Evaluation of polyvinylpyrrolidone and sodium alginate as carriers of solid dispersions with curcumin

K. Yoncheva[1*], K. Grigorova[1], M. M. Zaharieva[2], I. Spassova[3], D. Kovacheva[3], H. Najdenski[2]

[1]*Faculty of Pharmacy, Medical University of Sofia, 1000 Sofia, Bulgaria*
[2]*The Stephan Angeloff Institute of Microbiology, Bulgarian Academy of Sciences, 1113 Sofia, Bulgaria*
[3]*Institute of General and Inorganic Chemistry, Bulgarian Academy of Sciences, 1113 Sofia, Bulgaria*
[*]*Corresponding Author: kyoncheva@pharmfac.mu-sofia.bg*

The incorporation of hydrophobic drugs into solid polymer dispersions is a modern method for increasing their water solubility [1-2]. In this regard, the incorporation of curcumin into solid polymer dispersions can be considered as an alternative approach to improve its solubility and pharmacological effects in vivo. In the present study, polyvinylpyrrolidone (PVP) and sodium alginate (ALG) were selected as carriers of polymer dispersions. Both types of the dispersions were prepared via solvent evaporation method at three ratios between curcumin and the respective polymer, in particular 1:1, 1:20 and 1:50 (wt/wt). For both polymers the optimal ratio was 1:25. However, the results showed significantly higher solubility of curcumin after formulation in PVP-solid dispersion compared to ALG-solid dispersion. X-ray diffraction analyses revealed complete transformation of crystalline curcumin into an amorphous state in both types of the dispersions. Therefore, the transformation of curcumin into an amorphous state was not the only mechanism by which PVP-dispersion affected its solubility. Further, the release process of curcumin from the PVP-dispersion in phosphate buffer (pH 7.0) showed a complete release within 20 minutes, while the pure curcumin did not dissolve within the same time. The following studies compared the ability of the PVP-solid dispersion of curcumin and pure curcumin to inhibit a biofilm of *Staphylococcus aureus* (methi cillin resistant, MRSA). Microscopic studies showed a more pronounced inhibition of the MRSA biofilm when treated with curcumin incorporated into the PVP-solid dispersion compared to the pure drug. The inhibition of the biofilm by low concentration of curcumin in the PVP-dispersion (11.4 µM) was comparable to the effect of pure curcumin in 100 µM concentration. Thus, polyvinylpyrrolidone appeared as a very effective carrier for formulation of solid dispersion of curcumin that ensured better biopharmaceutical and antimicrobial properties of the drug.

Keywords: curcumin, polyvinylpyrrolidone, sodium alginate, antibacterial activity

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