WHO INVENTED PLASTIC?

Bakelite, the first fully synthetic plastic

40 HOW LONG HAS PLASTIC BEEN AROUND?

New York, 1907. Leo Hendrik Baekeland is doing experiments in his lab. He is a true entrepreneur. As a young man, the talented chemist left his home town of Ghent in Belgium for America, where he developed a photographic paper that immediately made him rich. Now he wants to come up with a man-made substance to replace expensive natural materials.

It is a time of immense scientific and technological progress. Industrialization is in full swing. Medical insights and agricultural advances are resulting in unprecedented population growth. Growing numbers of people need food, clothing, and everyday necessities. But natural resources such as wool, silk, mother-of-pearl, horn, and ivory are often only available in limited quantities; many of them need to be shipped in from the far corners of the earth.

Industry, too, is on the lookout for new materials to build the first cars, new machines, and to electrify the rapidly growing cities. There is particular interest in finding a heat-resistant material to insulate electrical cables. Until this time, shellac, obtained from the secretions of the female lac bug, had been used for this purpose, but 15,000 of these little red bugs need six months to produce just half a kilo of shellac. On top of this, the material requires costly transportation from India and Thailand, where the lac bug lives.

Baekeland, of course, is neither the first nor the only person interested in producing man-made substances. Half a century earlier, in 1839, American Charles Goodyear discovered how to make rubber by combining the natural rubber from tropical trees with sulfur over a hot stove. This made it possible to produce items such as fountain pens, piano keys, tires, and even erasers – removing the need to use bread to rub away errant graphite marks. Rubber also proved to be a good material for the cushions on billiard tables. At that time, billiards was as popular as video games are today and was played all around the world. Billiard balls, however, were made of African ivory. An entire elephant tusk was needed to produce just three of these balls. The hunt was cruel and the prized ivory expensive. In response, an American billiard player offered a large prize in 1864 to anyone who could find a substitute material for billiard balls.

Taking up the challenge, five years later a New York printer by the name of John Wesley Hyatt developed celluloid, which was based on cellulose, plants' cell walls. The new material was sadly not suitable for billiard balls, which knocked too loudly and did not bounce off each other properly. Hyatt therefore didn't win the prize, but he had succeeded in inventing the world's first thermoplastic. Together with his brother, he founded several companies producing items made of celluloid that were previously expensive luxuries, such as knife handles, combs, or costume jewelry. Celluloid did, however, have one major disadvantage. It was extremely flammable.

In 1907, at his private lab in New York, Baekeland senses an opportunity that promises to bring him fame and fortune. He becomes interested in phenol and formaldehyde. These chemicals are common waste products in the chemical industry and available in large quantities. Others before Baekeland had already realized that the two substances combine to form a tar or resin-like mass, but they believed it was simply an annoying by-product that stuck to the test tubes and was of no practical use.

Baekeland takes a systematic approach. He develops a pressure vessel and investigates the effects of temperature and pressure on the mixture. The result? For a long time, nothing happens. Nothing, that is, until he adds a few of the colorless phenol crystals to a pungent formaldehyde solution, heats it to just under 200 degrees Celsius, and pulls out a soft substance from the water that can be pressed into molds and quickly hardens under heat and pressure. The new material has outstanding properties: It does not catch fire, melt, or break, it is durable, and it conducts neither heat nor electricity. It is also inexpensive to produce. Baekeland applies for a patent for this material and calls it Bakelite, after himself. He has discovered the first plastic that does not contain any natural molecules. Bakelite is the first purely synthetic plastic and the predecessor of all modern plastics.

The electrical industry now has an insulating material and the automotive industry has a heat-resistant and durable material. Enriched with textile fibers, Bakelite is also used to make light bulb sockets, loudspeakers, office items, radio housings, light switches, telephones, and handles for pots and pans. As it turns out, it's also an excellent material for billiard balls. Most objects made of Bakelite are typically brown or black, as this plastic darkens and is therefore dyed a dark color during production. In addition, As Bakelite can only be easily removed from rounded molds the objects tend not to have sharp corners or edges. These properties of the new material will strongly influence product design and the tastes of society up until the middle of the twentieth century.

These days, Bakelite is only used where a particularly heat-resistant material is required, for example in pan handles. Other developments have overtaken it, and colorful plastics with even better and more varied properties have largely replaced Bakelite. All of them, however, are based on Baekeland's discovery. And many everyday objects made of Bakelite are now popular collector's items.