**Table 9.4** Component Ranges of the Formulation that Provide a Smooth and Continuous Phase Suitable for Optimization

| Range (%) | Component |
|---|---|
| 5 – 15 | Active |
| 0.1 | Preservative |
| 3.5– 10 | Emulsifier |
| 6.0– 16.25 | Coemulsifier |
| 3.6– 11.9 | Glycerin |
| 38.7– 78.2 | Water |
| 5 – 20 | Oil |

agram as seen in Figure 14 and in Ref. 18. Thus, for most commercial applications, the researcher defines the phase according to the stability requirements for the product.

Before the experimental design, modeling, and optimization steps can be established, the researcher must guarantee that a phase boundary is not crossed as the composition of each component is varied. Pseudoternary diagrams have now been constructed to bracket the constrained ranges of each of the component variables. If each of the 41 samples on each of the 18 diagrams was within the desired phase boundary, then the compositional ranges to be optimized would be identical with the values of the constraints we placed on each component. However, if the phase behavior was as shown in Figure 25, then the compositional ranges would be more limited. Note that for 5%, 10%, and 15% active compound, the 30%: 70% emulsifier/coemulsifier provide a stable emulsion only at higher than 20% to 25% by weight of the emulsifier–coemulsifier mixture. Thus, the emulsifier/coemulsifier ratio must be greater than 30:70. For the other two emulsifier/coemulsifier ratios, the amount of oil can range from 5 to 20 wt%, whereas the amount of emulsifier–coemulsifier can range from 10% to 25%. Within the above constraints, the water–glycerin mixture can range from 45% to 85% (remember, the formulation contains a minimum of 5% oil and 10% emulsifier–coemulsifier). The component ranges based upon the phase behavior results shown in Figure 25 are given in Table 4.