

Very light, colorful, and durable, plastic can look great. The long polymer chains are responsible for some of these properties. To make plastic, you take a substance such as ethylene. When you buy it, it is at most 80% to 90% pure, and already contains impurities and undesirable by-products, i.e., unknown chemicals – the **NIAS**. More chemicals are then added to achieve the desired material properties. **Additives** are what we call these wide-ranging substances that are intentionally added to the plastic, embed easily, and dissolve out again just as easily.

Plastic contains over 4,000 different chemicals.

Exposure to sunlight, for example, makes the material fragile and brittle. To protect it, you add **sunscreen agents**. These are free radicals that capture the energy in UV rays by bonding them to form a new substance. It works in a similar way to cat litter poured on oil stains: it perfectly absorbs the oil and bonds to form a soft mass. A bright plastic source material can be dyed to produce colorful bottles, building bricks, figurines, and much more by adding colorants or **pigments**. Colorings can be anything from bright to dark, and all the way to black. Some pigments are toxic, others harmless.

Toxic means poisonous. Even in small quantities, these substances, if ingested over a long period of time, can cause serious diseases such as cancer or disorders of the immune system, and may ultimately be fatal. You'll have seen warnings about **additives** on trucks that carry them: **harmful to the environment, harmful to health, carcinogenic, lethal**. There are

guideline values for added substances in plastics that must not be exceeded. With various studies highlighting the harmful effects of many of these additives, it has become clear in recent years that they must be lowered even further. Increasing numbers of research projects are looking into how **additives** accumulate in the environment through plastic waste and become sources of pollution. Some of them are persistent, which means they remain in the environment for a very long time.

