HLB SCALE AND ITS APPLICATION'S

HLB SCALE –

The HLB of surfactant is a measure of the degree to which it is HYDROPHILIC or LIPHOPHILIC determine by calculating values for the different of the molecules as described by GRIFFIN in 1949 and 1954.

Other method have been suggested by notyabaly in 1957 by DEVIES.

Hydrophilic–lipophilic balance (HLB) is the balance of the size and strength of the hydrophilic and lipophilic moieties of a surfactant molecule.

DEFINATION- Surfactant molecules have both hydrophilic (water loving) and lipophilic (oil loving) groups. The HLB system, which stands for "Hydrophilic Lipophilic Balance", indicates how the proportion of those groups will affect surfactant behavior in emulsions.

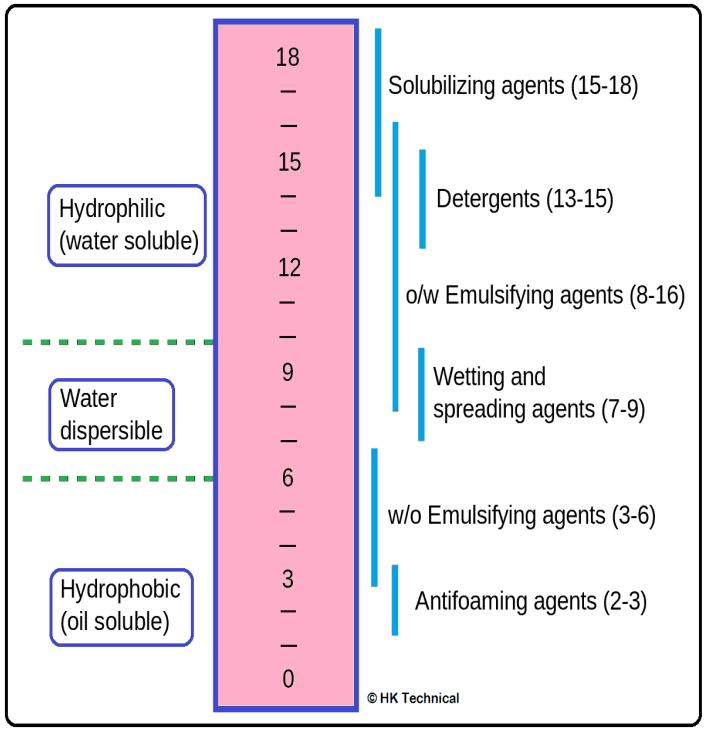
HLB Scale is essentially a **ranking of how hydrophilic an amphiphilic molecule (surfactant) is**. Developed by Griffin (1949), the HLB Scale ranks the tendency of a surfactant to be hydrophilic or hydrophobic (lipophilic). Since a surfactant molecule has both hydrophilic and hydrophobic portions (that's why its a surfactant!)

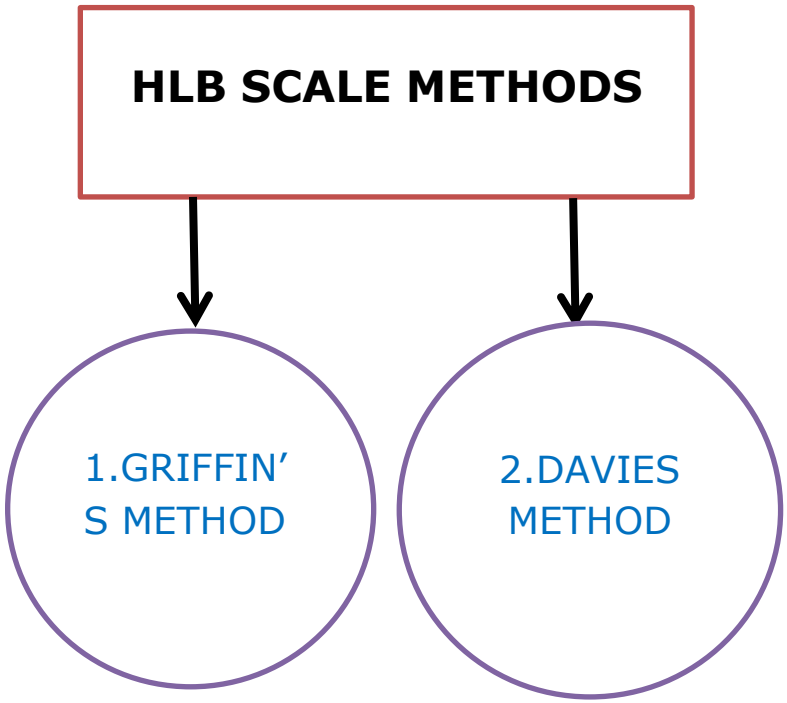
The HLB scale ranges from 0 to 20. In the range of 3.5 to 6.0Surfactants with HLB values in the 8

to 18 range are most commonly used in O/W emulsions

The hydrophilic-lipophilic balance (HLB), often used to describe surfactants, is calculated from the weight percentage of the hydrophilic groups to the hydrophobic groups in a molecule The HLB value of a surfactant should match the HLB value of the oil phase based on the notion of "like dissolves like". It is not a simple linear relationship in which functionality increases with higher hydrophobicity (Nakai, 1983).

HLB SCALE –





Hydrophilic (water soluble) - having a strong affinity for water

Water dispersible - water dispersible coating the binder is dispersed and emulsified as fine

Hydrophobic (oil soluble) – tending to repel or fail to mix with water

1.GRIFFIN'S METHOD –

Griffin's method for non-ionic surfactants as described in 1954 works as follows:

where is the molecular mass of the hydrophilic portion of the molecule, and M is the molecular mass of the whole molecule, giving a result on a scale of 0 to 20. An HLB value of 0 corresponds to a completely lipophilic/hydrophobic molecule, and a value of 20 corresponds to a completely hydrophilic / lipophobic molecule.

The HLB value can be used to predict the surfactant properties of a molecule:

- < 10 : Lipid-soluble (water-insoluble)
- > 10 : Water-soluble (lipid-insoluble)
- 1 to 3: anti-foaming agent[1]
- 3 to 6: W/O (water in oil) emulsifier
- 7 to 9: wetting and spreading agent[1]
- 13 to 16: detergent[1]
- 8 to 16: O/W (oil in water) emulsifier
- 16 to 18: solubiliser or hydrotrope[1]

William C. Griffin of the Atlas Paper Company introduced the HLB system in 1949. Understanding the importance of these hydrophilic-lipophilic proportions, Griffin devised a method to calculate HLB values of nonionic surfactants within a range of 1 – 20.

The hydrophilic-lipophilic balance (HLB) system is based on the concept that some molecules of surfactants are having hydrophilic groups; other molecules have lipophilic groups and some have both hydrophilic and lipophilic groups called amphiphilic molecules. Hydrophilic and lipophilic portions dissolve in an aqueous and oily phase. It is useful to correlate and measure these characteristics of the surfactants by some means for their applications in various fields such as to formulate various dispersed systems like lotions and emulsion

2 . DEVIE'S METHOD– In 1957, Davies suggested a method based on calculating avalue based on the chemical groups of the molecule. The advantage of this method is that it takes intoaccount the effect of stronger and weaker hydrophilic groups. The method works as follows:

where:- Number of hydrophilic groups in the molecule

- Value of the hydrophilic groups (see tables)
- Number of lipophilic groups in the molecule

Hydrophilic Groups	Group Number
$-SO_4^-Na^+$	38.7
$-COO^-K^+$	21.1
$-COO^-Na^+$	19.1
N (tertiary amine)	9.4
Ester (sorbitan ring)	6.8
Ester (free)	2.4
-COOH	2.1
Hydroxyl (free)	1.9
-O-	1.3
Hydroxyl (sorbitan ring)	0.5

Lipophilic Groups	Group Number
-CH-	-0.475
$-CH_2-$	-0.475
CH_3-	-0.475
=CH-	-0.475

Prepared by :-Ms.Shelke Vaishnavi Arun

Ms. Shaikh Sana

Mr. Rokade Pratik

MENTOR :-DR.Devhadrao Nitin

DEPARTMENT:- Pharmaceutics

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CLASS:-S.Y.BPharm

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