1.3: Seeing Green

Given the dependence of humans upon a livable environment, it is essential that it be maintained in a healthy state. The maintenance of a healthy environment is commonly termed **sustainability**. In recent years there has been a lot of activity in the area of sustainability. Earlier efforts in the sustainability arena centered around pollution and its effects. Degradation of the environment has been a concern of thoughtful people for many decades. Dating back to the early 1800s and even before, the widespread use of high-sulfur coal for fuel was noted as a cause of bad air quality and impaired visibility in urban areas such as London. Water polluted by pathogenic microorganisms sickened and killed millions of people for many centuries. By the end of World War II, the atmosphere of Los Angeles had become noxious, irritating, and unhealthy due to the presence of ozone and other chemical oxidants, aldehydes, and small particulate matter. In some respects, this condition resembled pollution of the London atmosphere observed earlier, which was a combination of smoke and fog which some called “smog.” So the condition afflicting Los Angeles and a number of similar cities came to be known as smog, but a kind of smog that developed in air having low humidity and exposed to intense sunlight, conditions opposite of those under which London smog was formed. Chemically, the two kinds of smog were totally different in that London smog was in a reducing atmosphere with high concentrations of chemically reducing SO_2 whereas the Los Angeles smog is oxidizing and any SO_2 emitted to it is rapidly oxidized to sulfuric acid.

Concern over deterioration of the environment increased with the 1962 publication of Rachel Carson’s classic book *Silent Spring*,[4] the theme of which was that DDT and other mostly pesticidal chemicals were becoming concentrated through the food chain with the result that birds at the top of the chain, such as eagles and hawks, were producing eggs with soft shells that failed to produce viable baby birds. The implication was that substances harming bird populations might harm humans as well.

By about 1970 it was generally recognized that air, water, and land pollution was reaching intolerable levels. As a result, various countries passed and implemented laws designed to reduce pollutants and to clean up waste chemical sites at a cost that has easily exceeded one trillion dollars globally.

More recently concern over environmental pollution has extended beyond a narrow focus upon pollution and its effects to include the broader area of sustainability. The achievement of sustainability certainly requires avoiding pollution and counteracting its effects. But it also mean maintaining flows of essential materials, energy, food, safe water, healthy air, and the other things that humans and other organisms on Planet Earth require for their survival and well-being.

The term “green” has come to stand for sustainability in its various forms and is used throughout this book. Most of sustainability has to do with matter, and chemistry is the science of matter. It is only natural, therefore, that sustainable chemistry is now known as green chemistry, a discipline that has developed rapidly since about the mid-1990s. This book is about green chemistry. But the practice of green chemistry involves more broadly green science and technology, which are discussed in this book and related to green chemistry.