Supplementary Materials

Experimental Study on Spatiotemporal Evolution Mechanisms of Roll Waves and Their Impact on Particle Separation Behavior in Spiral Concentrators

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Table S1. Summary table of range analysis data for global mean fluctuation amplitude.

Factor	$i = \mathrm{A}$	$i = \mathrm{B}$	$i = \mathrm{C}$	$i = \mathrm{D}$	$i = \mathrm{E}$
K_{i1}	0.813	1.983	2.004	2.054	1.850
K_{i2}	1.662	1.767	2.233	1.863	2.092
K_{i3}	3.483	2.208	1.721	2.042	2.017
$\overline{K_{i1}}$	0.090	0.220	0.223	0.228	0.206
$\overline{K_{i2}}$	0.185	0.196	0.248	0.207	0.232
$\overline{K_{i3}}$	0.387	0.245	0.191	0.227	0.224
R_i	0.297	0.049	0.057	0.021	0.027

Table S2. Summary table of range analysis data for per-turn mean fluctuation amplitude.

Turns	Factor	$i = \mathrm{A}$	$i = \mathrm{B}$	$i = \mathrm{C}$	$i = \mathrm{D}$	$i = \mathrm{E}$
The second turn	K_{i1}	0.775	1.825	1.763	1.888	1.638
	K_{i2}	1.288	1.713	2.038	1.800	1.925
	K_{i3}	3.337	1.863	1.600	1.712	1.837
	$\overline{K_{i1}}$	0.086	0.203	0.196	0.210	0.182
	$\overline{K_{i2}}$	0.143	0.190	0.226	0.200	0.214
	$\overline{K_{i3}}$	0.371	0.207	0.178	0.190	0.204
	R_i	0.285	0.017	0.049	0.019	0.032
The third turn	K_{i1}	0.962	2.175	2.175	2.362	2.150
	K_{i2}	1.962	1.938	2.525	2.088	2.350
	K_{i3}	3.837	2.650	2.063	2.313	2.263
	$\overline{K_{i1}}$	0.107	0.242	0.242	0.262	0.239
	$\overline{K_{i2}}$	0.218	0.215	0.281	0.232	0.261
	$\overline{K_{i3}}$	0.426	0.294	0.229	0.257	0.251
	R_i	0.319	0.079	0.051	0.031	0.022
The fourth turn	K_{i1}	0.700	1.950	2.075	1.913	1.762
	K_{i2}	1.738	1.650	2.137	1.700	2.000
	K_{i3}	3.275	2.113	1.500	2.100	1.950
	$\overline{K_{i1}}$	0.078	0.217	0.231	0.213	0.196

Turns	Factor	i = A	i = B	i = C	i = D	i = E
	$\overline{K_{i2}}$	0.193	0.183	0.237	0.189	0.222
	$\overline{K_{i3}}$	0.364	0.235	0.167	0.233	0.217
	R_i	0.286	0.051	0.071	0.044	0.026

Table S3. Summary table of range analysis data for per-radial-position mean fluctuation amplitude.

Location	Factor	i = A	i = B	i = C	i = D	i = E
R70mm	K_{i1}	0.683	1.383	1.250	1.233	1.567
	K_{i2}	1.100	1.267	1.800	1.350	1.300
	K_{i3}	2.500	1.633	1.233	1.700	1.417
	$\overline{K_{i1}}$	0.076	0.154	0.139	0.137	0.174
	$\overline{K_{i2}}$	0.122	0.141	0.200	0.150	0.144
	$\overline{K_{i3}}$	0.278	0.181	0.137	0.189	0.157
	R_i	0.202	0.041	0.063	0.052	0.030
R100mm	K_{i1}	0.817	1.917	2.100	2.200	1.683
	K_{i2}	1.800	1.600	1.950	1.700	2.133
	K_{i3}	3.200	2.300	1.767	1.917	2.000
	$\overline{K_{i1}}$	0.091	0.213	0.233	0.244	0.187
	$\overline{K_{i2}}$	0.200	0.178	0.217	0.189	0.237
	$\overline{K_{i3}}$	0.356	0.256	0.196	0.213	0.222
	R_i	0.265	0.078	0.037	0.056	0.050
R120mm	K_{i1}	0.883	2.283	2.450	2.333	2.133
	K_{i2}	2.033	2.133	2.400	2.017	2.583
	K_{i3}	3.833	2.333	1.900	2.400	2.033
	$\overline{K_{i1}}$	0.098	0.254	0.272	0.259	0.237
	$\overline{K_{i2}}$	0.226	0.237	0.267	0.224	0.287
	$\overline{K_{i3}}$	0.426	0.259	0.211	0.267	0.226
	R_i	0.328	0.022	0.061	0.043	0.061
R140mm	K_{i1}	0.867	2.350	2.217	2.450	2.017
	K_{i2}	1.717	2.067	2.783	2.383	2.350
	K_{i3}	4.400	2.567	1.983	2.150	2.617
	$\overline{K_{i1}}$	0.096	0.261	0.246	0.272	0.224
	$\overline{K_{i2}}$	0.191	0.230	0.309	0.265	0.261
	$\overline{K_{i3}}$	0.489	0.285	0.220	0.239	0.291
	R_i	0.393	0.056	0.089	0.033	0.067

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