HLB numbers, solvent miscibility and emulsification characteristics of Shell NEODOL® ethoxylates

HLB Numbers

The applicability of a surfactant as an emulsifier, wetting agent, detergent or solubilising agent can often be predicted by its hydrophile/lipophile balance (HLB). The HLB number, as shown in Table 1, expresses the basic principle that the emulsifying efficiency of a surfactant is associated with the polarity of the molecule. The molecular contribution of the polar hydrophilic head and the nonpolar lipophile tail is represented by an arbitrary scale in which the more oil-soluble materials have low HLB numbers while high HLB numbers correspond to increased water solubility. The HLB number is particularly useful for non-ionic surfactants and is directly proportional to the ethylene oxide content of the molecule.

Table 1: HLB numbers and applications of Shell NEODOL ethoxylates

Product name	HLB	Wetting agent	O/W emulsifier	Detergent	Solubiliser	W/O emulsifier
N91-2.5*	8.1	X				X
N91-5	11.6	X	X	X	X	
N91-6	12.5	X	X	X	X	
N91-8	13.8	X	X	X	X	
N23-1	3.7					X
N23-2	6.5					X
N25-3	7.5	X				X
N25-7	12.2	X	X	X	X	
N45-7	11.6	X	X	X	X	
N135-7**	12.2	X	X	X	X	

* N91-2.5 is a legacy grade, now discontinued. Included for comparison.

**N135-7 is a new grade for test marketing Please consult your Account Manager about its availability.

Table 2: Water Dispersibility by HLB

Type of dispersion	HLB Range
No dispersion	1-4
Poor dispersion	3-6
Milky dispersion after vigorous agitation	6-8
Stable milky dispersion	8-10
Translucent to clear dispersion	10-12
Clear solution	13+

Table 3: HLB ranges & applications for alcohol ethoxylates

HLB numbers	Range of Ethylene Oxide Content, %m/m	Applications
4-6	20-30	W/O emulsifier
7-15	35-75	Wetting agent
8-18	40-90	O/W emulsifier
10-15	50-75	Detergent
10-18	50-90	Solubiliser

Solvent miscibility of Shell NEODOL ethoxylates

Shell NEODOL alcohols and ethoxylates are miscible with many organic solvents. Shell NEODOL 91 is the most soluble of the Shell NEODOL alcohols and the Shell NEODOL 91 ethoxylates exhibit especially good compatibility with many solvents. Shell NEODOL 45 ethoxylates exhibit miscibilities similar to Shell NEODOL 25 ethoxylates with comparable ethylene oxide contents.

Emulsification characteristics

An important application of ethoxylates is the emulsification of various solvents in water. Most emulsion systems are very complex and require a blend of ethoxylates of different HLB numbers to achieve maximum efficiency and stability of the emulsion.

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