

Supporting Information

Prediction of Particle Suspension State for Various Particle Shapes Used in Slug Flow Crystallization

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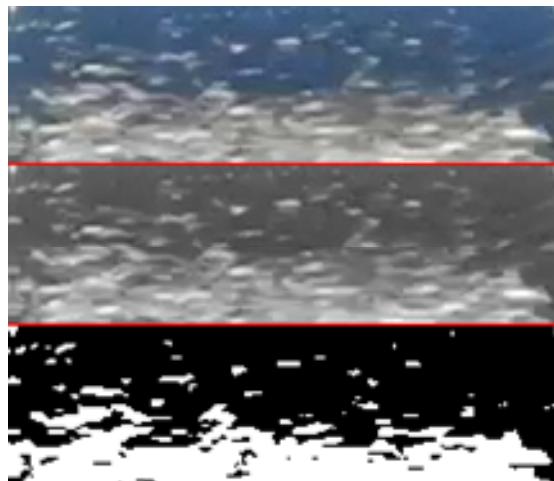


Figure S1. Picture of evaluated frame of the video at the end of the tubing ($L_{\text{tubing}} = 7.5 \text{ m}$) for the experiment with needle-shaped particles at $Q_{\text{tot}} = 20 \text{ mL min}^{-1}$ according to the analysis procedure described by Termühlen et al. [17,21]. The binary image is used to calculate the centroid of particle suspension/accumulation.

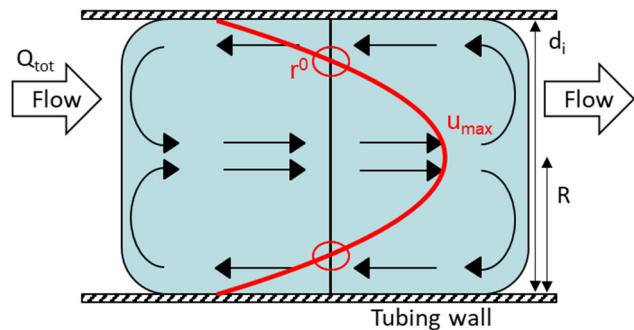


Figure S2. Schematic illustration of the parabolic flow profile (red) and the Taylor vortices (black arrows) present inside the liquid slug. The red circles marks the stagnation zone r^0 , where the vortex flow reverses in direction ($u_L = 0$).

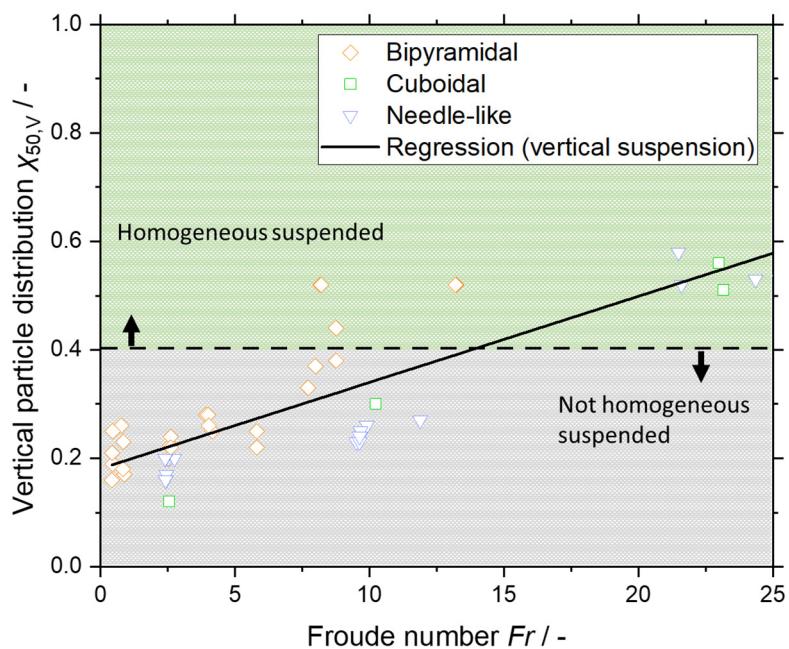


Figure S3. Plot of the vertical particle distribution represented by $\chi_{50,V}$ over the original Froude number Fr . The used data are given in **Tables S1** and **S2**. The regression line for the description of the vertical particle suspension is $\chi_{50,V} = 0.1810 + 0.0159 \cdot Fr$ with a MSE of 0.0053.

Table S1. Data for experiments in SFC conducted by Termühlen [21].

Data Termühlen [21]

Particle shape	Q_{tot} [ml·min ⁻¹]	T _{amb} [°C]	$\varepsilon_{L,0}$ [-]	$d_{50,3}$ [μm]	w [g _{solid} ·g _{solution} ⁻¹]	MIL ^{ch*} [μm]	MAL ^{ch*} [μm]	Φ^* [-]	λ^* [-]	$L_{\text{slug},50}$ [mm]	$\chi_{50,H}$ [-]	$\chi_{50,V}$ [-]
Bipyramidal	20	23.0	0.33	203	1.34	164	250	0.62	1.37	7.58	0.26	0.17
		21.4	0.33	203	5.13	164	250	0.62	1.37	7.14	0.44	0.26
		22.6	0.33	399	1.34	300	441	0.59	1.22	7.19	0.13	0.16
		20.3	0.33	399	5.13	300	441	0.59	1.22	6.96	0.23	0.21
		24.3	0.66	203	1.34	164	250	0.62	1.37	15.16	0.20	0.18
		22.3	0.66	203	5.13	164	250	0.62	1.37	15.12	0.28	0.23
		23.6	0.66	399	1.34	300	441	0.59	1.22	15.29	0.08	0.19
		20.3	0.66	399	5.13	300	441	0.59	1.22	16.30	0.12	0.25
	40	21.6								7.96	0.43	0.22
		22.0								8.06	0.44	0.20
		21.8	0.50	276	3.20	209	277	0.66	1.32	8.37	0.47	0.24
		23.1								10.3	0.43	0.22
60	60	21.7	0.33	203	1.34	164	250	0.62	1.37	4.94	0.52	0.52
		21.9	0.33	203	5.13	164	250	0.62	1.37	5.59	0.51	0.37
		23.0	0.33	399	1.34	300	441	0.59	1.22	4.75	0.41	0.28
		23.5	0.33	399	5.13	300	441	0.59	1.22	5.29	0.46	0.25
		22.3	0.66	203	1.34	164	250	0.62	1.37	10.64	0.50	0.52
		21.0	0.66	203	5.13	164	250	0.62	1.37	14.89	0.51	0.33
		22.5	0.66	399	1.34	300	441	0.59	1.22	10.18	0.36	0.28
		23.5	0.66	399	5.13	300	441	0.59	1.22	11.08	0.46	0.26

* calculated from raw data of Termühlen [21]

Table S2. Data for experiments in SFC owned in this work.

Particle shape	Q_{tot} [ml·min ⁻¹]	T _{amb} [°C]	$\varepsilon_{L,0}$ [-]	d _{50,3} [μm]	w [g _{solid} ·g _{solution} ⁻¹]	MIL _{ch} [μm]	MAL _{ch} [μm]	Φ [-]	λ [-]	L _{slug,50} [mm]	$\chi_{50,H}$ [-]	$\chi_{50,V}$ [-]		
Bipyramidal	20	25.1								9.06	0.36	0.12		
		25.1	0.50	122	1.00	54	103	0.48	1.33	9.09	0.35	0.12		
	40	25.7								10.26	0.54	0.22		
		25.7	0.50	122	1.00	105	163	0.61	1.27	10.53	0.54	0.25		
	50	26.7								9.35	0.56	0.44		
		26.8	0.50	122	1.00	74	121	0.56	1.25	9.18	0.56	0.38		
	60	26.0								8.69	0.51	0.52		
		26.0	0.50	122	1.00	95	155	0.54	1.35	8.69	0.51	0.52		
Cuboidal	20	24.0								11.58	0.55	0.12		
		25.5	0.50	70	1.00	49	105	0.50	1.28	9.83	0.56	0.12		
	40	26.7								9.12	0.53	0.30		
		26.7	0.50	70	1.00	48	97	0.45	1.37	8.89	0.53	0.30		
	60	28.0								8.75	0.54	0.56		
		28.0	0.50	70	1.00	49	95	0.50	1.23	8.29	0.51	0.51		
Data owned in this work	Needle-shaped	20	23.7							10.15	0.56	0.17		
			23.9							10.22	0.56	0.16		
			24.1	0.50	75	1.00	43	149	0.26	1.82	12.51	0.53	0.20	
			24.1				43	149	0.26	2.08	11.65	0.56	0.23	
			24.2				43	134	0.34	2.00	11.38	0.55	0.25	
			24.1				41	168	0.25	2.08	8.88	0.58	0.24	
			24.1				44	173	0.28	2.00	8.92	0.59	0.23	
		40	23.5	0.50	75	1.00	40	145	0.31	0.55	11.13	0.56	0.24	
			27.0				45	139	0.27	1.82	11.62	0.57	0.23	
	60		27.0				45	139	0.27	2.27	11.69	0.56	0.24	
			24.7				42	163	0.31	1.82	6.69	0.55	0.58	
			26.3	0.50	75	1.00	54	138	0.31	2.22	6.12	0.57	0.52	
Needle-shaped	20	22.5								8.00	0.55	0.20		
		21.4	0.50	69	1.00	42	135	0.27	2.56					
		21.4				38	176	0.23	2.22	8.35	0.57	0.20		
	40	21.5				38	176	0.23	2.22	7.85	0.57	0.26		
		20.2	0.50	69	1.00	37	130	0.26	2.17	7.75	0.57	0.27		
	60	20.4				37	130	0.26	2.17	7.54	0.58	0.53		
		20.9	0.50	69	1.00	38	139	0.25	2.22	7.30	0.56	0.53		

Abbreviations

H	Horizontal
MAL _{ch}	Characteristic major axis length
MIL _{ch}	Characteristic minor axis length
MSE	Mean square error
SFC	Slug Flow Crystallizer
V	Vertical

Latin Symbols

$d_{50,3}$	Volume based equivalent median diameter / mm
Fr	Froude number / -
$L_{slug,50}$	Median slug length / mm
L_c	Length of circulation zone / mm
L_{tubing}	Length of tubing / m
Q_{tot}	Total volume flow rate / mL min ⁻¹
w	Mass fraction / g _{solid} g _{solution} ⁻¹

Greek Symbols

$\varepsilon_{L,0}$	Liquid hold up / -
λ	Circularity / -
Φ	Sphericity / -
χ_{50}	Centroid of particle distribution / -
