Chemistry for a Sustainable Future
Reducing energy use and protecting the climate.
Green chemistry innovation provides sustainable product and process alternatives that meet market demands while also enhancing human health and quality of life.

In recent years, 3D printing has emerged. With population growth and rising living standards, the world’s demand for energy will soon outpace mankind’s ability to produce it from fossil fuels. Energy supply, of course, represents only part of the problem. Worldwide use of limited fossil fuel is producing increasing quantities of CO₂, a pollutant that contributes to global warming. As the need to reduce dependency on fossil fuels grows more urgent, sustainable chemistry and green engineering practices become a critical part of the solution. Investing in the development of green products and processes that address society’s energy and environmental challenges represents more than a desire to meet Xerox’s obligation as a corporate citizen. It also makes sense as a business strategy. At XRCC, we have focused on decreasing the carbon footprint of Xerox products and on developing ways of replacing petroleum-based polymers with more sustainable bio-renewable materials for xerographic and 3D printing.

Reducing energy and protecting our environment

Green chemistry innovation provides sustainable product and process alternatives that meet market demands while also enhancing human health and quality of life. At Xerox, we embrace the 12 principles of green or sustainable chemistry that encompass safety, energy efficiency, recyclability and environmental sustainability. With advances in materials chemistry, we can strive for a world in which our energy requirements are delivered sustainably, where usable energy can be produced, stored and then supplied wherever it is needed. We can minimize and remove pollutants from our environment as we create new consumer products that place less of a burden upon our natural resources.

In our efforts to reduce the carbon footprint of the products we offer to customers, we have developed a rapid internal metrics tool that simulates the Life Cycle Analysis (LCA) of a product. The LCA stems from the supply chain, geographical trace and energy footprint for all raw materials and processes. The LCA and sustainable chemistry practices enable us to reduce energy use during manufacturing and decrease the energy consumed by the end use of the product.

Emulsion Aggregation (EA) toner technology, developed at XRCC, represents one example of a successful green initiative. The novel EA manufacturing process used about 35 percent less energy/Kg of toner compared with the conventional toner predecessor. Toner size reduced from 11 to 5.8 microns, or 40 percent lower mass per print page, and produced 68 percent less waste. The printers use 15 percent less energy to make a print because toner chemistry was modified to be more efficient. Xerox integrated “earth smart” features into our global print driver to encourage and automate efficient use of paper through two-sided printing. Replacing single-function devices such as printers and copiers with Xerox multifunction systems also helped our customers to reduce energy use from their document technology by up to 50 percent.

Sustainable materials

The vast majority of polymeric materials are based upon the extraction and processing of fossil fuels, leading ultimately to increases in greenhouse gases and accumulation of non-degradable materials in the environment. Over the past decade, considerable progress has been made to replace petroleum-based polymers with sustainable materials from renewable biomass feedstock that have less of an impact on the environment. XRCC is working to develop bio-based polymers for use in xerographic and 3D printing.

The most prevalent commercial bio-based polymers are polyurethanes and polyester derived from corn, sugar or plant-based oils. Recently, more sustainable monomers from non-food biomass have been advocated, such as from lignocellulose or resenic acids obtained from pulp byproduct, gum sap or unwanted tree stumps. Although there are still challenges to degrade or transform lignocellulose to an economical bio-based monomer, Resenic acids are easily extracted, inexpensive and sustainable with worldwide production in excess of 1.2 million tons annually (mostly from China and Brazil).

Promoting demand of Resenic acids, especially in Brazil, would also encourage less deforestation of the Amazon that represents almost 20 percent of the earth’s oxygen production. The recycling of plastics, such as polyethylene terephthalate, or PET bottles, into bio-based monomers for renewed polymers is another promising avenue to sustainability.

At Xerox, we are exploring the use of biomass feed stocks obtained from the resenic acids coupled with building blocks obtained from recycled PET bottles. Additionally, through XRCC’s University Interaction Programs, our researchers are collaborating with university labs on longer-term solutions to obtain commercially viable biomass feedstock from lignocellulose.

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