Multicomponent sedimentation

I am solving an N-species continuity equation for a suspension of whole blood, given by equation 1:

Where represents a vector of particle volume fractions subject to the volume balance . In these equations, is the flux of each particle type, where is the absolute velocity of the particle type. This velocity is not known *a priori*, but results from a volume balance on particle velocities relative to the surrounding fluid:

The velocity comes by multiplying the infinite dilution particle velocity predicted by Stokes’ law with a correction for local particle concentration, referred to as a hindered settling correction and denoted as . This correction allows for particles to move at speed in a dilute suspension but reduces their speed to zero as approaches unity. For my current example, I’m applying the Richardson-Zaki correction:

Bibliography and notes

1. Richardson, J.F. and W.N. Zaki, *The sedimentation of a suspension of uniform spheres under conditions of viscous flow.* Chemical Engineering Science, 1954. **3**(2): p. 65-73.

2. Masliyah, J.H., *Hindered Settling in a Multi-Species Particles System.* Chem. Eng. Sci., 1979. **34**: p. 1166-1168.

3. Ungarish, M., *Hydrodynamics of suspensions : fundamentals of centrifugal and gravity separation*. 1993, Berlin ; New York: Springer-Verlag. xiv, 317 p.

4. Michaels, A.S.B., Justin, *Settling Rates and Sediment Volumes of Flocculated Kaolin Suspensions.* I&EC Fundamentals, 1962.

5. Lerche, D. and D. Frömer, *RBC aggregation and deformation.* Biorheology, 2001. **38**(2-3): p. 249-262.

There are endless correlations for hindered settling for monodisperse and polydisperse suspensions, and some of the most common include those from Richardson and Zaki [1], Masliyah, Lockett, and Basson [2], and from Michaels and Bolger [3-5].