

What kind of rheometer can be used to measure the yield point in flocculated emulsions or dispersions?

I have had the best results with controlled stress rheometers. In these instruments the stress (force per unit area) is slowly increased, usually in small steps from zero. If the emulsion or suspension is flocculated, the floc structure can withstand small stresses and not flow, although sometimes it will stretch a little and then stop. At higher stresses, the flocculated structure breaks apart and the emulsion or suspension flows. A plot of the shear rate (how fast the sample is moving) versus the applied shear stress shows almost no or little motion until a stress corresponding to the yield point is exceeded, called the Bingham yield point, after which the sample flows faster and faster. The sample can be put between a cone and a plate or between two parallel plates, but I prefer to use a bob and a cup because most of the samples I have tested have some volatility. The bob and cup is a little less sensitive to settling of the sample.

Another technique is to run the rheometer at a high applied stress where the emulsion or dispersion is flowing freely. This breaks the floc structure apart. Then reduce the stress gradually, step by step. When the sample flocculates at low shear rates, a structure will form which cannot be moved by the applied stress and the rheometer stops moving. This seems to be a little more reproducible.

The textbook by Morrison and Ross has a number of examples of emulsions and dispersions with yield points.

Several companies make the appropriate equipment. I recommend contacting ATS Rheosystems (www.atsrheosystems.com), Bohlin Instruments (www.bohlin.co.uk), Paar Physica (www.paarphysica.com), and TA Instruments (www.tainst.com). Each of these companies is willing to run samples for you. If you can arrange it, visit them to see how the measurement is made. They all have experts on staff to help you.