Behaviour of medicated inks on porous substrates – The effect of viscosity and surface tension on printing parameters

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INTRODUCTION

2D and 3D printing methods are of emerging interest in the pharmaceutical industry, since their offer enormous advantages from the aspect of dosing accuracy, modification of the drug release kinetic and personalized medicine [1]. Genina et al. revealed that the ink parameters (e.g spreading on non-porous substrates) may influence both printing accuracy and the behaviour and stability of the printed drugs [2]. Current project is focusing on the investigation how the physicochemical characteristics of the applied medicated ink influence the printing and dosing accuracy, the penetration into and the distribution inside a porous substrate.

MATERIALS AND METHODS

PVP K25 and Polysorbate 80 was used for setting of the viscosity and surface tension of the ink according to 3^2 full factorial design, which contained brilliant blue dye as model material to help to follow the ink distribution of the texture of carrier matrix. 13 mm in diameter tablets with different porosity were compressed from Pearlitol SD200 (Roquette, France) lubricated with 1% of magnesium stearate using a hydraulic press (Specac, UK) and 2, 3, 4 and 5 tons compression force. The surface tension and spreading parameters of the ink on the substrate surface was tested with an optical contact angle tester (OCA20, Dataphysics, Germany). The printing experiments were conducted with a self-developed printing apparatus.

RESULTS

The results revealed that the viscosity plays considerably higher role in the ink behaviour than surface tension. The highest dose/printing time was achieved with inks with high viscosity and surface tension, however this combination acts negatively on printing accuracy since the drop formation is not balanced with the trigger signal. Low viscosity promotes the ink penetration into the substrates which acts positively on the printing and drying speed but affects the printing pattern negatively especially in highly porous substrates.

CONSLUSION

There are complex interrelations between ink parameters and properties of porous substrates, which allows multiple ways for tailoring individualized delivery systems.

REFERENCES

1. Daly R. et al. Int. J. Pharmaceut. 494, 554-567 (2015)

2. Genina N. et al. Int. J. Pharmaceut. 453, 488-497 (2013)