# Influence of feed viscosity on liquid drop breakup during effervescent atomization of aqueous polyvinylpyrrolidone solutions

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**Abstract**

The atomization of highly viscous liquids into a fine dispersed spray e.g. for spray drying processes is very demanding. For this process, pneumatic atomizers are widely used atomizers in industrial applications, despite the disadvantage of their high atomization gas consumption. A special type of internal mixing pneumatic atomizer with measurably lower atomization gas consumption is the effervescent atomizer [1], for which the formation of a two phase flow in the nozzle is characteristic. In previous investigations, the effervescent atomization of solutions with different viscosities led to significant differences of the liquid breakup near the nozzle which is exemplary shown in fig. 1 for 3 different viscosities. Simple measurement of the drop size distribution in the spray cone center gives only integral information about the fineness of the spray. For better understanding of the liquid breakup the local drop size distributions are measured in dependence of the axial [2] and radial distance of the nozzle outlet.

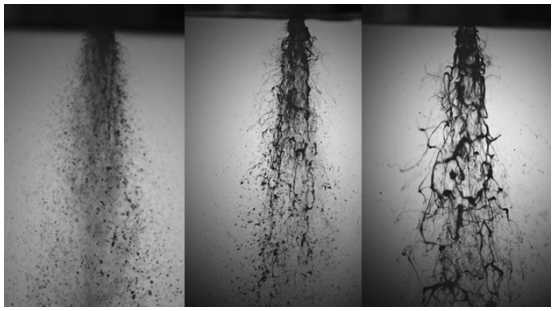

Fig.1: Shadowgraphy images of effervescent atomization of different concentrated PVP solutions near the nozzle: 20 % PVP (left, about 25 mPa·s), 30% PVP (middle, about 100 mPa·s) and 40 % PVP (right, about 500 mPa·s)

As feed aqueous solutions of the polymer polyvinylpyrrolidone (PVP) with different concentrations and therefore different viscosities up to 1200 mPa·s were used. Laser diffraction spectroscope (Malvern Spraytec) for measurement of drop size distribution and shadowgraphy for analyzation of the spray morphology were employed. Abel Inversion was applied to calculate the local, radially dependent drop size distributions from the integral measurements.

The sauter mean diameter of the spray droplets increases with rising viscosity and increases with the radial coordinate with the smallest droplets occurring in the cone center. Results depict that there may be drop coalescence at a distance of 25 cm underneath the nozzle. This will be subject of further investigations.

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[1] Petersen, F. J. et al.: *Effervescent atomization of aqueous polymer solutions and dispersions*, Pharmaceutical development and technology, 6 (2) 201-210, 2001.

[2] Schmidt, F., Mewes, D.: *Zerstäuben von Suspensionen - Tropfengröße und -geschwindigkeit im Spray eines innenmischenden Zweistoffzerstäubers*, Chemie Ingenieur Technik, 79 (12) 2075-2082, 2007.

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