



BIODEGRADATION OF STEPAN PRODUCTS

Applicable to these current Stepan products:

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| ZELEC® 874 | STEPAN® 874 | STEPAN™ GMC-8 |
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Applicable to these inactive Stepan products:

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| STEPAN® 653 STEPAN® 894 STEPAN® DGDS STEPAN® EGAS STEPAN® EGMS 70 STEPAN® GML STEPAN® GMS 63F STEPAN® GMS S.E. STEPAN® ICS STEPAN® IPP STEPAN® PEG 1000 MS STEPAN® PEG 200 ML STEPAN® PEG 300 MS STEPAN® PEG 400 DS STEPAN® PEG 400 MS | STEPAN® 654 STEPAN® BES STEPAN® DGS NEUTRAL STEPAN® EGDS STEPAN® GDL STEPAN® GMO STEPAN® GMS 860 STEPAN® GMS S.E./A.S. STEPAN® IPM STEPAN® OCTYL ISONONANOATE STEPAN® PEG 200 DL STEPAN® PEG 200 MO STEPAN® PEG 400 DL STEPAN® PEG 400 ML STEPAN® PEG 600 DL | STEPAN® 887 STEPAN® BS STEPAN® DGS S.E. STEPAN® EGMS STEPAN® GDS 386F STEPAN® GMS 24 S.E. STEPAN® GMS PURE STEPAN® IBS STEPAN® IPM-NF STEPAN® OCTYL PALMITATE STEPAN® PEG 200 DO STEPAN® PEG 200 MS STEPAN® PEG 400 DO STEPAN® PEG 400 MO STEPAN® PEG 600 DO STEPAN® PEG 600 DS STEPAN® PEG 600 ML STEPAN® PEG 600 MS STEPAN® PGMS 534F STEPAN® PGMS 8615 STEPAN® PGMS PURE ZELEC® 891 STEPAN™ PGML |
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Biodegradation Information:

STEPAN® products listed above are either fatty acid esters or ethoxylated fatty acid esters. The available literature information indicates that both fatty acid esters and ethoxylated fatty acid esters are biodegradable. Ultimate or complete breakdown of fatty acid esters will reach 90-100% in 20 to 25 days, while ultimate breakdown of ethoxylated fatty acid esters will reach 98-100% in 4 to 18 days (natural or synthetic medium inoculated with acclimated or unacclimated organisms).

In general, ethylene oxide chain length has little effect on the rate and extent of degradation. Rates generally decrease slightly with increasing chain length, and above 20 ethylene oxide units, the rate of degradation is retarded.

References:

*Swisher, R.D., "Surfactant Biodegradation", Vol. 18, 2nd Edition Marcel Dekker, Inc., 1987, pp. 827, 884-887

*Talmage, S. S., "Environmental and Human safety of major surfactants" Lewish Publishers. 1994..

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