



BIODEGRADATION AND SAFETY OF COMMERCIAL LAS

Commercial linear alkylbenzene sulfonate (LAS) consists of 85 to 98% LAS and three other constituents: linear alkylbenzene (LAB), dialkyltetralin sulfonate (DATS) and methyl branched alkylbenzene sulfonate (isoLAS). Like LAS, the three other constituents undergo biodegradation and are extensively removed during sewage treatment. Trace amounts remaining in treated wastewater and sludge biodegrade rapidly and completely in the environment and pose no risk to plants and animals. These results, together with the extensive data on LAS, demonstrate the environmental safety of commercial LAS.

LAS

- Commercial LAS consists of 85 to 98% LAS.
- Monitoring studies at 50 U.S. sewage treatment plants show that LAS is 99% removed in activated sludge plants and is highly removed even in less efficient trickling filter (77% removal) and rotating biological contactor (96% removal) plants. LAS is efficiently biodegraded by activated sludge (See "LAS Biodegradation and Removal in Sewage Treatment").
- LAS concentrations in rivers, streams and sediments are well below levels that would affect the environment. These trace levels of LAS continue to biodegrade completely (See "LAS Biodegradation and Safety in Rivers and Streams" and "LAS Biodegradation and Safety in Sediments").
- LAS in the solids (sludges) from sewage treatment plants biodegrades rapidly and completely when sludges are used as a soil conditioner or fertilizer (See "LAS Biodegradation and Safety in Sludge and Soils").

LAB

- Linear alkylbenzene (LAB) is the material used to produce LAS. Sulfonation of LAB yields LAS and a small amount of unsulfonated LAB, typically less than 0.5%.
- Monitoring studies at 10 U.S. sewage treatment plants show that LAB is 98% removed in activated sludge plants and is highly removed even in less efficient trickling filter (80% removal) and rotating biological contactor (89% removal) plants. LAB is efficiently biodegraded by activated sludge.⁽¹⁾
- LAB concentrations in rivers, streams and sediments are well below levels that would affect the environment. These trace levels of LAB continue to biodegrade completely.⁽¹⁾

- LAB in the solids (sludges) from sewage treatment plants biodegrades rapidly and completely when sludges are used as a soil conditioner or fertilizer.⁽²⁾

DATS

- Dialkyltetralin is formed in LAB when a second bond is formed between the alkyl chain and the benzene ring. Depending on the manufacturing process used to make LAB, commercial LAS contains less than 1% to 8% DATS. Improvements in process technology in recent years have reduced the DATS content to less than 5%.⁽³⁾
- Monitoring studies at 10 U.S. sewage treatment plants show that DATS biodegrades and is 95% removed in activated sludge plants. DATS is highly removed even in less efficient trickling filter (63% removal) and rotating biological contactor (85% removal) plants.^(4,5)
- DATS concentrations in rivers, streams and sediments are well below levels that would affect the environment.^(4,5) These trace levels of DATS continue to biodegrade rapidly and completely.^(6,7)
- DATS in sewage sludge mixed with soil, called sludge-amended soil, also biodegrades rapidly and completely.^(6,7)

IsoLAS

- IsoLAS, which has a methyl branch in the otherwise linear alkyl chain, occurs due to methyl branching present in the kerosene feedstock and methyl branch formation during manufacturing. Depending on the process used to make LAB, commercial LAS contains less than 1% to about 6% isoLAS.
- Because the methods for analysis of environmental levels of LAS do not distinguish between LAS and isoLAS, monitoring studies have included isoLAS in the LAS levels reported.
- Monitoring studies have shown that LAS and isoLAS are removed at comparable rates (99% removal) in activated sludge plants.^(3,8) LAS and isoLAS are highly removed even in less efficient trickling filter (77% removal) and rotating biological contactor (96% removal) plants.⁽⁹⁾
- High rates of removal are also observed in European sewage treatment plants.⁽¹⁰⁻¹²⁾
- Confirmation that isoLAS biodegrades as rapidly and completely as LAS comes from recent studies with isoLAS molecules^(13,17) and from a study which specifically analyzed for isoLAS intermediates during biodegradation of commercial LAS.⁽¹⁴⁾
- LAS and isoLAS concentrations in rivers, streams and sediments are well below levels that

are known to affect plants and animals in these environments.^(4,9,15) Branching of surfactants tends to decrease toxicity;⁽¹⁶⁾ thus isoLAS would be expected to show even less toxicity than LAS.

- The trace levels of isoLAS in the environment will continue to biodegrade rapidly and completely.⁽¹⁴⁾

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