CHAPTER V
CONCLUSIONS

Over the years, several kinds of the phase structures produced by various surfactants and phospholipids have been of interest to the pharmaceutical scientists as drug delivery systems. One of these structures is the liquid crystalline phase. Liquid crystalline phase structures are recognized as important in pharmaceutical formulations in terms of enhancement of emulsion stability, control of drug delivery, solubilization of low solubility drugs etc.

This study showed that most surfactants and lecithin formed lyotropic liquid crystalline phases in the presence of water. Liquid crystals from various surfactants and lecithin could be prepared by different methods. Liquid crystals from surfactants were prepared by melting method. Liquid crystals from lecithin were prepared by increasing the surface area of lecithin to allow better hydration of the phospholipid before water was added to form liquid crystals. The other components such as oils or a long chain alcohol (decanol in this study) also influenced the formation and structures of liquid crystals. All of the liquid crystalline systems were not always stable, depending on the composition of the system. Some systems such as triethanolamine, oleic acid, and water could form liquid crystalline structures of more than one phases. This system could form either a lamellar or a hexagonal structure. Differential Scanning Calorimetry is useful in examination and study of liquid crystal structure alteration while polarized light microscopy is a simple and rapid technique to detect formation and patterns of the liquid crystalline structure.

Addition of additives such as trehalose, urea, sodium chloride and α-tocopherol was shown to affect the formation and structures of liquid crystals when the concentration of these additives reached a certain level. These effects included alteration in gross physical appearance, abolishing of the liquid crystalline structure, and alteration in microscopic texture of the liquid crystals.

The liquid crystalline system formed from various surfactants and lecithin increased solubility of propylthiouracil (PTU). The drug molecules might be trapped between the surfactants and lecithin molecules. However, these liquid crystalline systems did not dramatically increase solubility of PTU. The inclusion of a small percentatage of PTU molecules into these structures did not significantly affect the liquid crystalline structure. The stability of the liquid crystalline system was not affected by PTU to a great extent. On the contrary, triamcinolone acetonide could not be added into the liquid crystalline structures in a significant amount probably because of its large and rigid molecular structure. Hence, the ability to increase drug solubility by liquid crystals depended also on the molecular structure of the drug.

The rates of water evaporation from liquid crystalline systems were also studied. The water evaporation rates from all liquid crystalline systems were slower than that from bulk water. The structure of liquid crystals could also influence the water evaporation from the systems.

In terms of release of PTU from liquid crystalline systems, all of these systems could sustained the release of PTU. The release kinetics followed a square root of time dependence in the systems of Brij®72, triehanolamine oleate and the nonionic cream base indicating that the release of PTU from these systems were diffusion-controlled. Rates of release of PTU from SDS system followed first-order kinetics. None of the

systems displayed zero-order kinetics. The other systems could not be fitted to any of the three release kinetics.

From these results, the liquid crystalline structure from surfactants and lecithin increased solubility of PTU, a low aqueous solubility drug, sustained its release, and decreased the water evaporation. However, the ability of these systems to solubilize drugs with low aqueous solubility was low and limited. Furthermore, these liquid crystalline systems required high concentrations of surfactants, which may cause irritation to the skin and other biological membranes. Stability and physical appearance might be a problem in some systems. Some components in these systems, particularly decanol, posses an unfavorable scent, and this makes their use in pharmaceutical and cosmetic preparations impractical. In a conventional o/w preparation, the nonionic cream base, liquid crystalline structures were also formed with low concentration of surfactant though the solubilizing activity of the system was low. If the crystals of the drug in such a system do not greatly irritate the skin upon application, the nonionic cream base would be a fair system in terms of its sustained release property. In order to make use of liquid crystalline systems for drug and cosmetic delivery, further studies are needed to reduce the concentration of surfactants to an acceptable range by modifying the composition of these systems. One method would be inclusion of other non-irritating liquid crystal forming components into the system.