

Linear alpha-Olefins

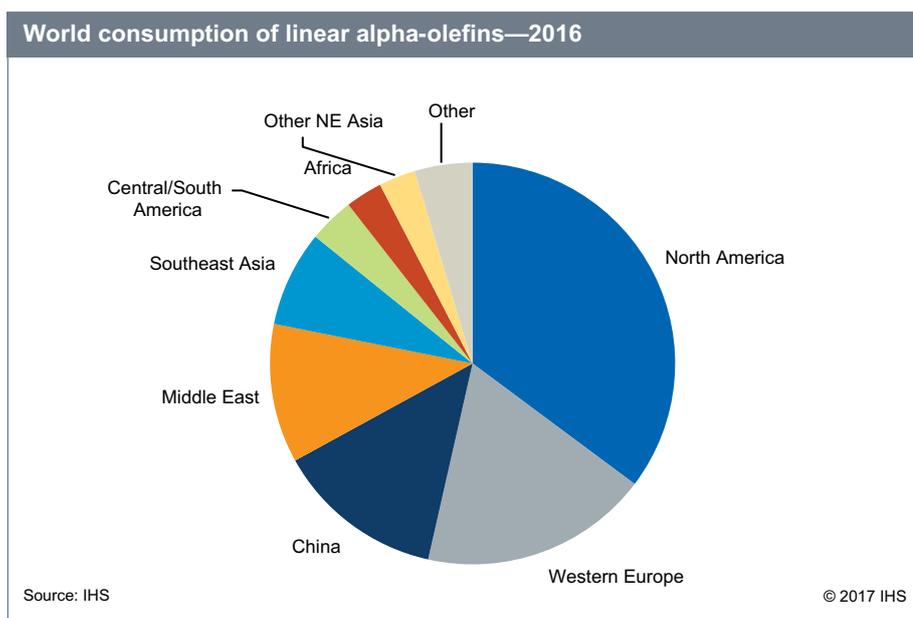
15 March 2017

ihs.com

Abstract

This report covers supply and demand for linear alpha-olefins (LAOs) with carbon chain-lengths of four (butene-1) and higher. Most of the current commercial LAO plants produce a broad range of even-numbered alpha-olefins based on ethylene oligomerization. However, on-purpose technology for the production of butene-1, hexene-1, and octene-1 (included and increasingly important) will continue to be vital in meeting the polyethylene comonomer supply gap that will continue to grow given the divergence in growth rates among polyethylene comonomers (the major LAO consuming market), polyalphaolefins, and more specialty applications. Butene-1 that is produced from raffinate is also included.

The following pie chart shows world consumption of linear alpha-olefins:



Global consumption of LAO during 2012–16 grew at an average annual rate of 5.6%, driven by polyethylene comonomers, detergent-range alcohols (based on linear alpha- and internal olefins), polyalphaolefins, oil field chemicals, and surfactants.

In 2016, North America accounted for almost 40% of the world production of LAO, followed by the Middle East (19%), Western Europe (16%), China (10%), the rest of Asia, Africa, and Central and South America. In addition to some capacity expansion for full-range LAOs, the majority of new capacity has been for on-purpose technology for the production of hexene-1 and octene-1. The continued North American abundance of shale-based natural gas and the need to meet the polyethylene comonomer supply gap have driven this growth.

Contacts

Koon-Ling Ring

Koon-Ling.ring@ihs.com

Maria deGuzman

Maria.deguzman@ihs.com

IHS™ CHEMICAL

COPYRIGHT NOTICE AND DISCLAIMER © 2017 IHS. For internal use of IHS clients only.

No portion of this report may be reproduced, reused, or otherwise distributed in any form without prior written consent, with the exception of any internal client distribution as may be permitted in the license agreement between client and IHS. Content reproduced or redistributed with IHS permission must display IHS legal notices and attributions of authorship. The information contained herein is from sources considered reliable, but its accuracy and completeness are not warranted, nor are the opinions and analyses that are based upon it, and to the extent permitted by law, IHS shall not be liable for any errors or omissions or any loss, damage, or expense incurred by reliance on information or any statement contained herein. In particular, please note that no representation or warranty is given as to the achievement or reasonableness of, and no reliance should be placed on, any projections, forecasts, estimates, or assumptions, and, due to various risks and uncertainties, actual events and results may differ materially from forecasts and statements of belief noted herein. This report is not to be construed as legal or financial advice, and use of or reliance on any information in this publication is entirely at client's own risk. IHS and the IHS logo are trademarks of IHS.



The low cost of ethylene in North America is driving several investments in the region. Most of these capacity additions are for polyethylene. However, polyalphaolefins and oil field chemicals are also contributing to this growth. The polyethylene comonomer supply gap will continue to grow given the divergence in growth rates among polyethylene comonomers (the major LAO consuming market), polyalphaolefins, and more specialty applications; the need to fill this gap will lead to capacity additions for both on-purpose LAO capacity (30% of the total additional capacity) and full-range LAO capacity (70%) in North America.

Approximately 55% of the announced global LAO capacity additions (for commencement in 2018 and beyond) are for full-range LAOs. However, on-purpose LAO capacity has grown significantly in the last few years, and this on-purpose technology for the production of butene-1, hexene-1, and octene-1 will continue to be vital in meeting the polyethylene comonomer supply gap.

World consumption of LAOs is forecast to grow at an average annual rate of 3.7% during 2016–21. Forecasts of growth rates vary significantly by region and by LAO cut. Annual growth during 2016–21 is expected to average approximately 5% in North America and China, 0.5–1.0% in Western Europe, and 4% in the rest of Asia (with India and Southeast Asia driving regional growth). In the developing regions, annual consumption growth is forecast to average 13% in Central and Eastern Europe (from a small base) and 3.0–3.5% in the Middle East. Central and South America will likely experience only modest growth given the current sluggish economic conditions, the lack of increased polyethylene (LLDPE) production until 2020, and declining HDPE production. However, regional consumption of LAO for oil field chemicals is expected to grow at a healthy rate during 2016–21, offsetting some of the expected decline for polyethylene.

Growth for comonomer-grade LAOs is expected to be considerably higher in North America (7.2%, and from a large base), where the region has a low-cost ethylene feedstock advantage. Other regions with comonomer-grade LAO growth rates exceeding 4% include China, Central and Eastern Europe, Africa, India, and Southeast Asia.

Contents

Executive summary	5
Summary	6
Introduction	10
Manufacturing processes	11
Ethylene oligomerization	11
Chevron Phillips Chemical's ethylene oligomerization (Ziegler process)	12
INEOS's ethylene oligomerization (modified Ziegler process)	13
Shell's ethylene oligomerization (Shell higher olefins process—SHOP)	14
Idemitsu's ethylene oligomerization process	15
Vista's Alfene® process	15
Exxon's ethylene oligomerization process	15
DuPont's Versipol™ process	15
SABIC/Linde alpha-SABLIN™ process	15
Ethylene tetramerization	16
Ethylene trimerization	16
Ethylene dimerization	16
Other alpha-olefin synthesis routes	16
Sasol's purification process	16
Paraffin wax cracking	17
Dehydration of alcohols	17
Isomerization of internal olefins	17
Metathesis of natural oils	17
Supply and demand by region	18
North America	18
Producing companies	18
Salient statistics	19
Consumption	20
Polyethylene comonomers	22
Linear low-density polyethylene (LLDPE) resins	23
High-density polyethylene (HDPE) resins	24
Elastomers and plastomers	25
Oxo alcohols	25
Detergent alcohols	25
Plasticizer alcohols	27
Polyalphaolefins	27
Oil field drilling fluids	30
Other lubricant additives	31
Linear alkylbenzene	31
Surfactants	32
Alkenylsuccinic anhydrides	32
Synthetic fatty acids (C7-C9)	33
Alkyldimethylamines and dialkylmethylamines	34
Polypropylene comonomer	36
Chlorinated olefins	36

IHS™ CHEMICAL

COPYRIGHT NOTICE AND DISCLAIMER © 2017 IHS. For internal use of IHS clients only. No portion of this report may be reproduced, reused, or otherwise distributed in any form without prior written consent, with the exception of any internal client distribution as may be permitted in the license agreement between client and IHS. Content reproduced or redistributed with IHS permission must display IHS legal notices and attributions of authorship. The information contained herein is from sources considered reliable, but its accuracy and completeness are not warranted, nor are the opinions and analyses that are based upon it, and to the extent permitted by law, IHS shall not be liable for any errors or omissions or any loss, damage, or expense incurred by reliance on information or any statement contained herein. In particular, please note that no representation or warranty is given as to the achievement or reasonableness of, and no reliance should be placed on, any projections, forecasts, estimates, or assumptions, and, due to various risks and uncertainties, actual events and results may differ materially from forecasts and statements of belief noted herein. This report is not to be construed as legal or financial advice, and use of or reliance on any information in this publication is entirely at client's own risk. IHS and the IHS logo are trademarks of IHS.



Linear mercaptans	36
Aluminum alkyls	37
Alkyldiphenylether disulfonates	37
Other	37
Price	38
Trade	38
Central and South America	39
Salient statistics	39
Consumption	40
Western Europe	41
Producing companies	41
Salient statistics	42
Consumption	42
Polyethylene comonomers	44
LLDPE/HDPE	44
Plastomers and elastomers	45
Polyalphaolefins	45
Oxo alcohols	46
Detergent oxo alcohols	46
Plasticizer alcohols	47
Polybutene-1	47
Alkenylsuccinic anhydride	48
Linear alkylbenzene	48
alpha-Olefin sulfonates/surfactants	48
Lube oil additives	48
Other	49
Price	49
Trade	50
Central and Eastern Europe	50
Producing companies	50
Salient statistics	51
Consumption	51
Middle East	52
Producing companies	52
Salient statistics	54
Consumption	54
Africa	55
Producing companies	55
Salient statistics	56
Consumption	57
Japan	57
Producing companies	57
Salient statistics	59
Consumption	60
Polyethylene comonomers	60
Oxo alcohols	61
Plasticizer alcohols	61
Detergent alcohols	61
alpha-Olefin sulfonates	62
Other	62
Price	62
Trade	62

China	64
Producing companies	64
Salient statistics	65
Consumption	65
Polyethylene comonomers	66
alpha-Olefin sulfonates	67
Polyalphaolefins	67
Other	68
Other Asia	68
Producing companies	68
Salient statistics	69
India	69
Other Northeast Asia	70
Southeast Asia	70
Trade	71
Other Northeast Asia	71
Southeast Asia	71
Bibliography	72

IHS Customer Care:

Americas: +1 800 IHS CARE (+1 800 447 2273); CustomerCare@ihs.com
Europe, Middle East, and Africa: +44 (0) 1344 328 300; Customer.Support@ihs.com
Asia and the Pacific Rim: +604 291 3600; SupportAPAC@ihs.com

