

**MASTER IN CHEMICAL TECHNOLOGY**

**SUPERFACE AND INTERFACE CHEMISTRY**

**Exercises – Emulsions**

1. The HLB is a semi empirical parameter used to characterize surfactants.
  - 1.1. What are and how can we classify the surfactants.
  - 1.2. Explain what evaluates the HLB values, and how can they be determined.
  - 1.3. What's the use of this parameter in the formulation of an emulsion?
  - 1.4. Looking at the data in the table, why do we use surfactants with HLBs between 8 and 14 in formulation of ophthalmic eye drops (containing antibiotics in the form of hydro chlorides), while in detergency we use surfactants with HLB higher than 12.

HLB	Application
1-4	--
3-6	Emulsifier W/O
6-7	Wetting agent
8-12	Emulsifier O/W
12-15	Detergent
15-18	Solubilizing agent

2. A mixture containing 70% of Tween 60 and 30% of Span 65 gives origin to a stable emulsion. What is the composition of a mixture of sodium lauryl sulphate and cetyl alcohol that also have a good behavior for the same system?

Tensioactive	HLB
Tween60 (polyoxyethylene sorbitan monoestearate)	14.9
Span65 (sorbitan triestearate)	2.1
Cetyl alcohol (C <sub>16</sub> H <sub>33</sub> OH)	
Sodium lauryl sulphate (C <sub>12</sub> H <sub>25</sub> OSO <sub>3</sub> Na)	

3. The emulsifiers are substances able to stabilize emulsions due to certain structural characteristics of the molecules. In table 1 there are several emulsifiers commonly used.

3.1. What are the structural requisites for a molecule to be used as emulsifier?

3.2. Draw a droplet dispersed in an emulsion W/O and O/W. Draw and indicate the orientation of molecules at the interface.

3.3. Using the data of table say what are the surfactants more adequate for the emulsions of last item.

**Tabela 1.** *Valores de HLB para alguns emulsificantes.*

Substance	HLB
Oleic acid	1.0
Sorbitan tristearate (Span 65)	2.1
Sorbitan monostearate (Span 60)	4.7
Sorbitan monopalmitate (Span 40)	6.7
Sorbitan monolaurate (Span 20)	8.6
Polyoxyethylene sorbitan tristearate (Tween 65)	10.5
Polyoxyethylene sorbitan monostearate (Tween 60)	14.9
Polyoxyethylene sorbitan monopalmitate (Tween 40)	15.6
Polyoxyethylene sorbitan monolaurate (Tween 20)	16.7
Sodium oleate	18.0
Cetrimide	
Sodium lauryl sulphate	40.0