



BIODEGRADATION OF ALCOHOL ETHOXYLATES

Applicable to these current Stepan products:

BIO-SOFT® AE-3	BIO-SOFT® E-670	BIO-SOFT® E-678
BIO-SOFT® E-840	BIO-SOFT® E-847	BIO-SOFT® EA-8
BIO-SOFT® EC-600	BIO-SOFT® EC-639	BIO-SOFT® EC-690
BIO-SOFT® EN-695	BIO-SOFT® EN8-90	BIO-SOFT® ET-650
BIO-SOFT® FF-400	BIO-SOFT® GSB-9	BIO-SOFT® N-1200
BIO-SOFT® N-400	BIO-SOFT® N-600	BIO-SOFT® N-900
BIO-SOFT® N-901	BIO-SOFT® N-905	BIO-SOFT® N1-3
BIO-SOFT® N1-5	BIO-SOFT® N1-7	BIO-SOFT® N1-73B
BIO-SOFT® N1-9	BIO-SOFT® N23-3	BIO-SOFT® N23-5
BIO-SOFT® N23-6.5	BIO-SOFT® N25-12	BIO-SOFT® N25-3
BIO-SOFT® N25-7	BIO-SOFT® N25-9	BIO-SOFT® N45-7
BIO-SOFT® N91-2.5	BIO-SOFT® N91-6	BIO-SOFT® N91-8
BIO-SOFT® TD-630	MAKON® DA-6	MAKON® TD-12
MAKON® TD-3	MAKON® TD-6	MAKON® TD-8
MAKON® TD-9	POLYSTEP® TD-129	POLYSTEP® TD-189
POLYSTEP® TD-3	POLYSTEP® TD-6	STEPANTEX® TD-560
STEPANTEX® TD-630		

Applicable to these inactive Stepan products:

BIO-SOFT® AE-1	BIO-SOFT® AE-2	BIO-SOFT® EA-10
MAKON® TD-18	POLYSTEP® AE-120	POLYSTEP® F-13
STEPANTEX® TD-560	MAKON® TD-6-85	BIO-SOFT® EA-4
MAKON® TD-15	POLYSTEP® F-12	

Biodegradation Information:

Alcohol ethoxylates (AE) are presently the largest volume nonionic surfactants produced in the U.S., with linear AE as the predominant type.

Variability in the alkyl chain length does not appear to greatly affect the rate and the extent of linear AE biodegradation. However, the degree of branching of the alkyl chain may affect the rate of biodegradation. As a class, alcohol ethoxylates undergo rapid primary (97% in 5-7 days) and ultimate ($\geq 65\%$ in 28 days) biodegradation under OECD 301 B, D, & F test guidelines.

Although biodegradation of AE surfactants has been assumed to be slower under anaerobic as compared to aerobic conditions, a number of studies has confirmed $> 80\%$ biodegradation by anaerobic bacteria. Anaerobic biodegradation tests have been performed using both anaerobically

digested sludge and anaerobic sediment as inocula.

The available treatment plant data indicate extensive removal (>80%) of AE through both degradation and adsorption to sludge as determined by Cobalt Thiocyanate Active Substances (CTAS) method, Bismuth Iodide Active Substance (BIAS) method, Thin Layer Chromatography (TLC), or Biochemical Oxygen Demand Method (BOD). Field tests performed at sights other than treatment plants (e.g. pond water) show AE removal as being greater than 90% as measured by the CTAS method.

The listed products comply with the EU Detergent Regulation (EC) No. 648/2004.

References:

*Human & Environmental Risk Assessment (HERA) on ingredients of European household cleaning products- Alcohol Ethoxylates (2009).

*Swisher, R.D., "Surfactant Biodegradation", Vol. 18, 2nd Edition, Marcel Dekker, Inc., 1987, pp. 482-484, 846-847.

*Talmage, S.S., "Environmental and Human Safety of Major Surfactants, Part I: Alkylphenol Ethoxylates", Lewis Publishers, pp. 35-50.

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