The Rayleigh-Gans Formalism

The tenets of the validity of the Rayleigh-Gans approximation are:

1. \( |m| - 1 < 1 \)
   - where \( m \) is the index of refraction of the platelets relative to the medium.
   - Hence, the platelet index of refraction is assumed very close to that of water (1.33).

2. \( 2\pi n - 1 < 1 \)
   - where \( n \) is the characteristic dimension of the platelet.

The angular dependence of the scattered radiation is obtained by evaluating a form factor defined as

\[
F(\theta, \phi) = \sum_i e^{-i(\sigma_i + \sigma_s) n (\cos \theta - \cos \phi)}
\]

where \( \sigma = 2\pi R \) is the coordinate of element \( dV \) of the particle and \( e_i \) and \( e_s \) are unit vectors in the initial and scattered directions. Phase functions of disks, spheroids, and spheres are shown in Fig. 2.

**Optical Parameters**

The attenuation coefficient of the platelet concentrate is given by

\[
\beta = \beta' + \beta''
\]

where the attenuation due to the fluid may be further defined in terms of the fluid absorption and scattering coefficients \( \beta_p \) and \( \beta_s \), respectively. The attenuation due to the platelets is given by

\[
\beta'' = N(\sigma_s + \sigma_a)
\]

where \( N \) is the platelet number density and \( \sigma_a \) and \( \sigma_s \) are the absorption and scattering cross sections of the platelets, respectively. The scattering phase function defined by

\[
\int \int \int \int f(\theta, \phi) \sin \theta d\theta d\phi d\sigma = \sigma_s (\sigma_a + \sigma_s)
\]

where the scattering angle \( \theta \) may be defined in terms of the spherical angles \( \theta \) and \( \phi \) and \( \psi \) is the single scattering albedo. The quantities \( \sigma_a, \sigma_s, \) and \( f \) are functions of particle size, shape, composition, and orientation. The Monte Carlo method uses random number generators to compute the path of the individual photons through the platelet solution. The individual photons are launched in the \( z \) direction. This path trajectory of each photon is then followed until one of the following conditions is met:

1. The photon is incident on some element of the detector.
2. The photon is detected outside the platelet volume so it is unlikely to reach the detector.
3. The photon intensity is decreased to an insignificant low value (method of partial photons) or absorbed.

**REFERENCES**


