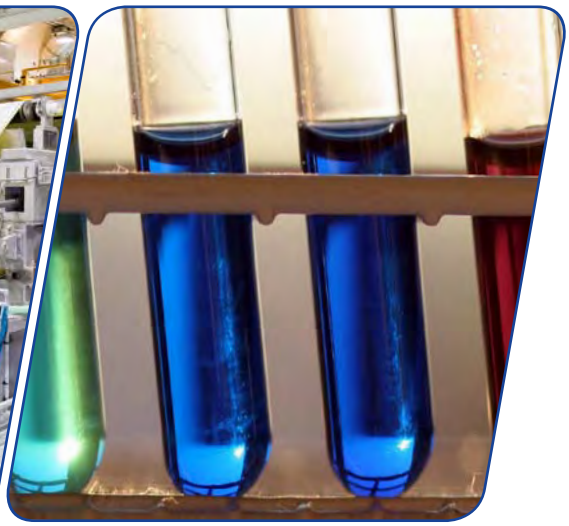
Market Study: Biocides

(2nd ed.)





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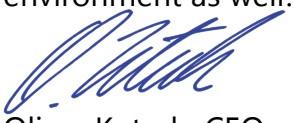

Oliver Kutsch, CEO

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- Experienced and neutral experts
- Quantitative and qualitative primary and secondary market research
- Reliable and objective survey, analysis, forecast, and preparation of data
- Expertise in branches, legal situation, innovations, and technologies

Our Market Studies

The basis for your strategic planning:
- Analysis of attractiveness and current situation of the market
- Analysis of the future development of the market
- Analysis of competitors
- Analysis of customer industries
- Analysis of supply industries

Your Strategic Planning

With our studies you will recognize:
- Current market trends and developments on time
- Ideal procurement and sales markets
- Relevant future markets and target groups
- Risks and market chances on time
- Candidates for mergers and acquisitions as well as divestments

Your Success

The strategic planning enables you to:
- Restructure your product portfolio
- Evaluate current and potential locations
- Plan and develop new marketable products
- Better adapt to needs and requirements of customers
- Deal with future markets

Biocides are chemicals or microorganisms preventing damages caused by microbes or other organisms: They protect industrial products and consumer goods as well as animals and human beings. Biocides often contain the same active ingredients as plant protection products. While plant protection products are only used in the agricultural sector, biocides are utilized in numerous application areas.
Ceresana analyzed the global market for biocides already for the second time. Although these products are added to the end products in only relatively small amounts, revenues of about USD 6.6 billion were generated with biocides worldwide in 2016. The current report expects a growth of revenues of, on average, 2.1% per year.

Biocides Are Popular in the USA

With share of about 41% of global consumption, North America is the major sales market for biocides. This region also accounted for the highest revenues in 2016. Asia-Pacific and Western Europe followed, ranking second and third. All regions utilized by far the highest amount of biocides in the segment water treatment. Application in the segment wood preservation followed in Eastern Europe, North America, and South America. In Western Europe however, the segment disinfectants ranked second; in Asia-Pacific, the second highest amount of biocides was used in the paper industry. By contrast, biocide demand in the application plastics ranked second in the Middle East and Africa.

Asia Expands Its Market Shares

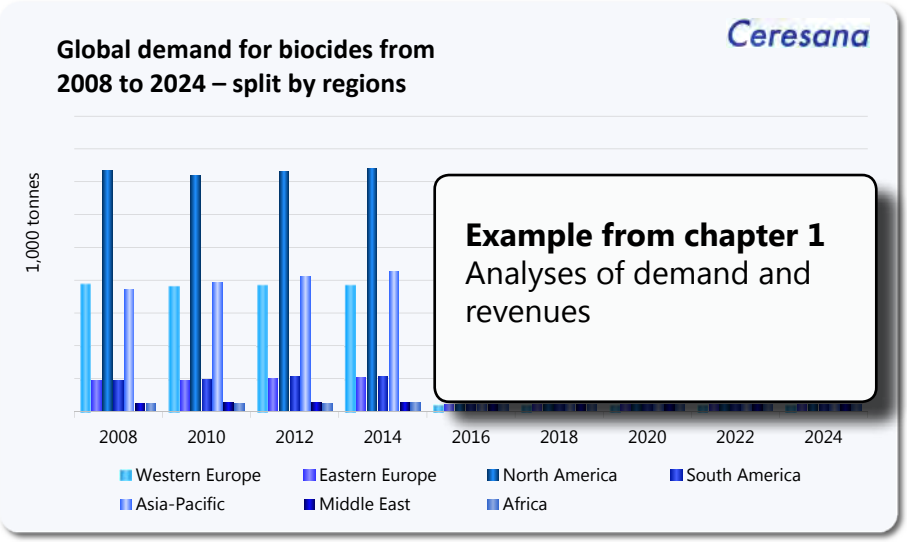
Ceresana expects countries in Asia-Pacific, with the exception of Japan and South Korea, to increase their shares of the global market for biocides. Until 2024, this region is likely to see its share of worldwide biocide consumption to expand to over 25%. This development will occur mainly at the expense of Western Europe and North America, where the sales markets are already saturated. Growth impulses generated in those regions are not as much caused by an increase in consumption volume within individual sectors, but by alternations between the different product types. In this regard, legal requirements as well as health concerns and trends in the environmental consciousness are of vital importance. The trade-off between pest control on the one hand and environmental and animal protection on the other hand often is difficult.

Revenues Depend on the Biocide Type

This report analyzed, among others, which role the individual types of biocides play on the global biocides market. The worldwide highest revenues in 2016 were generated with biocides based on halogen compounds, followed by biocides based on metallic and organosulfur compounds. Revenues generated with biocides based on halogen compounds that are, for example, used for tap water treatment, amounted to over USD 2 billion in 2016. Several ingredients are often combined to generate synergy effects.

The Study in Brief:

Chapter 1 provides a description and analysis of the global biocides market – including forecasts up to 2024: demand and revenues are explained for each region of the world. This chapter examines total revenues as well as revenues split by biocide types.
In chapter 2, demand and revenues generated with biocides in the sectors disinfectants, water treatment, wood preservation, paper industry, paints and varnishes, plastics, and other application areas are analyzed in detail for 16 different countries.
Chapter 3 provides an in-depth analysis of the application areas of biocides: Data on demand and sales development, split by the regions Western Europe, Eastern Europe, North America, South America, Asia-Pacific, the Middle East, and Africa are given.
Chapter 4 analyzes revenues of individual types of biocides based on halogenated, metallic, organosulfur, nitrogen, and phenolic compounds as well as other biocides.
Chapter 5 provides company profiles of the largest manufacturers of biocides – clearly arranged according to contact details, revenues, profit, product range, production sites, and profile summary. In-depth profiles of 86 producers are given, including Akzo Nobel, Arkema, BASF, DowDuPont, Evonik, Kemira, Lanxess, Lonza, SK Global, and Solvay.

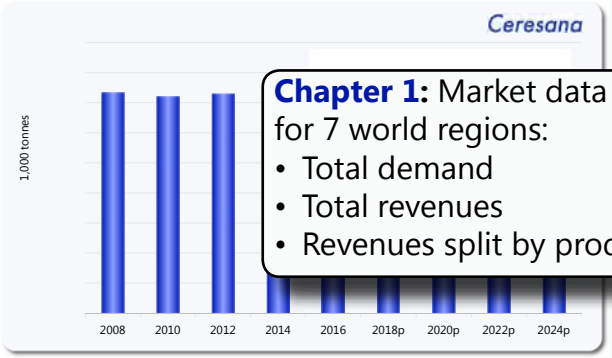


1.4 North America

1.4.1 Demand

Around XXX million tonnes of biocides were processed in North America in 2016. Thus, North America is the prime sales market for biocides worldwide. The North American demand is dominated by the USA; this country accounts for about XXX% of demand for biocides.

We expect demand to increase to approx. XXX tonnes during the next eight years. Given the below average growth rate, North American share of global demand for biocides is likely to fall to about XXX% in 2024.



Chapter 1: Market data for 7 world regions:
- Total demand
- Total revenues
- Revenues split by products

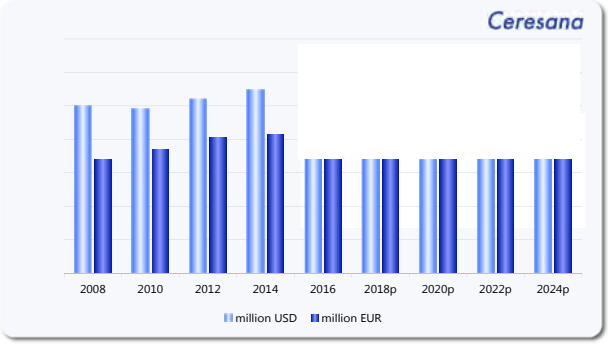
Graph: Demand for biocides in North America from 2008 to 2024

in 1,000 tonnes	2008	2010	2012	2014	2016	2018p	2020p	2022p	2024p	2016-2024
Canada	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	X% p.a.
Mexico	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	X% p.a.
USA	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	X% p.a.
Total	**XXX**	**XXX**	**XXX**	**XXX**	**XXX**	**XXX**	**XXX**	**XXX**	**XXX**	**X% p.a.**

Table: Demand for biocides in North America from 2008 to 2024 – split by major countries

1.4.2 Revenues

The market value of biocides sold in North America rose at an average rate of XXX% p.a. to USD XXX billion in 2016. We forecast revenues to continue to rise by XXX% p.a. in the upcoming eight years.



Graph: Revenues generated with biocides in North America from 2008 to 2024 in million USD and million EUR

in million USD	2008	2010	2012	2014	2016	2018p	2020p	2022p	2024p	2016-2024
Canada	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	X% p.a.
Mexico	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	X% p.a.
USA	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	X% p.a.
Total	**XXX**	**XXX**	**XXX**	**XXX**	**XXX**	**XXX**	**XXX**	**XXX**	**XXX**	**X% p.a.**

Table: Revenues generated with biocides in North America from 2008 to 2024 – split by major countries

Biocides based on halogenated compounds generated revenues of USD XXX billion in 2016. Biocides based on nitrogen compounds will develop at the highest growth rates in the upcoming eight years and increase their revenues to USD XXX million.

in million USD	2008	2010	2012	2014	2016	2018p	2020p	2022p	2024p	2016-2024
Halogenated	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	X% p.a.
Metallic	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	X% p.a.
Organosulfur	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	X% p.a.
Nitrogen	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	X% p.a.
Phenolic	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	X% p.a.
Other	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	X% p.a.
Total	**XXX**	**XXX**	**XXX**	**XXX**	**XXX**	**XXX**	**XXX**	**XXX**	**XXX**	**X% p.a.**

Table: Revenues generated with biocides in North America from 2008 to 2024 – split by products

2 Country Profiles

2.1 Western Europe

2.1.1 Germany

2.1.1.1 Demand

Demand for biocides in Germany amounted to XXX tonnes in 2016. Demand had risen by an average of XXX% p.a. since 2008. We expect market volume to continue to increase at an average growth rate of XXX% p.a. and to amount to approx. XXX tonnes in 2024.

The most important sales market for biocides in 2016 was the segment disinfectants. Demand for biocides in the sector paints and varnishes is likely to develop most significantly in percentages at rates of XXX% p.a.

in 1,000 tonnes	2008	2010	2012	2014	2016	2018p	2020p	2022p	2024p	2016-2024
Disinfectants	XXX									
Water Treatment	XXX									
Wood Preservation	XXX									
Paper Industry	XXX									
Paints and Varnishes	XXX									
Plastics	XXX									
Other	XXX									
Total	**XXX**	**XXX**	**XXX**	**XXX**	**XXX**	**XXX**	**XXX**	**XXX**	**XXX**	**X% p.a.**

Chapter 2: Extensive market data for 16 countries:
- Total demand
- Total revenues
- Demand split by applications
- Revenues split by applications
- Manufacturers of biocides

Table: Demand for biocides in Germany from 2008 to 2024 - split by applications

Despite low interest rates, a low oil price, and the devaluation of the euro, Germany has only experienced a restrained upswing in the past years caused by, among others,

the low global economy. However, the rather restrained demand of the global economy will increase again in 2017. The GDP growth was 1.9% in 2016 and is supposed to increase further by 1.5% in 2017. This economic growth is supported by a high private consumption and a stable labor market. In the scope of its expansive financial policy, the federal government passed an investment package of EUR 10 billion for the period 2016 to 2018. Tax reductions, rising pensions, as well as continuing migratory flows, and the related monetary transfers also provide further impulses for the German economy. Additionally, the number of employees increased in 2016, while the unemployment rate decreased. The purchase power of households is likely to rise further in 2017 and 2018, which can be explained by the growing employment figures and increasing incomes. We forecast an economic growth of 1.8% in 2018.

Occurrences such as the swine or avian influenza strengthened the hygiene awareness in Germany. Furthermore, a more wide-spread social media and image advertising led to an increasingly higher hygiene awareness. This growing hygiene awareness led to an increase in demand for disinfectants in the past years and also in the years to come, this situation is unlikely to change. Therefore, the market researchers of Ceresana forecast a growth of demand for biocides in the segment disinfectants in the years to come.

In the past years, a decreasing water consumption could be observed in Germany. Water consumption will presumably continue to decline in the years to come as well due to a rising environmental awareness and new technologies. This will cause a decreasing demand for biocides in the segment water treatment.

Reaching an output of 22.6 million tonnes in 2016, Germany is the largest producer of paper in Western Europe. The German paper industry is undergoing structural changes. While a notable decline can be seen in the subsegment graphic paper, the production of paper used in the packaging and hygiene sectors is increasing. Perspectives for the upcoming years are thus rather restrained. Therefore, we expect demand for biocides in the paper industry to increase only slightly in the next eight years.

2.1.1.2 Revenues

Revenues generated with biocides amounted to about EUR XXX million Market value is projected to increase at an average rate of XXX% p.a. until 2024. The highest revenues were generated with biocides for the segment disinfectants in 2016. In the upcoming eight years, this segment will account for high growth rates and presumably reach total revenues of EUR XXX in 2024.

in million EUR	2008	2010	2012	2014	2016	2018p	2020p	2022p	2024p	2016-2024
Disinfectants	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	X% p.a.
Water Treatment	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	X% p.a.
Wood Preservation	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	X% p.a.
Paper Industry	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	X% p.a.
Paints and Varnishes	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	X% p.a.
Plastics	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	X% p.a.
Other	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	X% p.a.
Total	**XXX**	**XXX**	**XXX**	**XXX**	**XXX**	**XXX**	**XXX**	**XXX**	**XXX**	**X% p.a.**

Table: Revenues generated with biocides in Germany from 2008 to 2024 in million EUR – split by applications

Company
Company 1
Company 2
...

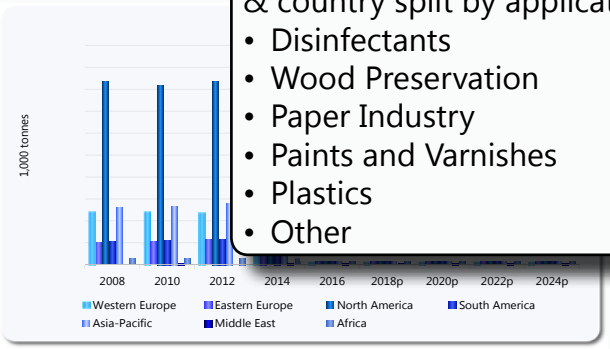
Table: Important manufacturers of biocides in Germany

3 Applications

3.1 World

3.1.3 Wood Preservation

Biocides are used to protect wood against insects and fungi. The aim is to achieve a longer shelf life and protection against discoloration. Wood preservatives are used in the construction of houses, for example in half-timbered houses or in roof constructions. They are used both as a preventative measure as well as in the treatment of already infested wood products. In addition to the gases used to combat insect pests, there is a range of chemical products that are utilized. Wood preservatives containing biocides are included in the chemical wood preservatives category that can be subdivided into three groups: water-based, solvent-based, and wood preservatives based on coal tar. The wood preservation sector mainly relies on metallic compounds, followed by phenols. Consumption of [illegible] compounds is likely to increase.



Graph: Global demand for biocides in the segment wood preservation from 2008 to 2024 – split by regions

Chapter 3: Demand per region & country split by applications:
- Disinfectants
- Wood Preservation
- Paper Industry
- Paints and Varnishes
- Plastics
- Other

4 Products

4.1 Biocides Based on Halogenated Compounds

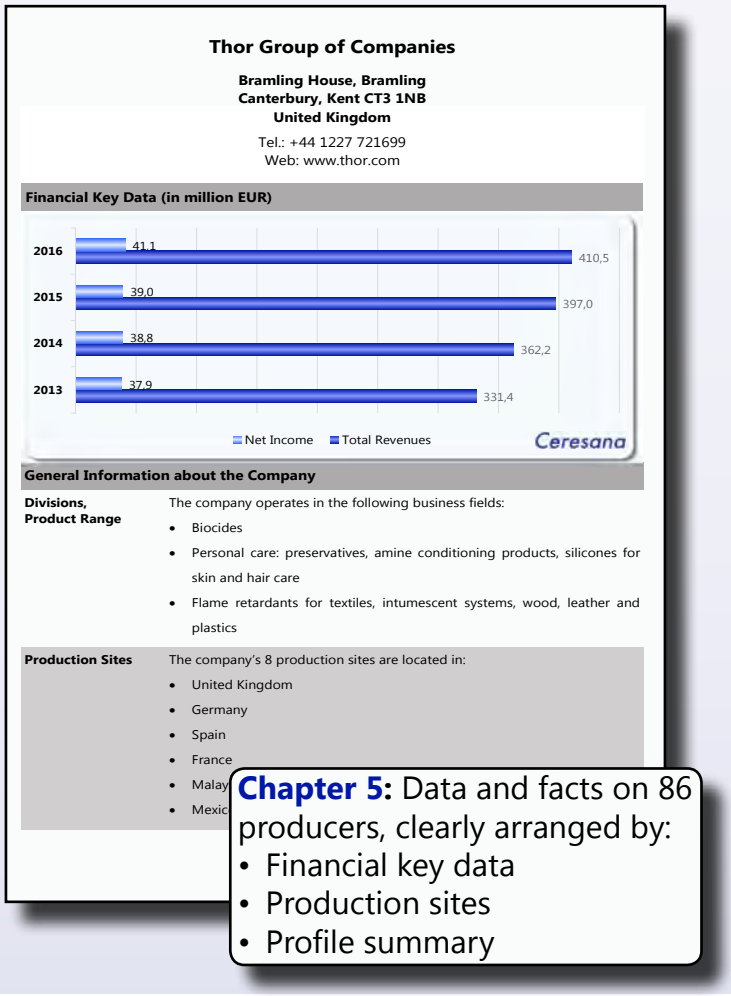
This group includes products based on chlorine compounds, bromine compounds, and iodine compounds. Their main field of application is the water treatment sector, followed by disinfectants, the paper industry, and paints and varnishes. Given the broad product portfolio, they are also utilized in most of the other applications for biocidal products, albeit in relatively small quantities. The most common types of halogenated compounds are: Chloroisocyanurates, Sodium bromide, 2-Bromo-2-nitropropane-1,3-diol, 1,3-Dichloro-5,5-dimethyl hydantoin, 1-Bromo-3-chloro-5,5-dimethyl hydantoin, 1,3-Dibromo-5,5-dimethyl hydantoin, 3-Iodo-2-propynylbutyl carbamate, Povidone-iodine, and 2,2-Dibromo-3-nitrilopropionamide.

in million USD	2008	201
Western Europe	XXX	XX
Eastern Europe	XXX	XX
North America	XXX	XX
South America	XXX	XX
Asia-Pacific	XXX	XX
Middle East	XXX	XX
Africa	XXX	XX
Total	**XXX**	**XX**

Table: Global revenues generated with biocides based on halogenated compounds in million USD from 2008 to 2024 – split by regions

Until 2016, global revenues generated with biocides based on halogenated compounds increased to USD XXX billion. Revenues will increase by, on average, XXX% p.a. during the upcoming eight year period and amount to USD XXX billion in 2024. In 2016, Asia-Pacific reached a market value of USD XXX billion, accounting for the largest share of...

Chapter 4: Revenues split by biocides based on:
- Halogenated compounds
- Metallic compounds
- Organosulfur compounds
- Nitrogen compounds
- Phenolic compounds
- Other biocides



Thor Group of Companies

Bramling House, Bramling
Canterbury, Kent CT3 1NB
United Kingdom

Tel.: +44 1227 721699
Web: www.thor.com

Financial Key Data (in million EUR)

General Information about the Company

Divisions, Product Range

The company operates in the following business fields:

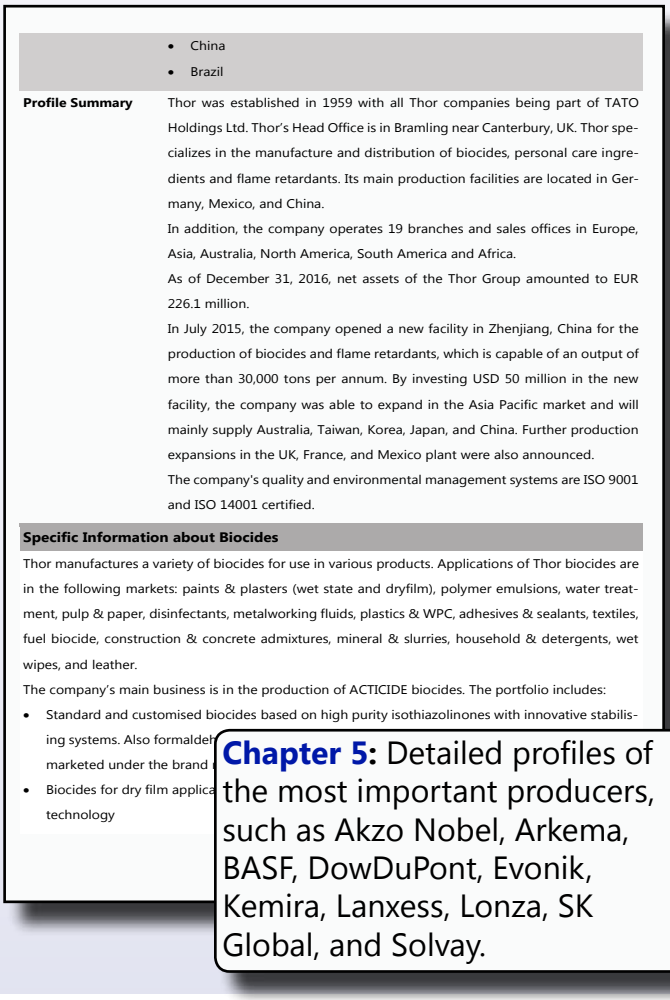
- Biocides
- Personal care: preservatives, amine conditioning products, silicones for skin and hair care
- Flame retardants for textiles, intumescent systems, wood, leather and plastics

Production Sites

The company's 8 production sites are located in:

- United Kingdom
- Germany
- Spain
- France
- Malay
- Mexic

Chapter 5: Data and facts on 86 producers, clearly arranged by:
- Financial key data
- Production sites
- Profile summary



- China
- Brazil

Profile Summary

Thor was established in 1959 with all Thor companies being part of TATO Holdings Ltd. Thor's Head Office is in Bramling near Canterbury, UK. Thor specializes in the manufacture and distribution of biocides, personal care ingredients and flame retardants. Its main production facilities are located in Germany, Mexico, and China.

In addition, the company operates 19 branches and sales offices in Europe, Asia, Australia, North America, South America and Africa.

As of December 31, 2016, net assets of the Thor Group amounted to EUR 226.1 million.

In July 2015, the company opened a new facility in Zhenjiang, China for the production of biocides and flame retardants, which is capable of an output of more than 30,000 tons per annum. By investing USD 50 million in the new facility, the company was able to expand in the Asia Pacific market and will mainly supply Australia, Taiwan, Korea, Japan, and China. Further production expansions in the UK, France, and Mexico plant were also announced.

The company's quality and environmental management systems are ISO 9001 and ISO 14001 certified.

Specific Information about Biocides

Thor manufactures a variety of biocides for use in various products. Applications of Thor biocides are in the following markets: paints & plasters (wet state and dryfilm), polymer emulsions, water treatment, pulp & paper, disinfectants, metalworking fluids, plastics & WPC, adhesives & sealants, textiles, fuel biocide, construction & concrete admixtures, mineral & slurries, household & detergents, wet wipes, and leather.

The company's main business is in the production of ACTICIDE biocides. The portfolio includes:

- Standard and customised biocides based on high purity isothiazolinones with innovative stabilising systems. Also formaldeh
  marketed under the brand
- Biocides for dry film applica
  technology

Chapter 5: Detailed profiles of the most important producers, such as Akzo Nobel, Arkema, BASF, DowDuPont, Evonik, Kemira, Lanxess, Lonza, SK Global, and Solvay.

This study is useful for:

- Manufacturers and distributors of biocides
- Manufacturers and processors active in the following areas: disinfectants (sanitary products, cleaning lotions, disinfectant sprays, all-purpose cleaners and antibacterials), paper, paints and varnishes, products for water treatment, plastics, adhesives and sealants, textiles, leather, rubber, lubricants
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- Automotive Plastics - World
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Bio-Economy

- Biobased Packaging - World
- Bioplastics - World
- Polylactic Acid (PLA) - World
- Starch Based Plastics - World

Chemicals

- Biocides - World
- Carbon Black - World
- Chelating Agents - World
- Fillers - Europe
- Fillers - World
- Flame Retardants - World
- Pigments - World
- Plastic Additives - World
- Plasticizers - World
- Solvents - World
- Stabilizers - World
- Surfactants - World
- Titanium Dioxide (TiO2) - World

Industry

- Adhesives - Europe
- Adhesives - World
- Insulation Material - Europe
- Insulation Material - World
- Paints & Coatings - Europe
- Paints & Coatings - World
- Plastic Extrusion - Europe
- Plastic Injection - Europe
- Plastic Pipes - Europe
- Plastic Pipes - World
- Plastic Windows - World
- Printing Inks - Europe
- Printing Inks - World
- Windows & Doors - Europe

Plastics

- Composites (CFRP & GFRP) - World
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- Expandable Polystyrene (EPS) - World
- Masterbatches - World
- Plastics - Europe
- Plastics - World
- Polyethylene (HDPE) - World
- Polyethylene (LDPE) - World
- Polyethylene (LLDPE) - World
- Polypropylene - World
- Polystyrene & EPS - World
- Polyvinyl Chloride (PVC) - World
- Silicones - World
- Synthetic Rubber - World
- Thermoplastic Elastomers (TPE) - World

Packaging

- Bags, Sacks & Pouches - Europe
- Bags, Sacks & Pouches - World
- Corrugated Board & Solid Board - Europe
- Flexible Packaging - Europe
- Food Packaging - Europe
- Labels - Europe
- Plastic Caps & Closures - Europe
- Plastic Caps & Closures - World
- Plastic Containers - Europe
- Plastic Films - Europe
- Plastic Films - World
- Plastic Packaging for Cosmetics - Europe
- Rigid Metal Packaging - Europe
- Rigid Plastic Packaging - World

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