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Transfer of twin-screw granulation process using a shear stress description of screw configuration

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Factors like liquid-to-solid ratio (L/S), screw configuration and barrel fill level have crucial impact on the extent of granule formation [1]. Strategies that allow successful process transfers onto twin-screw granulators of different barrel diameters, without necessity of numerous experiments, are rare and still challenging [2,3].
Aim of this study was to transfer a TSG process using a newly developed equation that numerically describes the screw configuration as shear stress (τ)

$$\tau \left[\frac{N}{m^2}\right] = \frac{\dot{m}_{tot} \cdot n \cdot \pi \cdot D_{screw}}{L/S} \cdot \sum \left(\left(\frac{A_{contact}}{V_{free}} \right)^2 \cdot \frac{L_{screw}}{D_{screw}} \cdot sin(\alpha) \right)$$

$\dot{m}_{tot}$	total material throughput
n	screw speed
$A_{contact}$	contact area screw-barrel
V_{free}	free volume
L_{screw}	element length
D_{screw}	element diameter
L/S	liquid to solid ratio
α	stagger angle of kneading elements or aperture angle of conveying elements

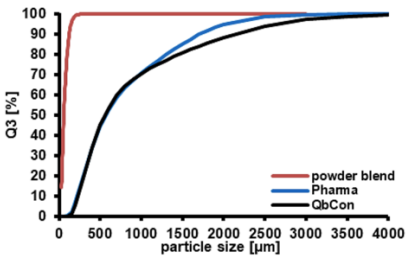

Fig. 1. GSD of a process transfer approach.

Two granulators of different barrel diameters (Pharma: 16 mm, QbCon: 25 mm) were used. The granule size distributions (GSD) of the original granules were compared only in the first place (Fig. 1). The GSD curves were comparable to each other with regard to their characteristics. Deviations were noticed above approx. 1000 µm only, resulting in higher x90 values for the granules produced on the QbCon. In a second step and to draw a final conclusion, process transfers were performed, where the original and turbo-sieved granules as well as tablets were characterized according to the European Pharmacopoeia. Very similar characteristics could be revealed. A successful transfer can be assumed.

References
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