J Pharm Innov (2011) 6:232–240
DOI 10.1007/s12247-011-9116-4

RESEARCH ARTICLE

Studies on Flash Evaporation for Preparation of Porous Solid Dispersions Using Piroxicam as a Model Drug

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Published online: 17 November 2011

Abstract An amalgamation of solid dispersion and capillarity has been attempted in present study for enhancement of dissolution rate of poorly soluble drugs. Flash evaporation technique was utilized for enhancement of the dissolution rate of piroxicam. One of the major problems with this drug is its very low solubility in biological fluids, which results in poor bioavailability after oral administration. An attempt was made to enhance the dissolution rate of piroxicam by converting it into porous solid dispersion by flash evaporation method using polyvinylpyrrolidone (PVP) 40,000 as a water-soluble carrier. The resulting solid dispersions were characterized by DSC, FTIR, and X-ray diffraction. In vitro dissolution study revealed significant improvement of dissolution profile of piroxicam. The release of drug from porous solid dispersions containing PVP was superior to those of marketed product, conventional nonporous solid dispersion prepared by solvent evaporation method and drug alone. The steep increase in dissolution rate of porous form is attributable to combined effect of solid dispersion and capillarity.

Keywords Piroxicam · Solid dispersion · Polyvinylpyrrolidone · Dissolution rate · Flash evaporation · Capillarity

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Introduction

Enhancement of the dissolution rate has been a fascinating area of research during the past three decades and various techniques have been employed to increase the dissolution rate of poorly soluble drugs. The solubility of poorly soluble drug can be altered in many ways such as particle size reduction, adsorption, use of surfactants, complexation, pro-drug/salt formation, cosolvency, solid dispersions, etc. [1]. Among these possibilities, formulation of drug as solid dispersions is a fruitful approach for improving the dissolution rate of poorly water-soluble drugs [2]. Solid dispersions lead to the formation of systems in which the drug is dispersed almost to a molecular level, exhibiting an increased dissolution rate and potentially higher bioavailability [3, 4]. In the present study, an attempt was made to enhance the dissolution rate of solid dispersions of piroxicam by converting it into porous form using the flash evaporation technique. This not only led to reduction of drug to molecular size but also enhancement of the dissolution of drug due to the formation of the porous mass containing numerous capillaries. The resulting product is naturally expected to steeply enhance the dissolution rate due to combined effect of solid dispersion and capillarity. Piroxicam, 4-hydroxy-2-methyl-*N*-(2-pyridyl)-2H-1, 2-benzothiazine-3-carboxamide-1, 1-dioxide is a non-steroidal anti-inflammatory agent with analgesic and antipyretic properties [5]. It is used as a first-line drug in the treatment of rheumatoid arthritis, osteoarthritis, and has fewer incidences of side effects [6]. In terms of biopharmaceutics classification, piroxicam is a class II drug since it is characterized by low solubility and high intestinal permeability [7, 8]. For drugs belonging to this class, dissolution is important because it changes the actual drug concentra-