Plant-Derived Chemicals, a new study from The Freedonia Group, provides you with an in-depth analysis of major trends in the industry and the outlook for product segments and major markets -- critical information to help you with strategic planning.

This brochure gives you an indication of the scope, depth and value of Freedonia’s new study, Plant-Derived Chemicals. Ordering information is included on the back page of the brochure.

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Demand for plant-derived chemicals in the US is projected to advance 7.1 percent per annum, including price increases, to $2.9 billion in 2005.

Growth will be driven by the development of new plant-based pharmaceuticals and gains in the beverage market, where consumer preferences continue to shift away from carbonated soft drinks toward alternative beverages with natural flavor loadings.

Botanical extracts to register the fastest growth, although this represents a slowing from the torrid pace of the past decade when nutraceuticals first moved from the niche market of health food stores to the shelves of superstores and other mass market retailers.

The best market opportunities will be in newly developed products, especially those with health or appearance benefits.

The top six producers of plant-derived chemicals accounted for roughly one-fifth of US sales in 1999. These firms were Indena, Hercules, AM Todd, SKW Trostberg (E.ON), Sunkist and Rhodia.

* Commodity chemicals derived from plants, such as starches, oils and fatty acids, are excluded from the scope of this study, as are chemicals produced through fermentation or which go through significant synthetic processing before being used.
### Plant-Derived Chemicals Demand

(million dollars)

<table>
<thead>
<tr>
<th>Item</th>
<th>1995</th>
<th>2000</th>
<th>2005</th>
<th>2010</th>
<th>00/95</th>
<th>05/00</th>
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<td>Nondurable Goods Shpts (bil 1996$)</td>
<td>1636</td>
<td>1774</td>
<td>1938</td>
<td>2117</td>
<td>1.6</td>
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<td>lb plant chem/mil $ nondurables</td>
<td>298</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Plant-Derived Chem Demand (mil lb)</td>
<td>487</td>
<td>650</td>
<td>840</td>
<td>1080</td>
<td>5.9</td>
<td>5.3</td>
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<tr>
<td>$/lb</td>
<td>2.84</td>
<td>3.14</td>
<td>3.43</td>
<td>3.76</td>
<td>2.0</td>
<td>1.8</td>
</tr>
<tr>
<td>Plant-Derived Chemicals Demand</td>
<td>1385</td>
<td>2040</td>
<td>2880</td>
<td>4065</td>
<td>8.1</td>
<td>7.1</td>
</tr>
<tr>
<td>Essential Oils</td>
<td>518</td>
<td>711</td>
<td>943</td>
<td>1240</td>
<td>6.5</td>
<td>5.8</td>
</tr>
<tr>
<td>Gums, Gels &amp; Polymers</td>
<td>391</td>
<td>525</td>
<td>689</td>
<td>886</td>
<td>6.1</td>
<td>5.6</td>
</tr>
<tr>
<td>Botanical Extracts</td>
<td>284</td>
<td>511</td>
<td>843</td>
<td>1380</td>
<td>12.5</td>
<td>10.5</td>
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<tr>
<td>Other</td>
<td>192</td>
<td>293</td>
<td>405</td>
<td>559</td>
<td>8.8</td>
<td>6.7</td>
</tr>
</tbody>
</table>

% Annual Growth

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Market Environment

The Market Environment Section discusses factors influencing plant-derived chemical demand, including consumer spending and competitive materials.

This information provides you with an understanding and an analysis of the climate in which the plant-derived chemicals industry operates.

Competitive Materials

In most applications, plant-derived chemicals compete against petroleum-derived chemical products as well as low-priced natural products, such as starch; fermentation products, such as lactic acid and xanthan gum; and animal products, such as gelatin. Competition is based on the offsetting criteria of cost, availability, performance, and environmental impact. In general, price volatility and supply uncertainty have limited the competitiveness of plant-derived chemicals, a situation aggravated during the preceding decade by years of low-cost crude petroleum supplies. However, escalating oil prices could eliminate the pricing advantage of petroleum-based synthetics, and health issues concerning the use of bovine byproducts may prompt gelatin users to turn to plant gums, gels and polymers.

Advantages offered by plant-derived chemicals include derivation from renewable supplies and positive environmental image. With names that are more familiar than long chemical nomenclature, such ingredients as aloe and chamomile tend to be more positively perceived by consumers.

Despite such advantages, plant-derived chemicals face challenges in the market place from synthetic alternatives due to supply uncertainties, volatile prices, inconsistencies inherent in natural products, and proposed changes in FDA labeling requirements in the large volume food and beverage market. For example, while “natural” flavor materials account for the majority of flavors consumed in foods and beverages, the FDA may restrict use of the "natural" label, eroding the edge currently enjoyed by natural flavor materials. As these labeling requirements are tightened, some food processors may reassess the value of the natural label, given the increased difficulty and expense associated with maintaining it, and use of flavor blends in which natural flavors are diluted with less costly synthetic flavor...
**Ginseng**

Demand for ginseng is expected to expand at a rate of 8.4% per annum to reach $27 million in 2005. Growth reflects several widely accepted health benefits which will lead to expanding uses in single and multiple dietary supplements, functional foods and beverages, and specialized nutritional preparations. Ginseng’s reputation as an energy-boosting agent will especially benefit demand by extending opportunities to include nutraceutical beverages aimed at the elderly, athletes and exercise-active adults. Value gains will be moderated by declining prices as end users exert greater pricing pressure on bulk materials, and supplies of ginseng catch up with demand, barring unforeseen supply interruptions.

Ginseng’s current popularity as a nutraceutical is attributable to its apparent actions involving stress and disease resistance, enhanced sexual potency and heightened physical and mental activities, although verification of these benefits by well-controlled clinical studies remains to be completed. Panax varieties sourced in China and Korea are regarded as the most effective forms of this herb. A less expensive type, derived from Siberian root, is considered to be less beneficial to overall health and wellness. The US grows a substantial portion of the ginseng it consumes, although imports from China grew rapidly between 1995 and 2000. The US also exports ginseng, with more than half being destined for Hong Kong.

Ginseng serves as an ingredient in numerous branded and private label dietary supplements sold in the US. One top-selling brand is marketed by Pharmaton (Boehringer Ingelheim) under the GINSANA label. Containing panax ginseng, GINSANA is promoted as an all-natural daily supplement which aids in the absorption and use of oxygen by the body for increased physical energy. A related product, GINSANA SPORT, contains a higher level of ginseng which is claimed to shorten recovery time after exercise and to allow for longer workouts by lowering the heart rate and blood lactate levels.

---

**Peppermint Oil Demand**

(million dollars)

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Resident Population (mil persons)</td>
<td>249.5</td>
<td>262.8</td>
<td>275.1</td>
<td>287.6</td>
<td>299.7</td>
</tr>
<tr>
<td>lb oil/000 capita</td>
<td>13.2</td>
<td>16.7</td>
<td>19.6</td>
<td>22.6</td>
<td>26.0</td>
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<tr>
<td>Peppermint Oil Demand (mil lb)</td>
<td>3.3</td>
<td>4.4</td>
<td>5.4</td>
<td>6.5</td>
<td>7.8</td>
</tr>
<tr>
<td>$/lb</td>
<td>13.33</td>
<td>12.95</td>
<td>12.59</td>
<td>12.31</td>
<td>12.18</td>
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<tr>
<td>Peppermint Oil Demand</td>
<td>44</td>
<td>57</td>
<td>68</td>
<td>80</td>
<td>95</td>
</tr>
<tr>
<td>Food &amp; Candy</td>
<td>35</td>
<td>46</td>
<td>54</td>
<td>61</td>
<td>71</td>
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<tr>
<td>Other</td>
<td>9</td>
<td>11</td>
<td>14</td>
<td>19</td>
<td>24</td>
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<tr>
<td>net exports</td>
<td>53</td>
<td>70</td>
<td>80</td>
<td>101</td>
<td>127</td>
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<tr>
<td>Peppermint Oil Production</td>
<td>97</td>
<td>127</td>
<td>148</td>
<td>181</td>
<td>222</td>
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</table>

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The Markets Section analyzes trends and considers the threats and opportunities in each of the major markets for plant-derived chemicals.

The information presented will help you:

- Focus your sales and marketing efforts on high growth areas.
- Propose new areas for development.

**Plant-Derived Chemicals Demand**

Total demand for plant-derived chemical products in the US nutraceutical products market is expected to grow 8.8 percent per year to $391 million in 2005, driven by expanding scientific evidence of health benefits. Opportunities for bulk nutraceuticals vary by product group, but several trends will impact favorably on demand. Aging of the resident population and a growing trend toward self treatment will continue to boost US sales of dietary supplements and other herbally-enriched food and beverages offering to promote health and prevent disease. Compounds with broad health benefits, such as ginkgo biloba and ginseng, will account for the best growth opportunities. However, advances are expected to slow from the double-digit levels of the 1990s as consumers become more informed about the efficacy (or lack thereof) of certain botanically-derived products and purchasing power weakens the increasing acceptance of dietary supplements. Manufacturers of single vitamin products are following the success of brands of multivitamins, which offer a stronger market entry point. For example, an increasing number of private label brands competing in the US nutraceutical products market are extending their product lines into performance-enhancing products like St. John's wort. The competition for sales is becoming more intense, and manufacturers are increasingly focusing on high value-added combination products which offer more specific benefits, target certain user groups and are harder to copy. For example, in the year 2000, Natrol introduced PC CARE, a blend of eight herbs designed to promote prostate health in men. Other strategies designed to differentiate products include the use of unique delivery systems, such as transdermal patches for St. John's wort.

**Cosmetics & Toiletries: Plant-Derived Chemicals Demand**

(million dollars)

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Cosmetics &amp; Toiletries Shpts (bil $)</td>
<td>19.8</td>
<td>22.7</td>
<td>30.9</td>
<td>37.0</td>
<td>44.1</td>
</tr>
<tr>
<td>$ plant chem/000 $ C&amp;T</td>
<td>10.6</td>
<td>11.4</td>
<td>11.6</td>
<td>12.1</td>
<td>12.5</td>
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<tr>
<td>Cosmetics &amp; Toiletries Market</td>
<td>210</td>
<td>260</td>
<td>358</td>
<td>448</td>
<td>552</td>
</tr>
<tr>
<td>Perfume</td>
<td>99</td>
<td>117</td>
<td>145</td>
<td>175</td>
<td>208</td>
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<tr>
<td>Skin Care Products</td>
<td>72</td>
<td>93</td>
<td>145</td>
<td>190</td>
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<tr>
<td>Other</td>
<td>39</td>
<td>58</td>
<td>68</td>
<td>83</td>
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<td>By Type:</td>
<td></td>
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<tr>
<td>Essential Oils</td>
<td>107</td>
<td>125</td>
<td>156</td>
<td>190</td>
<td>226</td>
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<tr>
<td>Botanical Extracts</td>
<td>46</td>
<td>57</td>
<td>78</td>
<td>106</td>
<td>145</td>
</tr>
<tr>
<td>Other</td>
<td>57</td>
<td>76</td>
<td>124</td>
<td>152</td>
<td>181</td>
</tr>
<tr>
<td>% cosmetics &amp; toiletries</td>
<td>21.8</td>
<td>18.6</td>
<td>17.5</td>
<td>15.6</td>
<td>13.6</td>
</tr>
<tr>
<td>Total Plant-Derived Chemicals</td>
<td>964</td>
<td>1385</td>
<td>2040</td>
<td>2880</td>
<td>4065</td>
</tr>
</tbody>
</table>
Industry Structure

Gain a better understanding of your competition and analyze your company’s position in the industry with information about:

- market share
- competitive strategies
- manufacturing
- marketing & distribution
- acquisitions & divestitures
- cooperative agreements

INDUSTRY STRUCTURE

Manufacturing - Raw Materials

Finding a consistent and reliable source of plant raw materials is critical to the success of any plant-derived chemical producer. Most companies buy their raw materials from a variety of growers, collectors and brokers. Raw materials for botanicals are found worldwide, with some of the most important materials coming from developing regions of the world. As a result, the US runs a considerable trade deficit in plant-derived chemicals. Producers do import a considerable amount of unfinished materials and then sold to domestic end users or re-exported.

SAMPLE PAGE

Many products are derived from plants with limited growing regions, which makes output susceptible to the vagaries of weather, disease and politics. For instance, supplies of rose oil from Bulgaria, at one time the leading world supplier, were severely reduced after the collapse of communism in Eastern Europe, and did not recover until the end of the 1990s; and Vietnam’s ban in 1997 on exportation of sassafras oil initiated a period of price volatility for the oil in the world market. Supply disruptions can have a lingering effect, sending customers seeking alternatives. For example, when the US embargo on Haiti lifted in 1995, demand for amyris, an oil produced only in that country, remained depressed because customers had reformulated their products during the period of unavailability. Even when conditions are favorable, the quality of botanicals can vary from year to year, which causes difficulties in producing standardized products and may result in substantial price changes. These weather and political threats, with their associated price instability, continue to be among the most serious obstacles to the growth of plant-derived chemicals. In addition, as botanical products are expected to continue to experience rapid growth in popularity worldwide, demand pressure...
Company Profiles

The Profiles Section analyzes 41 companies active in the U.S. plant-derived chemicals market. These profiles represent a sampling or cross-section of the types of companies involved in the industry.

Divisions, subsidiaries, joint ventures, etc., are discussed under appropriate parent companies.

Sources for profiles included:

- Information provided by key staff members in the respective companies
- Annual reports
- 10-K reports
- Security analysts reports
- Corporate product literature

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Milan 20139
Italy
39-2-57-4961

Indena USA
1001 Fourth Avenue Plaza, Suite 3714
Seattle, WA 98154
206-340-6140

Indena is a leading worldwide supplier of botanical derivatives for pharmaceutical, cosmetic and health food applications. The privately-held company, which is owned by IdB Holding, sources botanicals throughout the world and uses advanced extraction and isolation techniques to produce its extracts. In addition, Indena has activities in plant cultivation in order to ensure a supply of botanical raw materials. In 1999, the Company had sales of $190 million, of which nearly 90 percent, or approximately $170 million, were to markets outside of Italy. Indena employed 700 in 1999. (Sales and employment as reported by company.)

The Company is active in the US primarily through its Indena USA subsidiary. Indena USA was the leading supplier of plant-derived chemicals to the US market in the year 2000. The company’s leadership position reflects its strength as a supplier to the pharmaceutical, cosmetic and health food industries of a wide variety of plant-derived products, including standardized extracts, selected active principles, semi-synthetic products and isolated pure products, as well as the PHYTOSOME line of complexes of active principles combined with phospholipids. Indena USA imports both liquid and dry extracts from its parent’s processing plants in Italy, the United Kingdom and France, which have a total annual
Active Organics Incorporated
Aloecorp
Alltech Incorporated
Bayer AG
    H&R Florasynth
    Haarmann & Reimer Corporation
Bell Flavors & Fragrances Incorporated
Cargill Incorporated
    Cargill Citro Pure LP
Chr. Hansen Holding A/S
    Ingredient Technology Corporation
Croda International
Danisco A/S
    Cultor Corporation
Desert Whale Jojoba Company Incorporated
E.ON AG
    Alex Fries Incorporated
    Alfrebro Incorporated
    SKW Trostberg AG
Florida Chemical Company Incorporated
FMC Corporation
    Pronova Biopolymer AS
Hauser Incorporated
    Botanicals International Extracts
    Wilcox Natural Products
    Zuellig Botanical Extracts
Henkel KGaA
    Cognis Corporation
Hercules Incorporated
    Aqualon
    CP Kelco ApS
ICC Industries Incorporated
    Frutarom Meer
Indena SpA
International Flavors & Fragrances Incorporated
    Bush Boake Allen Incorporated
    Laboratoire Monique Remy
International Flora Technologies Limited
    Floratech
International Paper Company
    Arizona Chemical
International Specialty Products Incorporated
    ISP Alginates
    Kelco Alginates
Kalsec Incorporated
Koster Keunen Incorporated
Manheimer (J.) Incorporated
Multiceras SA de CV
Pharmacia Corporation
    Monsanto Company
Polarome International Incorporated
Raisio Group
Rhodia SA
Ross (Frank B.) Company Incorporated
San-Ei Gen FFI Incorporated
Sensient Technologies Corporation
    Dr. Marcus GmbH
    Pointing Holdings Limited
    Universal Foods
    Warner-Jenkinson Company
    Strahl & Pittsch Incorporated
    Sunkist Growers Incorporated
    Superior Natural Oils International Incorporated
    SNOI
TIC Gums Incorporated
Todd (AM) Group of Companies
    Cargill Citro Pure LP
    East Earth Herb
    Folexco
    SunPure Limited
    Zink & Triest
Treatt plc
Triarco Industries Incorporated
    WILD (Rudolf) Group

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Freedonia does not just collect and reprint data; Freedonia develops data. Our analysts thoroughly investigate an industry by extensively interviewing key industry participants and analyzing information from sources such as associations, government and trade literature. Once this research is complete, Freedonia establishes one set of forecasts. All writing, editing and forecasting is done in-house to assure quality and consistency. In cases where data does not exist, Freedonia develops the data based on input/output ratios, bills of materials and flow charts. The following chart summarizes Freedonia’s methodology:
About The Freedonia Group

The Freedonia Group, Inc. is a leading international industry study/database company.

Since 1985, Freedonia has published over 1,600 titles covering areas such as chemicals, coatings and adhesives, building materials, plastics, industrial components and equipment, health care, packaging, household goods, security, and many other industries.

Freedonia has produced a wide variety of titles, including:

- Nutraceuticals
- Food & Beverage Additives
- Flavors & Fragrances
- Natural Polymers

Because Freedonia is a reliable information source, our forecasts are cited in numerous publications such as The Wall Street Journal, Chemical Week, Chemical Market Reporter and The Financial Times.

Advantages of Freedonia Reports

In-house operations
Because all of our staff work at the same location, interaction between analysts and departments provides a strong system of checks and balances.

Consistency
Our Economics Group develops indicators that are used by all analysts. Therefore, every Freedonia study is based on a consistent set of economic assumptions (GDP, food and beverage shipments, resident population, etc.)

Reliable forecasts
Because all of our forecasts consider the environment in which a product or industry is operating, as well as threats and opportunities to the market, Freedonia forecasts are reliable indicators of future performance.

One-on-one interviews
All studies are produced by conducting interviews with key industry participants and end-users.

Proprietary electronic database
Freedonia’s analysts can tap into an extensive in-house electronic database containing corporate literature (including private company information), trade publications, government reports and many other sources of information.

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About Our Customers

Freedonia's clients include major US and international companies in the manufacturing, services, consulting and financial sectors.

Typical purchasers of Freedonia studies:

- Key Executives
- Corporate Planners
- Market Researchers
- Financial Analysts
- Information Centers
- New Product Developers
- Merger & Acquisition Specialists

Since 1985 we have provided research to customers ranging in size from global conglomerates to one person consulting firms. More than 90% of the industrial companies in the Fortune 500 use Freedonia research to help with their strategic planning.

Some of Freedonia’s customers in the market include: Bayer AG, Cargill, Incorporated, Henkel KGaA and Rhodia SA.
Nutraceuticals
US demand for nutraceuticals will grow nearly 7% annually. Herbal and related extracts will grow the fastest based on expanding scientific evidence of health benefits and the rising popularity of alternative medicines. Nutrients and functional additives will also generate strong sales gains, spurred by ongoing advances in the quality of ingredients. This study examines the $1.9 billion US nutraceuticals industry to 2004 and 2009 by type and end-use. It also evaluates market share and profiles key firms.

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Plant-Derived Chemicals - Private Companies Report
Most companies in the $2.1 billion US plant-derived chemicals industry are privately-held niche players. No one firm, public or private, controls a dominant share of the market. Ten private companies, however, each have plant-derived chemical sales of over $25 million. This report profiles over 120 companies (e.g., Aloecorp, Buffalo Color, Frutarom Meer, Indene USA, Kalsec, J. Manheimer, AM Todd, Triarco). The report also forecasts industry demand, analyzes acquisitions, and lists firms by product and location.

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Food & Beverage Additives
Food and beverages additives demand in the US will grow over 5% annually. Natural additives will remain a driving force, affecting all segments including flavors, coloring agents and preservatives. The rapid growth of processed and prepared foods, which typically contain relatively high additive contents, will also contribute to demand. This study analyzes the $4 billion US food and beverage additives industry to 2004 and 2009 by product and market. It also profiles key companies and evaluates market shares.

$3,600

Pharmaceutical Chemicals
US demand for pharmaceutical chemicals will increase 7% annually. Bulk hormones and related agents will see the fastest growth based on new bioengineered compounds for cancer, diabetes and infertility. Respiratory chemicals will also do well spurred by improved asthma and allergy therapies. This study analyzes the $14.6 billion US pharmaceutical chemicals industry to 2004 and 2009 by therapeutic class, regulatory status, and production source. It also presents market share data and profiles key industry players.

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