Predicting Performance of Pharmaceutical Lotions Through Rheological Characterization

Keywords: cosmetics, pharmaceutical, oscillatory testing, flow testing, creep, creep-recovery, sensory panel RH020

PROBLEM

A pharmaceutical company wanted to compare the "spreadability" of two lotions to determine the effects of formulation differences. A complication affecting characterization was the limited quantity of material available for testing.

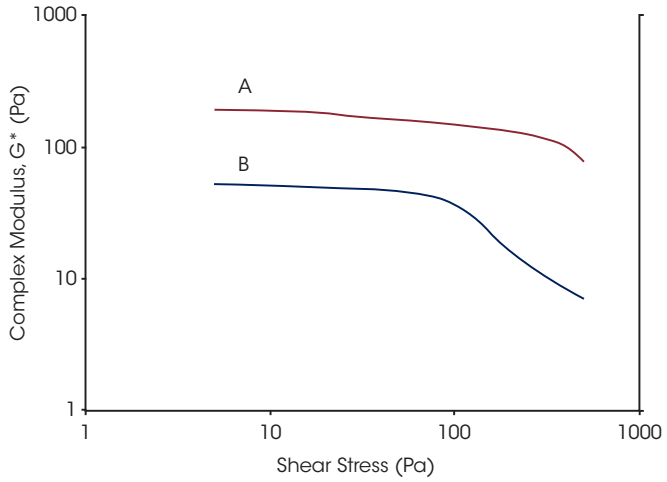

Figure 1: Complex Modulus vs. Stress

SOLUTION

Characterization of the rheological properties of creams and lotions using a Controlled Stress Rheometer requires as little as 0.2 ml of material. Furthermore, the material can be evaluated under conditions which simulate the ultimate end-use. Figures 1-3 show the differences between two lotions under oscillatory, creep, and dynamic conditions. The results in Figure 1 were obtained when the lotions were exposed to a small cyclic (oscillatory) stress. Oscillatory experiments are particularly useful as a non-destructive method for investigating the structure of delicate materials over short and medium periods of time. These results indicated that lotion A had a stronger more elastic structure than lotion B.

Figure 2 shows the creep behavior of the two lotions. In creep, a constant stress (force) is applied to the material and displacement (flow) is measured over a longer period of time, before the stress is removed and the material's recovery is measured. In this case, lotion B was more compliant (less rigid) and tended to flow under smaller applied forces.

Finally, flow tests (Figure 3) indicated that lotion A had a higher apparent yield stress and a higher viscosity under comparable conditions than lotion B. Of particular interest was the region of those curves at higher shear stresses which began to approach conditions which the lotion would see during rubbing on a surface.

Together, the rheology tests indicated that lotion B would perform better than lotion A in applications requiring rubbing or spreading. All three rheological tests were performed using less than a total of 1 ml of material and were obtained in about 60 minutes of total laboratory time.

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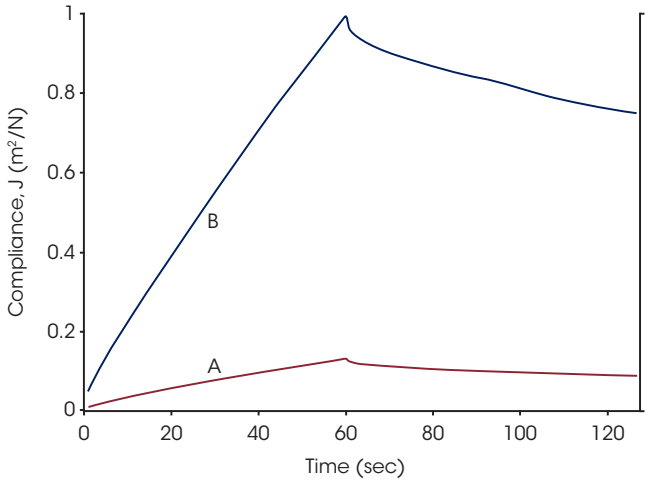

Figure 2: Compliance vs. Time

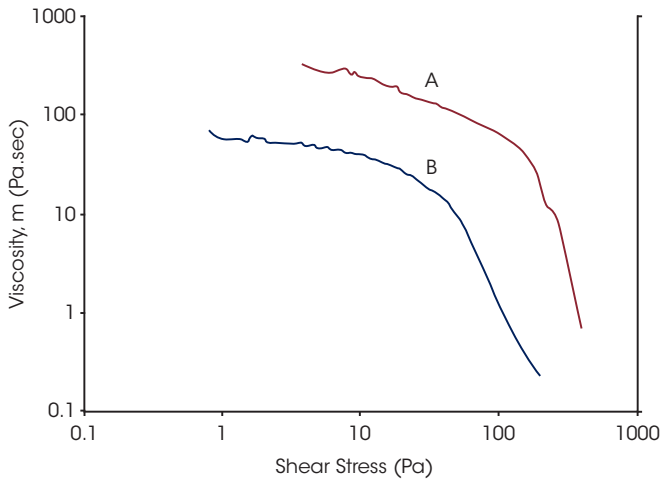

Figure 3: Viscosity vs. Shear Stress