coatings

Supplementary Material: Study on Spray Evaporation Treatment of Desulfurization Wastewater

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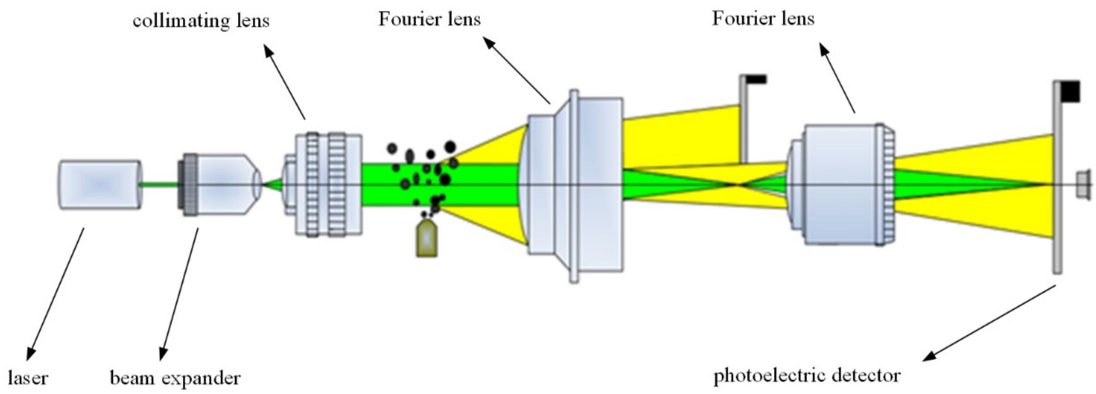

Figure S1. Schematic diagram of the atomized droplet laser measuring analyzer.

The atomized droplet laser measuring analyzer is designed based on the Mie scattering theory. Considering that the laser beam is processed with the excellent monochromatic nature and strong directionality, the scattering phenomenon will occur when the laser beam encounters the atomized droplet particles. The angle between the main laser beam propagation direction and the scattered beam propagation direction represents the particles size and the particle size distribution can be obtained by measuring the scattered beam intensity. As shown in Figure S1, the collimating lens and a set of Fourier lens are equipped as the optical means and the photoelectric detector is installed to convert the optical signal into electrical signal.

The Sauter Mean Diameter (SMD) is the most widely used parameter for indicating the atomized particle diameter. The particle diameter of the atomized droplet is not well-distributed, therefore the SMD is applied to demonstrated the fineness of the droplet particles. Under the assumption that the entire droplet particles are processed with the same diameter, the SMD is obtained by dividing the total volume of the detected droplet particles with the total surface area of the corresponding particles. The equations are described as followed,

$$V = \frac{N}{6}\pi d_{SMD}^3 = \frac{\pi}{6}\sum N_i d_i^3 \tag{1}$$

$$A = N\pi d_{SMD}^2 = \pi \sum N_i d_i^2 \tag{2}$$

$$d_{SMD} = \frac{\sum N_i d_i^3}{\sum N_i\, d_i^2} \tag{3}$$

where V is the total volume of the detected droplet particles and A is the total surface area, N is the quantity of the atomized droplet particles and N_i is the quantity of the droplet particles with the diameter of d_i.

The atomized droplet particles diameter distribution represents the percentage of droplet particles in different size ranges. In the present study, the volume distributions of the droplet particles are automatically analyzed and obey the Rosin-Rammler law. Table S1 shows an example of the calculated volume distribution value and the corresponding accumulations of droplet particles with different size ranges. Figure S2 is the droplet particle volume distribution and the accumulation distribution curve.

Table S1. The droplet particle volume distribution value under different size ranges.

d (μm)	V %	$\sum V$ %	d (μm)	V %	$\sum V$ %	d (μm)	V %	$\sum V$ %
1.090	0.007	0.007	8.653	0.285	1.937	68.675	5.644	57.918
1.188	0.008	0.015	9.433	0.333	2.270	74.866	5.763	63.681
1.296	0.009	0.024	10.283	0.388	2.658	81.615	5.749	69.430
1.412	0.011	0.035	11.210	0.452	3.110	88.973	5.582	75.012
1.540	0.013	0.048	12.220	0.526	3.636	96.993	5.251	80.263
1.678	0.015	0.063	13.322	0.612	4.248	105.737	4.761	85.024
1.830	0.017	0.080	14.523	0.711	4.959	115.269	4.133	89.157
1.995	0.020	0.100	15.832	0.825	5.784	125.661	3.412	92.569
2.175	0.024	0.124	17.259	0.956	6.740	136.989	2.655	95.224
2.371	0.027	0.151	18.815	1.106	7.846	149.338	1.929	97.153
2.584	0.032	0.183	20.512	1.278	9.124	162.801	1.293	98.446
2.817	0.038	0.221	22.361	1.473	10.597	177.477	0.789	99.235
3.071	0.044	0.265	24.376	1.692	12.289	193.476	0.431	99.666
3.348	0.051	0.316	26.574	1.940	14.229	210.918	0.207	99.873
3.650	0.060	0.376	28.970	2.216	16.445	229.932	0.086	99.959
3.979	0.070	0.446	31.581	2.519	18.964	250.660	0.030	99.989
4.338	0.082	0.528	34.428	2.852	21.816	273.256	0.009	99.998
4.729	0.096	0.624	37.532	3.210	25.026	297.890	0.002	100.000
5.155	0.112	0.736	40.915	3.588	28.614	324.744	0.000	100.000
5.620	0.131	0.867	44.604	3.982	32.596	354.020	0.000	100.000
6.126	0.153	1.020	48.625	4.378	36.974	385.934	0.000	100.000
6.679	0.179	1.199	53.008	4.762	41.736	420.725	0.000	100.000
7.281	0.209	1.408	57.787	5.118	46.854	458.653	0.000	100.000
7.937	0.244	1.652	62.996	5.420	52.274	500.000	0.000	100.000

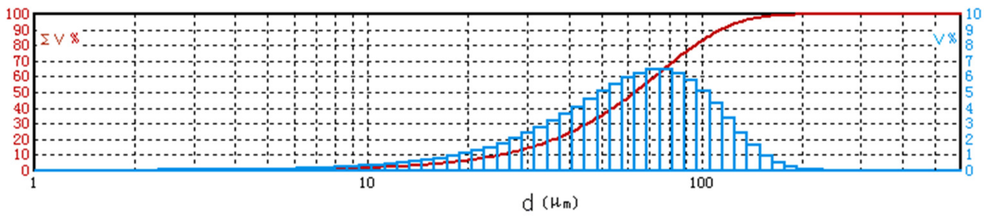

Figure S2. The droplet particle volume distribution and the accumulation distribution curve.