



Biodegradability of Surfactants

Definition and measuring methods

For the biodegradation of laundry detergents and cleaning agents, one differentiates between primary and secondary degradation:

Primary degradation: The surfactant loses its surface-active properties, i.e. the surface tension of the water no longer is affected by the surfactant; this is important for aquatic organisms.

Secondary or ultimate degradation: The surfactant is completely biodegraded into CO_2 , water, minerals, and biomass (during biodegradation of e.g. laundry detergents the number of micro-organisms feeding on the laundry detergent increases).

Secondary degradation distinguishes between:

Aerobic degradation (corresponds to degradation in sewage works)

Anaerobic degradation (corresponds to direct degradation in soil)

Surfactant	aerobic degradation	anaerobic degradation
Sugar surfactant (APG)	x	x
Fatty alcohol sulfates (FAS)	x	x
Plant-derived oil soaps	x	x
Linear alkyl benzene sulfonate	x	-
Sulphonic acid	x	-

Measuring methods for determining the degradation pattern in compliance with OECD (Organisation for Economic Cooperation and Development):

OECD 301A-F: These measuring methods determine the ultimate degradation of surfactants. They either measure the dissolved carbon, the used-up oxygen in the liquid, or the CO_2 which is being released. If the results fulfil the legal requirements, the substance is considered „readily biodegradable“; i.e. easily and completely biodegradable.

Example: According to OECD 301B, the laundry detergent to be tested is used as sole carbon nutrient for the microorganisms. The biodegradation is being determined by measuring the carbon released as CO_2 . If 60 % of the total organic carbon content in the laundry detergent is released after 28 days as CO_2 , the complete biodegradability is guaranteed, and the product considered „readily biodegradable“.

Sonett Products are tested in compliance with OECD 301B, and fulfil the criteria of effortless biodegradability: thus after only 10 days, Sonett Laundry Detergent Lavender, Hand Soaps, Clear Rinse, and Toilet Cleaner are decomposed by 64%, 60%, 69% and 73% respectively.

OECD 302A-C: These measuring methods are applied when the legal requirements for ultimate degradation of the series OECD 301 are not met. OECD 302 tests the limited biodegradability.

OECD 303: In this measuring method only the primary not the ultimate degradation is tested.

Biodegradability Of Surfactants Biodegradability Of Surfactants

Sylvia S. Talmage



Biodegradability Of Surfactants Biodegradability Of Surfactants:

Biodegradability of Surfactants D.R. Karsa, M.R. Porter, 2012-12-06 The awareness and development of biodegradable surfactants pre dates current pressures by the environmental movement by nearly three decades wherein a responsible industry mutually agreed to replace hard non biodegradable components of household detergents by soft biodegradable alternatives without course to legislation The only requirement at that time was for surfactants used in detergents to exhibit a primary biodegradability in excess of 80% this referring to the disappearance or removal from solution of the intact surface active material as detected by specified analytical techniques This proved useful as observed environmental impacts of surfactants e.g visible foam on rivers are associated with the intact molecule Test methods for primary biodegradability were eventually enshrined in EU legislation for nonionic surfactants Directive 821242 EEC amended 73 404IEEC and for anionic surfactants Directive 8212431IEEC amended 73 405IEEC No approved test methods and resultant legislation have been developed for cationic and amphoteric surfactants to date The environmental classification of chemical substances which of course includes surfactants and associated risk assessment utilises a second criterion ready biodegradability This may be assessed by a number of methods which monitor oxygen uptake BOD carbon dioxide production or removal of dissolved organic carbon DOC Some surfactants which comply with the above Detergents Directive are borderline when it comes to ready biodegradability *Surfactant Biodegradation* Robert Donald Swisher, 1970 **Handbook of Detergents,**

Part B Uri Zoller, 2004-08-30 The second installment of the multivolume Handbook of Detergents deals with the potential environmental impact of detergents as a result of their production formulation usage consumption and disposal This volume forms a comprehensive treatise on the multidimensional issues involved and emphasizes the alignment of scientific knowledge with the relevant contemporary data and methodologies in toxicology ecotoxicology and environmental risk assessment With contributions from over 50 experts worldwide this volume discusses industry procedures involving surfactant and detergent treatments and explores global concerns centering on recent legislative and regulatory developments *Surfactant Biodegradation, Second Edition*, Robert Donald Swisher, 1986-10-31 **Handbook of**

Biodegradable Materials Gomaa A. M. Ali, Abdel Salam H. Makhoulouf, 2023-02-20 This Handbook discusses the recent advances in biodegradation technologies and highlights emerging sustainable materials including environmentally friendly nano based materials for replacing plastics It is useful to scientists engineers biologists medical doctors and provides alternative eco friendly materials to replace the currently used ones with harmful impact on the environment and life The chapters present different types of alternative materials in diverse areas such as food packaging materials materials for construction and agricultural materials The principles and types of biodegradation technologies are described in depth

Chemistry and Technology of Surfactants Richard J. Farn, 2008-04-15 Surfactants are used throughout industry as components in a huge range of formulated products or as effect chemicals in the production or processing of other materials A

detailed understanding of the basis of their activity is required by all those who use surfactants yet the new graduate or postgraduate chemist or chemical engineer will generally have little or no experience of how and why surfactants work. Chemistry Technology of Surfactants is aimed at new graduate or postgraduate level chemists and chemical engineers at the beginning their industrial careers and those in later life who become involved with surfactants for the first time. The book is a straightforward and practical survey of the chemistry of surfactants and their uses providing a basic introduction to surfactant theory information on the various types of surfactant and some application details. This will allow readers to build on to their scientific education the concepts and principles on which the successful use of surfactants across a wide range of industries is based.

Environmental and Human Safety of Major Surfactants Sylvia S. Talmage, 2020-04-08 The book summarizes and reviews the environmental and human safety of two classes of nonionic surfactants alcohol ethoxylates AE and alkylphenol ethoxylates APE. This unique resource contains critical data from published sources as well as from unpublished studies submitted by Soap and Detergent Association member companies. It reviews information on product chemistry and analysis biodegradation environmental levels including fate and distribution aquatic toxicity and human safety. Recently developed analytical techniques for the extraction separation detection and measurement of nonionic surfactants and their metabolites in environmental samples are described. Results of biodegradation studies performed with a variety of test systems are tabulated as are results of field studies at wastewater treatment plants. Reported comparisons of environmental levels with results of acute and chronic aquatic toxicity tests are provided. The information on the toxicity and irritation potential of AE and APE surfactants includes data from in vitro mammalian and human studies.

Encyclopedia of Surface and Colloid Science P. Somasundaran, 2006

Pesticide formulations and application systems Bala N. Devisetty, 1993 Annotation Papers presented at the Twelfth ASTM Symposium on title held in San Diego California October 1991. The volume is divided into four sections novel surfactants and their properties four papers pesticide formulation technologies 14 papers pesticide packaging and management one paper Container Design and Glug and pesticide application technologies eight papers. Annotation copyright by Book News Inc Portland OR

Biodegradation Rolando Chamy, 2013-06-14 This book contains a collection of different biodegradation research activities where biological processes take place. The book has two main sections A Polymers and Surfactants Biodegradation and B Biodegradation Microbial Behaviour.

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truss forces why is it important to know that the structure is statically determinate

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web a free body diagram isolates an object from its environment or system and symbolically examines all of the forces acting
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web why is it important to create free body diagrams a free body diagram isolates a structural element from its surroundings for the purpose of exposing the forces acting between objects fbds are useful in solving for the forces acting on objects 2

sketch a free body diagram of the person sitting in a car seat as shown below

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web in this activity you will calculate reaction and member forces for the truss system illustrated below it is essential to follow each step within the procedure to ensure proper calculations and free body diagrams calculate external reaction forcesx and y reaction force at pin a and y reaction force at roller c