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Enhancement of nifedipine solubility by solid dispersion formulation

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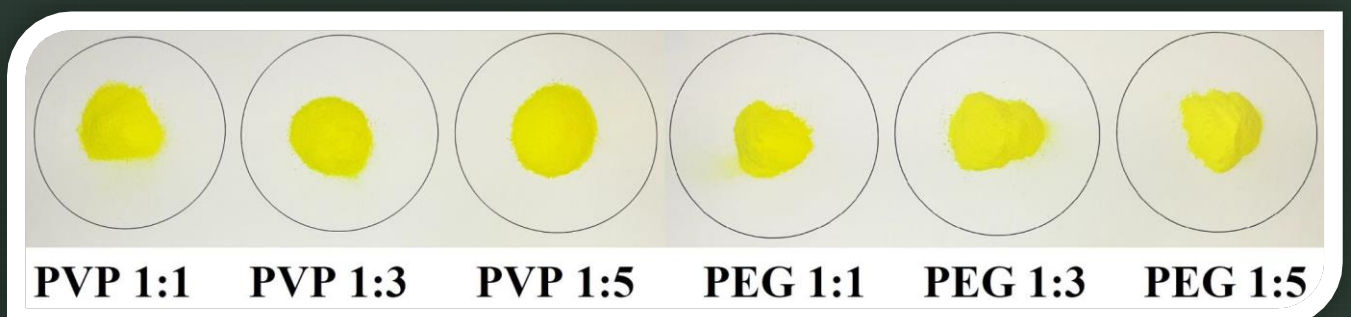
Nifedipine is a representative of drugs that belong to the second group of the biopharmaceutical classification system. It is characterized by low solubility and high permeability. Solid dispersion technology has proven to be a good approach to increase solubility, dissolution rate and consequently bioavailability. The objective of this paper was to prepare solid dispersions of nifedipine with two different polymers, in three different ratios, and examine potentially increasing of solubility in in vitro conditions.

Solid dispersions of nifedipine were made with polyvinylpyrrolidone K30 (PVP) and polyethylene glycol 4000 (PEG) in three mass ratios: 1:1, 1:3 and 1:5. The kneading method of obtaining dispersions was applied using concentrated ethanol as a production medium.



After drying, the solid dispersions were stored protected from light (as during all subsequent experiments) and in a desiccator. The solubility test was performed in a thermostatic water bath with a shaker, by spectrophotometric measurement of nifedipine concentration from saturated solutions. Solubility in water and biorelevant medium (isotonic phosphate buffer pH 6.8 with addition of sodium lauryl sulfate) was observed at 25 °C and 37 °C, after 2 h and 24 h. The results were obtained in triplicate and compared with physical mixtures and nifedipine alone.

The tested solid dispersions increase the solubility of nifedipine, including the solubility recorded in the physical mixtures. The difference in solubility is more pronounced in solid dispersions with different polymers than in any dispersion in which the proportion of used polymer is varied. The solubility of nifedipine from solid dispersions with PVP and PEG after 24 h in a biorelevant medium is shown in the table below.

Solid dispersion	Solubility [µg/ml]
PVP 1:1	130.23 ± 3.08
PVP 1:3	131.94 ± 10.83
PVP 1:5	128.64 ± 9.59
PEG 1:1	74.45 ± 6.49
PEG 1:3	79.12 ± 10.42
PEG 1:5	72.11 ± 16.70

The kneading method proved to be suitable for formulating nifedipine solid dispersions. These solid dispersions have a higher solubility, which is why a higher dissolution rate and bioavailability can be expected, but further tests are needed for final confirmation.