CHAPTER V
CONCLUSIONS

In the present study, the effects of spray dried formulation, light and relative humidity on solid-state stability of nifedipine spray dried microspheres were investigated. The microspheres were prepared by spray drying with combined polymers containing Eudragit RS100 and PVP K30 with drug-polymer mixing ratio of 1:10. The HPLC conditions were optimized for high specificity, linearity, accuracy and precision in order to analyze the nifedipine content in the microspheres. The image analyzer was used in microspheres particle size measurement. The results from the investigation are concluded as follows:

1) Nifedipine microspheres could be prepared by spray drying with combined polymers at 1:10 mixing ratio at 55, 65 and 75 ^{o}C inlet air temperature. As the PVP content increased and the inlet temperature increased, the particle size decreased. The particle size might be influenced by the viscosity and concentration of the spray solution.

2) The photodegradation of nifedipine microspheres was found to follow the first-order kinetics.

3) The PVP K30 content in the combined polymers of the microspheres and the inlet air temperature had significant effect on degradation rate constant ($p<0.05$).

4) As the microsphere size increased, the degradation rate constant decreased significantly ($p<0.05$). This might be the decreased surface area as the size increased, thus the reactive site exposed directly to light decreased.

5) The drug-polymer mixing ratio significantly affected the degradation rate constant ($p<0.05$). As the nifedipine concentration increased, the degradation rate constant

increased. This was conformable to the increased of the reaction sites on the microspheres surface. The effect of drug-polymer mixing ratio was more intense when PVP K30 was used than Eudragit RS100 at the same level of nifedipine-polymer ratio.

6) The light intensity as determined by an illuminance meter showed significant effect on the degradation rate constant ($p<0.05$). The higher irradiation intensity, the higher the degradation rate constant. As the light intensity increased, the higher energy absorbed by the drug molecules was raised to the excited state. The plot between k and intensity gave a linear relationship with the R^2 of 0.9913. From this plot, the predicted $t_{90\%}$ of microspheres under normal light intensity could by determined.

7) Curcumin showed the significantly highest protection power to nifedipine solution and also to nifedipine microspheres. The photostabilization of curcumin was superior to other UV absorbers and antioxidant, sodium bisulfite.

8) Nifedipine microspheres added with curcumin of 4 times nifedipine concentration showed no degradation throughout the study under ambient condition. The dissolution characteristics were not affected by the ambient atmosphere.

9) The effect of humidity was studied by the determination of the water uptake by the microspheres under 31, 53, 75 and 96 %RH at 40 ^{o}C. The water uptake increasingly dependent on the relative humidity and on the PVP K30 content in the microspheres. The critical relative humidity values of the microspheres were determined.