COMPONENTS OF EMULSIONS USED FOR PARENTERAL APPLICATIONS

A typical parenteral o/w emulsion is composed of lipid droplets (10–20%), emulsifier, and osmotic agent; it is administered by either intravenous (IV) bolus or IV infusion. In addition, when an emulsion formulation is packaged in a multidose container, antimicrobial agents should be included in the formulation to prevent the growth of microorganisms.

Lipids

The classical operational definition of lipids are those components of biological material that are water insoluble but soluble in organic solvents such as methylene chloride. An alternative definition sometimes preferred by pharmaceutical scientists is that lipids are fatty acids and their derivatives, and substances related biosynthetically or functionally to these compounds (Christie and Han, 2010). Lipids can thus encompass not only naturally occurring lipophilic materials but also those easily derived from lipids that occur naturally. Table 10.1 summarizes the lipids most commonly used in parenteral emulsions. Long- and medium-chain triglycerides (LCT and MCT, respectively), either alone or in combination, are used in commercial parenteral emulsions owing to their long history of safety. LCT are derived from vegetable sources such as soybean oil, safflower oil, sesame oil, and cottonseed oil, whereas MCT are obtained by re-esterification of fractionated coconut oil (mainly caprylic and capric fatty acid). Other lipids have also been investigated for use in parenteral emulsions. Ethyl oleate can be used as the oil phase in emulsions for intramuscular or subcutaneous administration. Oleic acid has been used experimentally for parenteral emulsions; it is used in a number of commercial oral products. d-α-Tocopherol (vitamin E) has been recently investigated as a novel lipid for parenteral emulsions (Constantinides et al., 2004). A study has shown that d-α-tocopherol was well tolerated in patients receiving a daily IV administration of d-α-tocopherol at doses up to 2300 mg/m^2 for 9 consecutive days (Helson, 1984), but the safety of higher doses or chronic use of d-α-tocopherol needs to be further evaluated. Recently, marine oils containing large quantities of long-chain omega-3 polyunsaturated fatty acids have drawn lots of attention because of their health benefits. Parenteral emulsions prepared from marine oils have also been reported (Ton et al., 2005; Cui et al., 2006).

TABLE 10.1
Lipids Approved for Clinical Use in Parenteral Lipid-Based Formulations

Class	Trade or Common Name	Chemical name
Long-chain triglycerides	Triolein	(Z)-9-Octadecenoic acid 1,2,3-propanetriyl ester
	Soybean oil	
	Safflower oil	
	Sesame oil	
	Cottonseed oil	
	Castor oil	
Medium-chain triglycerides	Fractionated coconut oil	Medium-chain triglycerides
	Miglyol®, 810, 812	
	Neobee® M5	
	Captex® 300	
Fatty acids and derivatives	Oleic acid	(Z)-9-Octadecenoic acid
	Ethyl oleate	(Z)-9-Octadecenoic acid, ethyl ester
Novel lipids	Vitamin E	D-α-tocopherol