polymer or clay can modify the characteristics of the QPM films for use in tablet coatings.

Keywords: Quaternary polymethacrylate; Sodium alginate; Magnesium aluminium silicate; Coated tablets
The related SDG (Optional): None