SOME COMMENTS ON THE USE OF THE FORWARD ANGLE DISSYMMETRY METHOD IN RAYLEIGH'S REGION*

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The forward angle dissymmetry method is suited for the particle size determination in monodisperse systems of unknown concentration also in the case when the relative refractive index approaches unity, *i.e.* in Rayleigh's region. The dissymmetry values have been tabulated.

The forward angle dissymmetry method (FAD) is a modified method suggested by Maron and Pierce[1]; it is suited for the fast determination of the particle size and number in monodisperse systems, particularly if their concentration is not known[2]. We should like to demonstrate that the FAD method may also be applied successfully in Rayleigh's region ($m \to 1$, where m is the relative refractive index of the particles) and that the method preserves its advantages which have been discussed in detail in both papers mentioned above[1,2].

Table I gives the forward angle dissymmetry values ζ defined as the ratio of the intensities of light scattered at two angles smaller than 90°. In our case $\zeta = i_{30}/i_{45}$, i_{45}/i_{60} and i_{60}/i_{75}. To evaluate the applicability of the FAD method we compared these data with those of classical dissymmetry, $z = i_{30}/i_{150}$, i_{45}/i_{135} and i_{60}/i_{120}. (The symbol L designates the particle size; λ is the wavelength in a medium with the refractive index n_0, since it holds $\lambda = \lambda_0/n_0$ where λ_0 is the wavelength *in vacuo*. The quantities L and λ are expressed in the same units). The values were computed with a Wang model 614 programmable calculator.

The relationships $\zeta = f(L/\lambda)$ and $z = f(L/\lambda)$ are oscillating functions which attain the first maxima approximately between the following L/λ values:

Dissymmetry ξ	i_{30}/i_{45}	i_{45}/i_{60}	i_{60}/i_{75}
1. maximum	1·87—1·88	1·43—1·44	1·17—1·18
2. maximum	3·21—3·22	2·46—2·47	2·01—2·02

Dissymmetry z	i_{30}/i_{150}	i_{45}/i_{135}	i_{60}/i_{120}
1. maximum	0·73—0·74	0·77—0·78	0·82—0·83
2. maximum	1·27—1·28	1·33—1·34	1·41—1·42

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TABLE I

Forward Angle Dissymmetry Values, ζ, for Pairs of Angles 30/45, 45/60, and 60/75

L/λ	(30/45)	(45/60)	(60/75)	L/λ	(30/45)	(45/60)	(60/75)
0·05	1·002	1·002	1·002	0·95	1·899	2·616	4·211
0·10	1·006	1·008	1·010	1·00	2·058	3·032	5·898
0·15	1·014	1·019	1·022	1·05	2·247	3·598	9·583
0·20	1·026	1·034	1·039	1·10	2·474	4·405	21·46
0·25	1·040	1·053	1·063	1·15	2·747	5·621	151·0
0·30	1·059	1·078	1·093	1·20	3·082	7·607	(105·8)
0·35	1·081	1·109	1·130	1·25	3·497	11·26	(7·931)
0·40	1·108	1·145	1·176	1·30	4·022	19·28	(1·637)
0·45	1·139	1·190	1·231	1·35	4·699	45·38	(0·351)
0·50	1·176	1·242	1·300	1·40	5·593	279·5	(0·003)
0·55	1·218	1·305	1·384	1·45	6·811	(569·5)	(0·001)
0·60	1·267	1·379	1·487	1·50	8·535	(38·31)	(0·111)
0·65	1·323	1·468	1·617	1·55	11·10	(10·60)	(0·286)
0·70	1·387	1·575	1·781	1·60	15·15	(4·124)	(0·531)
0·75	1·462	1·703	1·995	1·65	22·19	(1·806)	(0·869)
0·80	1·548	1·861	2·282	1·70	36·15	(0·797)	(1·352)
0·85	1·648	2·056	2·682	1·75	70·68	(0·316)	(2·088)
0·90	1·763	2·301	3·272	1·80	203·8	(0·090)	(3·325)

We can see that also in Rayleigh's region the range of applicability of the FAD method is approximately twice that of the classical dissymmetry method. It is then possible, by using Table I, to obtain the required L values for the given wavelength λ from experimental data. By using light having a longer wavelength one can also somewhat extend the applicability of the method: the ratio of L values obtained at two wavelengths gives a rough information about the particle distribution width in the system under investigation.

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