

## **Case Study for Industry**

### **Plastics: An American Success Story**

The United States is one of the most successful industrial powers in history, and plastics have been critical to that success. Plastics manufacturing is America's third-largest industry. One million Americans work directly in this industry, producing materials vital to other industries. The plastics industry benefits the American people as well, providing a plethora of goods that are durable, lightweight, inexpensive, and environmentally beneficial.

The plastics industry grew with American industry and helped propel the development of the United States into an industrial giant. At the end of the 19th century industry in the United States saw explosive growth, ignited by improvements like railroad expansion, the rise of electrical power, and the use of scientific investigation to address industrial problems. It was during this period that John Wesley Hyatt invented celluloid, the first man-made polymer.

Developed as a substitute for increasingly rare ivory, celluloid provided a cheaper alternative for expensive items like tortoiseshell brushes, billiard balls, combs, and even linen shirt collars. This revolutionary new product freed manufacturing from the limits of natural resources, which was good for people and good for the environment. An 1878 ad for celluloid proclaimed, "Celluloid [has] given the elephant, the tortoise, and the coral insect respite in their native haunts, and it will no longer be necessary to ransack the earth in pursuit of substances which are constantly growing scarcer."<sup>1</sup>

In 1907 Leo Baekeland invented the first fully synthetic polymer, Bakelite, as a substitute for shellac, another natural material used for electrical insulators. Bakelite also proved extremely versatile and ideal for mass production. Baekeland marketed it as "the material of a thousand uses," and it soon became popular in commercial products like telephones, radios, and jewelry as well as in the electrical machinery that was powering America's industrial growth.

The success of Bakelite led large chemical companies to invest in polymer development. One of these research programs ended a long-running quest for a synthetic substitute for silk. DuPont scientist Wallace Carothers made the breakthrough in 1936 with a polymer that could be spun into fabric: nylon. The public embraced nylon stockings so enthusiastically that scammers in the 1940s tried to pass off once-coveted silk stockings as the real (nylon) thing.

During World War II the plastics industry proved its value to American industry. Fought on battlefields around the globe, the war was also a contest of manufacturing capacity. To win the war American industries searched for materials that could substitute for and improve the performance of scarce natural resources like rubber, metal, wool, wood, and cotton. In all cases plastic provided the answer. Plastics went into war materials of all sorts, from helmet liners, to bomber windshields, to components of the first atomic bomb.

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<sup>1</sup> Quoted in Donovan Hohn, "Moby Duck, or, the Synthetic Wilderness of Childhood," *Harper's Magazine*, July 2007, p. 62.

World War II proved a boon for the plastics industry. Plastic production tripled between the outbreak of the war and its end in 1945, and growth continued after the war as plastic consumer products flooded the market. The postwar boom of plastic accompanied a postwar surge in the population. This new generation of Americans, the Baby Boomers, grew up in a world of previously unknown material abundance, thanks in large part to inexpensive plastic.

Plastics also provided for many technological advances. Inventions like padded foam dashboards and plastic bicycle helmets improved safety. Lighter cars boosted fuel efficiency. Medicine benefited tremendously from the use of plastic, and plastics made technologies like cell phones and high-powered computers a possibility.

Americans have not always embraced plastics despite their many benefits. Since the days of celluloid, which acquired a reputation of being dangerously flammable, people have looked at unfamiliar materials with suspicion. Public anxieties continue to shape perceptions of plastics. There is widespread concern that polyvinyl chloride, a common plastic, leaches toxins. Fears abound over bisphenol A (BPA), an additive in some plastics, even though no harmful effects have been proven and the Food and Drug Administration classifies BPA as safe.

The plastics industry is also blamed for waste and litter problems. Anti-waste activists attack plastic packaging without considering the important role it plays in protecting food. Without plastic packaging food prices would increase, and there would be less food available to feed the world's population. Furthermore, activists who target plastic bags often overlook the environmental liabilities of paper bags: the manufacturing and transportation of paper bags consume more energy and produce more air pollution than that of plastic bags.

The environmental benefits of plastics are often ignored by those seeking to limit plastic use. Most of the fossil fuels used to make plastics are by-products of refining that would otherwise be discarded as waste. Because of their light weight compared to other materials like glass or metal, plastics require less fuel to transport. Plastics make vehicles themselves lighter as well, adding to fuel efficiency. Plastics are also excellent insulators. Therefore, they conserve nonrenewable fossil fuels and help reduce emissions of greenhouse gases like carbon dioxide.

Furthermore, the plastics industry has been promoting recycling since the Society for the Plastics Industry proposed the numbered codes for recycling plastics in 1988. Most municipal recycling systems were created as a result of the industry's recommendations.

For the past century plastics have improved the lives of billions through advancements in safety, medicine, transportation, energy efficiency, and technology. Plastics have increased the standard of living and created widespread material prosperity. It would be impossible to imagine our world without plastic, a substance that allows us to "devise materials to meet precise specifications. This is a great step toward the practical mastery of the world we live in."<sup>2</sup>

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<sup>2</sup> Joseph L. Nicholson and George R. Leighton, "Plastics Come of Age," *Harper's Magazine*, August 1942, p. 307.