phate. However, the thickness of tablets produced from matrix granules using both lactose and dicalcium phosphate increased with the increasing ratio of the water-soluble polymer in solid dispersions of nifedipine. This can be explained by the fact that the mixed weight of solid dispersions needs to be equivalent to 20 mg nifedipine, and thus the weight increases with the increasing ratio of water-soluble polymer to nifedipine.

As shown in Table 3, most tablets produced from matrix granules of lactose with the addition of any form of nifedipine showed a higher hardness than that seen with matrix granules of dicalcium phosphate. Also, tablets produced from matrix granules of either lactose or dicalcium phosphate with additional HPMC showed a higher hardness. However, a deterioration effect of increasing EC in the matrix formulation on the hardness of matrix tablets at the same HPMC percentage was observed for tablets produced from matrix granules of either lactose or dicalcium phosphate. Furthermore, a positive influence of water-soluble polymer on the formulation of the solid dispersion was shown on the hardness of the resulting matrix tablets. HPMC had a greater ability than PVP to influence this property, but the increasing ratio of HPMC in the formulation of the solid dispersion contrarily led to a decrease in the hardness of the resulting matrix tablets.

Obviously, the binding ability of HPMC in the matrix granules resulted in improved adhesion among granules producing a higher tablet hardness. Its effect on the hardness of matrix tablets seemed to deteriorate with an increased weight percentage of EC in the formulation. Two possibilities may explain this influence. One is that the de-shielding effect of the ethylcellulose film on the bonding of particles results in deterioration of the hardness of matrix tablets. Another possibility is that the extent of free water in the aqueous solution of the granulating agent (as provided by the aqueous dispersion of ethylcellulose) available for solubilization of HPMC (50 cps) decreases as the weight percentage of ethylcellulose added to the formulation increases. As indicated in the "Experimental Section", HPMC was added in dry powder form to the formulation during granulation, and the total water amount in the granulating solution was kept constant (50 g for lactose and 90 g for dicalcium phosphate). With an increased amount of ethylcellulose in the granulating solution, the viscous nature of the resulting solution was less able to impart free water for dissolving HPMC, and so a smaller fraction of HPMC could be dissolved in a fixed granulation time. Both effects lead to minimization of the dissolved amount of HPMC available for bonding of matrix granules during compression.

All tablets demonstrated an acceptable friability (less than 1) as shown in Table 3. The influence of additional HPMC on the friability of matrix tablets seemed to follow the same tendency as that for hardness. Friability decreased with the addition of HPMC to formulations containing the same weight percentage of ethylcellulose for matrix tablets produced from either lactose or dicalcium phosphate. Because of the bonding effect of water-soluble polymers of either PVP or HPMC, the inclusion of the solid dispersion of nifedipine in matrix tablets should decrease the friability of the resulting matrix tablets with either lactose or dicalcium phosphate (≤ 0.1)compared to those tablets including nifedipine alone (≥ 0.2).

The dissolution profiles of nifedipine from various forms of nifedipine particles are illustrated in Fig. 1. It clearly indicates that the addition of water-soluble polymer improved the dissolution of nifedipine from the corresponding matrix granules. The enhancing effect seemed to be greater for HPMC than for PVP. An increasing ratio of HPMC to nifedipine also further promoted the dissolution rate of nifedipine. The difference in the ability to enhance the dissolution rate of nifedipine from corresponding solid dispersions with HPMC and PVP might be attributable to the lower extent of solubility enhancement by PVP and the retardation of dissolution by the higher viscosity of PVP. It has been reported that solid dispersions of nifedipine to PVP at a ratio of 1:3 dissolved rapidly in the initial stage of dissolution and yielded a supersaturated solution.[18] The viscosity of PVP (grade K30) should also be higher than that of the HPMC grade used in this study (5 cps). However, Fig. 2 shows that the formation of an amorphous form of nifedipine seemed to be greater when using PVP than HPMC as the water-soluble polymer in the preparation of solid dispersions. The same extent of inhibition of nifedipine crystalline formation by HPMC could only be achieved by increasing the ratio to 1:3 as compared to that by PVP at a 1:1 ratio. Therefore, a slower dissolution rate of