

2. The viscosity of the external phase
3. The phase volume ratio
4. What emulsifiers are used and in what amount
5. The electroviscous effect
6. Distribution of particle sizes

#### 4.6. Appearance of Emulsion Systems

The appearance of the emulsion will be a function of globule size, and Table 2 gives a gross correlation of these two factors. When an emulsion breaks, the hyponatant, rather than being a solution, will have one of the two first appearances in the table, i.e., will also be an emulsion, but with very fine droplets.

#### 4.7. Breaking and Coalescence

It can be concluded from what has been mentioned that the reasons for breaking would include

1. Chemical incompatibility between the emulsifier and another ingredient in the emulsion system (Borax and gum acacia is a case in point)
2. Improper choice of surfactant pair (e.g., wrong HLB)
3. High electrolyte concentration
4. Instability of an emulsifier
5. Too low a viscosity
6. Temperature

As shown in the foregoing, breaking and creaming of emulsions are the typical defective criteria to be looked for in stability programs. Breaking implies that the emulsion separates into two distinct phases (Fig. 7). If this is a slow process, it often manifests itself in the appearance of small amounts of oil particles on the surface, and it then is referred to as *oiling*. When separation into two emulsions occurs (as described above), then the phenomenon is called *creaming*. A rapid test for this is to dip a finger into the preparation and notice if there are different "colors" present (Brown, 1953). Also, a creamed o/w emulsion will not drain off the skin with ease, and the converse holds for a creamed w/o emulsion.

A few words regarding the effect of ionic substances and the actual process of flocculation and coalescence are in order. Van den Tempel (1953) demonstrated that flocculation and coalescence are two different processes. Flocculation depends on electrostatic repulsion (and is akin to the zeta-potential considerations discussed previously). Coalescence depends on the properties of the interfacial film.

**Table 2** Correlation Between Globule Size and Appearance of Emulsions

Globule size ( $\mu\text{m}$ )	Appearance
>0.005	Translucent (transparent)
0.005–0.1	Semitransparent, gray
0.1–1	Bluish-white emulsion
>1	Milky-white emulsion