Chemical Packaging, Production and its Enviro-Reformation

The catalysts and fears that have driven the industry's green progress; the product and package innovations that strive to achieve a level of environmental responsibility; alternative recycling options; and the influence of legislative bodies, trade groups and other stakeholders on the future of the chemical industry will be examined in this report.

Introduction

The chemical industry is inundated with negative connotations – fears associated with human and animal health risks and environmental destruction have persisted for decades. Limited awareness of the impact of these risks has prevented true growth in green substitutions. As technologies, research and developments improve, the chemical industry has begun a drastic transformation. Increased environmental consciousness and greater understanding of the risks associated with chemicals related to health and function has shaped a new industry of organic, natural chemicals and sustainable packaging.

A small number of powerful forces have driven the chemical industry into the 21st century era of green-consciousness. First, the campaign to reduce levels of carbon dioxide and greenhouse gas has played a major role in examining the manufacturing process of chemicals. Second, the need to reduce landfill space and to prevent toxic leakage has created a blossoming market for safe, secure, natural chemical manufacture and sustainable packaging.

Stakeholders in the chemical industry have a powerful influence over sustainable reformation. Legislative bodies, trade groups and regulatory associations have pushed for change and will provide chemical companies the insight to future trends and growth. Understanding the origins and future implications for manufacturers, retailers and packagers is critical in guaranteeing a voice and an influence in the chemical marketplace.

Fears, Uncertainties and other Catalysts Leading to Green Development

The chemical industry has long been a target of health officials, environmental groups and trade organizations. The hazardous composition of chemicals has provoked these groups to promote alternative, consumer-friendly solutions. **A general fear surrounding chemicals and its affect on the eco-system has prompted great reform in recent years.**

The effect of chemicals on human and environmental health continues to be a main factor in the development of organic and natural chemical practices. According to scientists from the National Oceanic and Atmospheric Administration (NOAA), "polybrominated diphenyl ethers (PBDEs), chemicals commonly used in commercial goods as flame retardant since the 1970s, have been found in all United States coastal waters and the Great Lakes […] and have been found in high concentrations in American [citizens]."[1] The affect of chemical storage on groundwater, waste streams and landfills has prompted the need for recyclable, sustainable packaging alternatives.

Creating commercial and industrial chemicals through natural fermentation processes is an example of the developing trends in biotechnology that are supporting the reduction of greenhouse gas and CO2 emissions. One company, Verdezyne (Carlsbad, CA), is working on ways to convert sugar into chemical products. Damien Perriman, Vice President of Business Development, believes his company is about two years away from "having a renewable-based chemical product being manufactured in a 5-10 liter fermentor and producing yields that are meaningful to the industrial chemical industry."[4]

Kurt Bock, Chief Financial Officer at BASF, the world's leading chemical company, recently stated at a Pittsburgh, PA chemical conference "the chemical industry needs to accept responsibility for products. […] The industry needs to better demonstrate that chemistry is part of the solution, not the problem."[2] This is most relevant in the current global battle to combat rising carbon dioxide emissions, saying "it's up to our industry to define the future going forward." The production of chemicals is a large contributor to this CO2 debate, with BASF committing to reduce its CO2 emissions of products sold by 25% by 2020.

Industry & Industry Groups (NAICS)	Carbon Dioxide Emissions (Million Metric Tons)	Share of Total Manufacturing Emissions (Percent)
Chemicals	311.0	22.2
Petroleum	304.8	21.8
Primary Metals	212.8	15.2
Paper	102.4	7.3
Food	94.7	6.8
Nonmetallic Mineral Products	91.1	6.5
All Other Manufacturing Industries	284.3	20.3
Total	**1,401.2**	**100.0**

Source: http://www.eia.doe.gov/oiaf/1605/ggrpt/pdf/industry_mecs.pdf

According to a 2002 Environmental Information Administration study, chemical manufacturing contributes the greatest share to carbon dioxide emission in the manufacturing industry, at 22.2%. This results in 311 million metric tons of carbon dioxide emissions released per year, more than petroleum, metals, paper and other industrial activities. According to the study, the chemical industry's high use of natural gas, electricity, coal and petroleum are cause for the high level of carbon emission.[3] Reducing this impact, through natural and organic manufacturing, alternate energy use and clean gas will be industry drivers over the next decade.

Product & Package Innovations

Alternative manufacturing solutions will be a significant contributor to the future growth of the chemical industry. Adopting clean solutions in industrial, commercial and consumer markets will help alleviate the public pressure on the industry. In a recent survey by US-based Information Resources Inc, roughly 30% of the 22,000 participants said they look for eco-friendly products and packaging, while 40% search specifically for organic products.[5] Biodegradable, renewable, natural and organic products have already gained favor in many markets, including the food and beverage and retail sectors, but are just beginning to gain strength with household, commercial and industrial chemicals. The cleaning industry specifically, according to Information Resources Inc.'s Chief Marketing Officer Andrew Salzman, "has long been the target of green reformation."[6]

10 Keys to Successful Sustainable Packaging

1. Choosing materials for performance and delivery of packaging features.
2. Selecting materials that can be recycled, reused or offer other environmental benefits.
3. Considering design of packaging lifecycle for reuse, refill and long-term loyalty.
4. Packaging that optimizes labeling, printing and associated processes.
5. Creating effective design with cost targets and highly competitive features.
6. Asking: How well does the package provide access to the product?
7. Asking: How well does the package protect contents?
8. Keeping the ingredients/content fresh and intact after use?
9. Determining: How well does the container open after repeated use?
10. Asking: Is there a technique to opening or using the package?

Source: Converting Influence

One example, according to Salzman, is green laundry detergent. Green detergent currently accounts for 2% of the total detergent market, but "the growing demand for biodegradable, nontoxic and plant-based products is reflected in a 66% increase in green product sales during the past year where the overall category sales were flat."[7]

US-household producers Clorox and SC Johnson have began to target the green market. Clorox recently launched its Green Works line of cleaners, said to be "99% made from natural ingredients. Clorox said it will deliver 100% natural cleaning products as soon as they can find raw material sources to make natural-based fragrance and color."[8] SC Johnson, wanting to show consumers their products are environmentally friendly, has started posting their Greenlist logo on product packaging. According to the company, "the Greenlist process rates more than 95% of the raw materials SC Johnson uses, in accordance to their environmental and health profile."[9] These strategies are important in producing eco-friendly chemicals, but many times, the packaging of such products becomes the focus to ensure reduced landfill use, reduced transportation and fuel expenditures and increased human safety.

Chemical packaging is the most important barrier between hazardous substance and human contact.

Ensuring a secure, safe environment is paramount to consumers, retailers and manufacturers alike. There are many new packages that satisfy the safety concerns, in addition to providing a greener footprint. Traditionally, many chemical manufacturers have used pails and drums in transporting their product. While these products have many benefits over competitive materials, there are new products satisfying a large gap in the market – sustainability. Bag-in-box and industrial bulk containers allow for more product-per-package and are collapsible, allowing for reduce landfill space and reduced transportation costs. Ecover, a Belgium-based company, is currently testing a bag-in-box format in their retail laundry detergent products. The detergent, filled in the bag, is placed on the store shelves and is manually filled by consumers, using their own reusable bottles, at the retail outlet. Product price is determined by weight. With this eco-friendly format, the box stays stagnant in the store and the retailer is only required to replace the interior bag. This solution reduces the millions of HDPE jugs normally purchased by laundry detergent users that end up in landfills worldwide. Packaging that reduces waste will ultimately be desired by the 21st century consumer as being environmentally responsible, sustainable and organic.

Sustainable options in plastic packaging are generating a loud buzz in the chemical industry. According to Chemical Business NewsBase, many plastic film manufacturers are "calling on the industry to adopt barrier-film technologies to address issues surrounding sustainability."[10] Barrier films offer a balance of barrier properties, toughness, chemical resistance, softness, flexibility, attractive appearance and good economics in a single film structure and are chemically resistant to most acids, bases, foods, pharmaceuticals and alcohols. Chemical Business NewsBase furthers its claim for sustainability by identifying that "because they weigh less and use less energy to produce, barrier films are friendlier to the environment than heavier materials such as metal, glass or all-plastics packaging." Barrier films, while not a new science, are now being recognized further because of their sustainable benefits.

Barrier films are co-extruded multilayered films containing a layer of plastic resin integrally placed between outer layers of polyolefins.

Other technologies, like nanotechnology, are beginning to take form and can "deliver better oxygen barrier than 10-20 microns of EVOH."[11] Some film companies are taking sustainability "a step further" according to Chemical Business NewsBase. These companies combine biodegradable and renewable features in their products to deliver the most secure and environmentally responsible packaging for chemical products.[12]

Alternative Recycling Options

Despite the innovations in sustainable packaging and organic production, few chemical products can be traditionally recycled due to the hazardous content in the package and the high associated cost with cleaning the package. Fortunately alternatives exist that prevent toxic chemicals from effecting local inhabitants of landfills and recycling facilities. The most common disposal for chemical products is in waste-to-energy facilities, using technologies like incineration, gasification, pyrolysis and anaerobic digestion. These technologies destroy pathogens and toxins at high temperature levels, preventing the toxic makeup from entering the commercial wastewater stream. All waste-to-energy processes convert the product waste to usable energy forms, using combustion that generates electric power.

Scrubbers clean chemical gas emissions by spraying a liquid into the gas stream to neutralize the acids. Fabric filters and electrostatic precipitators remove particles from the emissions. The particles are then mixed with the ash that is removed from the bottom of the waste-to-energy plant's furnace when it is cleaned.

According to the American Plastics Council, **"waste incineration today is one of the cleanest and strictly regulated and monitored industrial activities, producing very small quantities of final waste"** and that "the plastics included in waste enable incinerators to operate without fuel and even generate energy." Although the outcry against waste-to-energy facilities is the amount of pollution emitted, modern facilities drastically reduce this output. According to the Environmental Protection Agency, waste-to-energy facilities are required to use "anti-pollution devices, including scrubbers, fabric filters, and electrostatic precipitators."[13] Alternative waste-to-energy solutions are the most practical and efficient means for chemical producers thriving to reduce their own environmental impact.

Legislators, Trade Bodies and Regulatory Associations Impact on Sustainable Chemistry

The radical transformation to sustainable chemical production and packaging did not occur randomly. Facilitators, including governments, trade groups and regulatory associations have pushed this topic due in large part to consumer pressure. Public outcry over chemical spills and leaks into waste streams and groundwater has provoked legislative change. According to the American Chemistry Council, there are "11 bills pending in eight states to establish green chemistry mandates, 12 bills in 10 states on green cleaning products, and 47 bills in 21 states seeking to ban bisphenol-A (BPA) in consumer products."[14] In the United States, the American Chemistry Council (ACC), Consumer Specialty Products Association (CSPA) and the Soap and Detergent Association (SDA) are three groups that have influenced the green proceedings. The ACC trade group specifies they are "fully on board with the growing green consumer trend and has been setting up dialogues with product manufacturers and retailers on how the industry can contribute on their sustainability journey."[15] Bill Lafield, spokesman for the CSPA stated "the key is not only being environment-friendly but also being effective, how well the product works and what benefit it provides." These organizations are first-line resources for chemical producers and manufacturers, making their influence important.

REACH, the European community regulation on safe chemical use has brought attention to sustainable and organic development in Europe. Unlike trade groups and associations like the SDA and CSPA, REACH has the authority to regulate and is thus a critical entity to closely follow for American chemical manufacturers. The aim of REACH is to "improve the protection of human health and the environment through the better and earlier identification of the intrinsic properties of chemical substances" and to enhance the "innovative capability and competitiveness of the EU chemicals industry."[16] Instituted in 2007, REACH provisions will be phased in over an 11 year period. In REACH, "the main responsibility for chemical safety is placed on the chemical producer or importer (into the EU), not on public authorities or downstream users."[17] This understanding is imperative for all chemical entities looking to establish market share in Europe and is a good representation of possible legislation to come in the United States.

A Call to Action

Following organizations like REACH, ACC, CSPA and SDA will be an integral responsibility of all chemical companies heading into the future. As consumer education and the environmental debate grow, the chemical industry will continue to face tight scrutiny of their products. Maximizing these resources will allow United States businesses to react to the next phase of trends in the industry.

It is clear that conscious decision making is now a priority in the chemical industry. Organic products and sustainable packages have become essential tools for chemical companies. Innovative solutions now exist to make chemicals and chemical interaction more safe and secure. These solutions provide a way to reduce the environmental impact of the industry and satisfy consumer demand. Although instituting such radical formulations may take time, it will prove to be a critical need for businesses to thrive in the 21st century chemical marketplace.

[1] http://ccma.nos.noaa.gov/about/coast/nsandt/pdf/PBDEreport/PBDEreport.pdf
[2] Bewley, Lindsey. "Sustainability is 'recipe' for managing the downturn.(BUSINESS & FINANCE NEWS: UNITED STATES/AMERICAS)(Brief article)." Chemical Week 171.14 (May 18, 2009):
[3] http://www.eia.doe.gov/oiaf/1605/ggrpt/pdf/industry_mecs.pdf
[4] http://www.icis.com/blogs/green-chemicals/2009/08/industrial-biotech-interview-v.html
[5] http://www.icis.com/Articles/2008/02/11/9096925/consumer-industry-increases-sustainability-initiatives.html
[6] http://www.icis.com/Articles/2008/02/11/9096925/consumer-industry-increases-sustainability-initiatives.html
[7] http://www.icis.com/Articles/2008/02/11/9096925/consumer-industry-increases-sustainability-initiatives.html
[8] http://www.icis.com/Articles/2008/02/11/9096925/consumer-industry-increases-sustainability-initiatives.html
[9] http://www.scjohnson.com/environment/growing_1.asp
[10] Chemical Business NewsBase - Plastics News: Film users demand more: lighter, higher performance plastic films take on challenge of sustainability. July 1, 2009
[11] Chemical Business NewsBase - Plastics News: Film users demand more: lighter, higher performance plastic films take on challenge of sustainability. July 1, 2009
[12] Chemical Business NewsBase - Plastics News: Film users demand more: lighter, higher performance plastic films take on challenge of sustainability. July 1, 2009
[13] http://www.eia.doe.gov/kids/energyfacts/saving/recycling/solidwaste/wastetoenergy.html
[14] http://www.icis.com/blogs/green-chemicals/2009/04/us-anti-chemical-campaigns-int.html
[15] http://www.icis.com/Articles/2008/02/11/9096925/consumer-industry-increases-sustainability-initiatives.html
[16] http://ec.europa.eu/environment/chemicals/reach/reach_intro.htm
[17] http://www.chemicalspolicy.org/reach.shtml