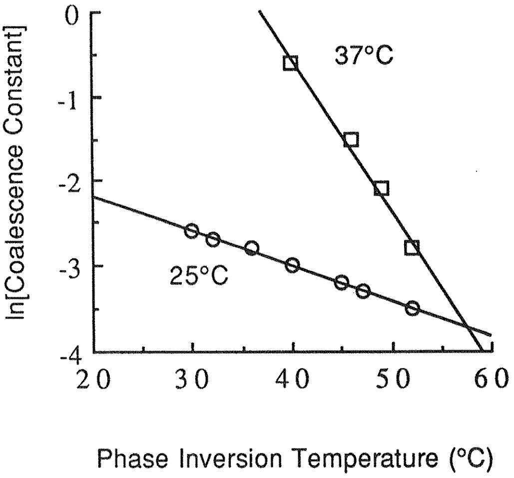

**Fig. 11** Coalescence rate versus inversion temperature. (Graph constructed from data published by Enever, 1976.)

ation and will be noticed in the appearance testing of the emulsion. Such phenomena lead to graininess of feel. In some cases part of an emulsion will invert, another not, and then there is a distinct difference in appearances in various regions of the emulsion (creaming).

But the possibility for inversion should always be considered. It is the more likely the closer the system is to a close-packed system of spheres. In this connection, another of the formulator's tasks should be to determine the inversion temperature. (This is at times used to advantage in the manufacturing step, in that, in producing the emulsion, the inverse emulsion is produced at high temperature; this is then cooled, and at the inversion temperature, the "correct" type will result. Conversion in this manner gives rise to very small globules, and homogenization is then often not necessary.) If an inversion temperature exists, then accelerated testing above this temperature is meaningless. So preliminary testing is always advocated, if accelerated testing is contemplated, the philosophy being that there is no sense in testing a system above a temperature where it converts to a physical state that differs from that at room temperature (or recommended storage temperature). Enever (1976) has shown that there is a correlation between phase inversion temperature and the rate of coalescence (Fig. 11). It is possible to use a combination of sedimentation field flow fractionation and photon correlation spectroscopy to record droplet sizes in fat emulsions, and this would appear to be an excellent technique for studying the coalescence of finer spheres, and hence to obtain an extrapolatory tool early on in the storage of an emulsion system.

### 4.5. Rheological Properties

It has been mentioned that there is a gross correlation between viscosity and globule size. However, the rheological characteristics of an emulsion system in general depends on other factors as well (Sherman, 1955):

1. The viscosity of the internal phase