Green Chemistry and Engineering

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Introduction

The pharmaceutical industry is continually seeking ways to develop medicines with less harmful side-effects and using processes that produce less toxic industrial waste. Merck and Codexis developed a second-generation green synthesis of sitagliptin, the active ingredient in JanuviaTM, a treatment for type 2 diabetes. This collaboration causes an enzymatic process that reduces waste, improves yield and safety, and eliminates the necessity for a metal catalyst. Early research suggests that the new biocatalysts will be useful in manufacturing other drugs as well. Originally sold under the brand name Zocor[®], the drug, Simvastatin, is a leading prescription for treating high cholesterol. The traditional multistep method to form this medication used large amounts of hazardous reagents and produced an outsized amount of toxic industrial waste within the process. Professor Yi Tang, of the University of California, created a synthesis using an engineered enzyme and a low-cost feedstock. Codex is, a biocatalysts company, optimized both the enzyme and therefore the chemical change. The result greatly reduces hazard and waste, is cost-effective, and meets the needs of customers. Several companies have been working to develop plastics that are made from renewable, biodegradable sources. NatureWorks of Minnetonka, Minnesota, makes food containers from a polymer called polylactic acid branded as Ingeo. The scientists at NatureWorks discovered a method where microorganisms convert cornstarch into a resin that is just as strong as the rigid petroleum-based plastic currently used for containers such as water bottles and yogurt pots. The company is working toward sourcing the raw material from agricultural waste. BASF developed a compostable polyester film called "Ecoflex[®]." they're making and marketing fully biodegradable bags, "Ecovio®, "made of this film alongside cassava and carbonate . Certified by the Biodegradable Products Institute, the luggage completely disintegrates into water, CO2, and biomass in industrial composting systems. The bags are tearresistant, puncture-resistant, waterproof, printable and elastic. Using these bags within the place of conventional plastic bags, kitchen and yard waste will quickly degrade in municipal composting systems. Oil-based "alkyd" paints give off large amounts of volatile organic compounds (VOCs). These volatile compounds evaporate from the paint as it dries and cures and many have one or more environmental impacts. Procter & Gamble and Cook Composites and Polymers created a mixture of soya oil and sugar that replaces fossil-fuel-derived paint resins and solvents, cutting hazardous volatiles by 50 percent. Chempol® MPS paint formulations use these biobased Sefose® oils to exchange petroleum-based solvents and make paint that's safer to use and produces less toxic industrial waste . Sherwin-Williams developed water-based acrylic alkyd paints with low VOCs which will be made up of recycled pop bottle plastic (PET), acrylics, and soyabean oil . These paints combine the performance benefits of alkyds and low VOC content of acrylics. In 2010, Sherwin-Williams manufactured enough of those new paints to eliminate over 800,000 pounds. To explore more realworld examples of green chemistry, visit the US EPA website for summaries of the Presidential Green Chemistry Challenge winners.