Comparative study of swelling and erosion properties of PEO, HPMC and Kollidon SR

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Introduction

Kollidon SR is a physical mixture of polyvinylacetate (PVAc) and polyvinylpyrrolidone (PVP) or Kollidon 30. It is made by spray drying of the mixture of PVAc and PVP (PVAc: PVP=4:1). The povidone component gradually leaches out of the matrix during dissolution thereby creating pores for the active to diffuse out. The compressed PVAc component maintains tablet core structure during dissolution. The amorphous nature of PVAc coupled with its unusually low glass transition temperature of 28-31? impacts certain unique characteristics to this binary mixture. HPMC and PEO's properties are discussed previously.

Objectives

To compare the floatability, swelling, erosion and drug release characteristics of matrices based on HPMC, PEO and Kollidon SR.

Methodology

Theophylline was used as a low solubility model drug. HPMC K4M and K15M, PEO 303, PEO N60-K and Kollidon SR were used as release rate controlling polymers for comparison purpose.

❖Dissolution study
Dissolution study was carried out using USP 27 apparatus 2 under sink condition at pH 2.0, the stirring rate was 100rpm and 50rpm. Theophylline release was detected by UV absorbance at 271nm.

❖Determination of swelling and erosion-Texture Analyzer Application
The swelling and erosion behavior of monolithic matrices based on HPMC, PEO and Kollidon SR were evaluated by the texture analyzer TX-2i at 2, 4, 6, 8 and 12 hour in different dissolution media.

❖Weight gain and weight loss
The wet weight of each layer or tablet was checked before the texture analysis, the residues after testing was put into drying oven to achieve constant dry weight. The percent weight gain and weight loss was calculated at each time point.

❖Powder rehology study
The powder characterization was performed on the plain powder of Kollidon SR, PEO N60-K, PEO 303 and HPMC K4M using the ManUnit Powder Rheometer in conjunction with the TA.XT2*i* Texture Analyzer.

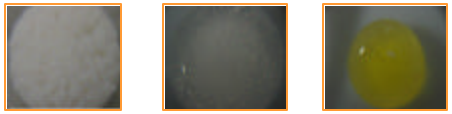

Figure 1. General appearance of monolithic matrices during dissolution at 8hr: SR (left), PEO 303 (middle) and HPMC K4M (right).

Results and Discussion

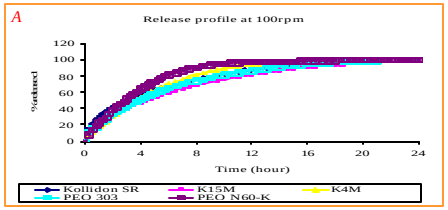

Figure 2. Theophylline release profile from monolithic matrices based on each polymer at pH 2.0 under 100rpm (A) and 50rpm (B0.

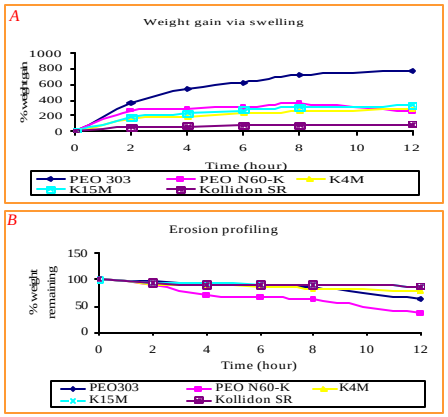

Figure 3. Percent weight gain (A) and mass loss (B) of monolithic matrices based on various polymers.

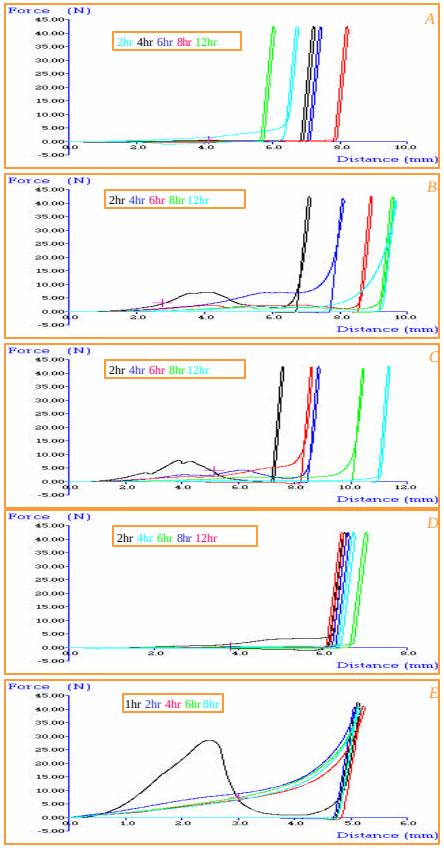

Figure 4. Force-distance profiles of monolithic matrices based on each polymer: PEO 303 (A), HPMC K15M (B), HPMC K4M (C), PEO N60-K (D) and Kollidon SR (E).

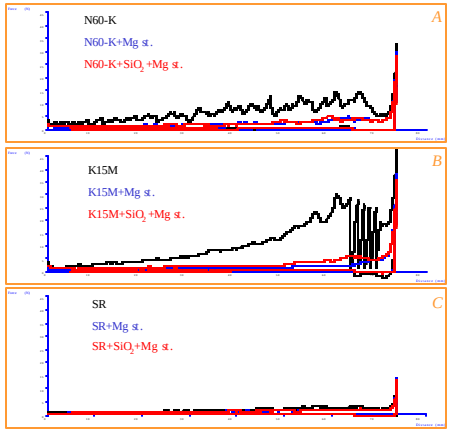

Figure 5. powder flowability profiles of polymer and their binary and ternary mixture: PEO N60-K (A), HPMC K15M (B) and Kollidon SR (C).

Results and discussion

Figure 1 shows the appearance of hydrated matrices. The extensive swelling and erosion characteristics of PEO N60-K based matrices demonstrated highest release rate at pH 2.0 (*Figure 2*). The harsher (100rpm) hydrodynamic condition increased the release rate from both PEO and HPMC based matrices. Drug release from Kollidon SR based matrix was independent of changes in rpm. All matrices achieved floating without lag time. Among all the three polymers used, PEO underwent most extensive swelling and erosion (*figure 3*).Kollidon SR showed minimum swelling and erosion, and its weight remained constant after 8 hours and glassy core was only available in HPMC and Kollidon SR based matrices (*Figure 4*).

Powder flowability study (*figure 5*) showed that both colloidal silica and magnesium stearate help to reduce the cohesion of each polymer in the order of SR<PEO N60-K<HPMC K4M.

Conclusions

All polymers demonstrated significant differences in swelling and erosion behavior. PEO showed extensive swelling and erosion. The overall order of swelling and erosion was PEO N60-K > HPMC K15M > HPMC K4M > Kollidon SR. There is no obvious swelling and erosion in SR based matrices, resulting in a robust system independent of hydrodynamic changes. Drug release rates in early time period (<4 hours) from all matrices were unpredictable but generally in the order of Kollidon SR > PEO > HPMC. Further work on Kollidon SR characterization is underway.