

The Petrochemical Industry & Its Influence On Pharmaceuticals

The petrochemical industry makes a variety of products for various applications. The major raw material for petrochemicals is the hydrocarbon molecule, generally several carbons long, primarily derived from petroleum (crude oil) and natural gas. Important petrochemicals include methanol, ethylene, ethanol, propylene, and butadiene. These petrochemicals often undergo intermediate reactions to make functional derivatives by addition of functional oxygen or nitrogen groups to produce major end-use products such as plastics, fibers, paints, rubbers, and very importantly, pharmaceuticals, as shown in Figure 1 below.

These products are of much use to the world, providing a significant contribution to modern life. The transition to a petrochemical-based economy occurred worldwide in industrialized nations during the 1960s. The industry has grown remarkably into a major powerhouse as indicated by Professor Greg Orwig from the University of Washington in 1996:

Production of ethylene, the most versatile of the olefins, is a \$30 billion-a-year business worldwide.

Since oil consumption has been a major political and economic issue from the 1960s on, the petrochemical industry and the related pharmaceutical industry has been closely tied to the price of oil. Fortunately, due to the low cost of petrochemicals, great strides have been made in the medical field in research and production of various drugs and diagnostic products. Table 1 summarizes the petrochemicals and corresponding pharmaceuticals that have come from research in the past half century.

PETROCHEMICAL INTERMEDIATES & DERIVATIVES

MAJOR END USE MARKETS

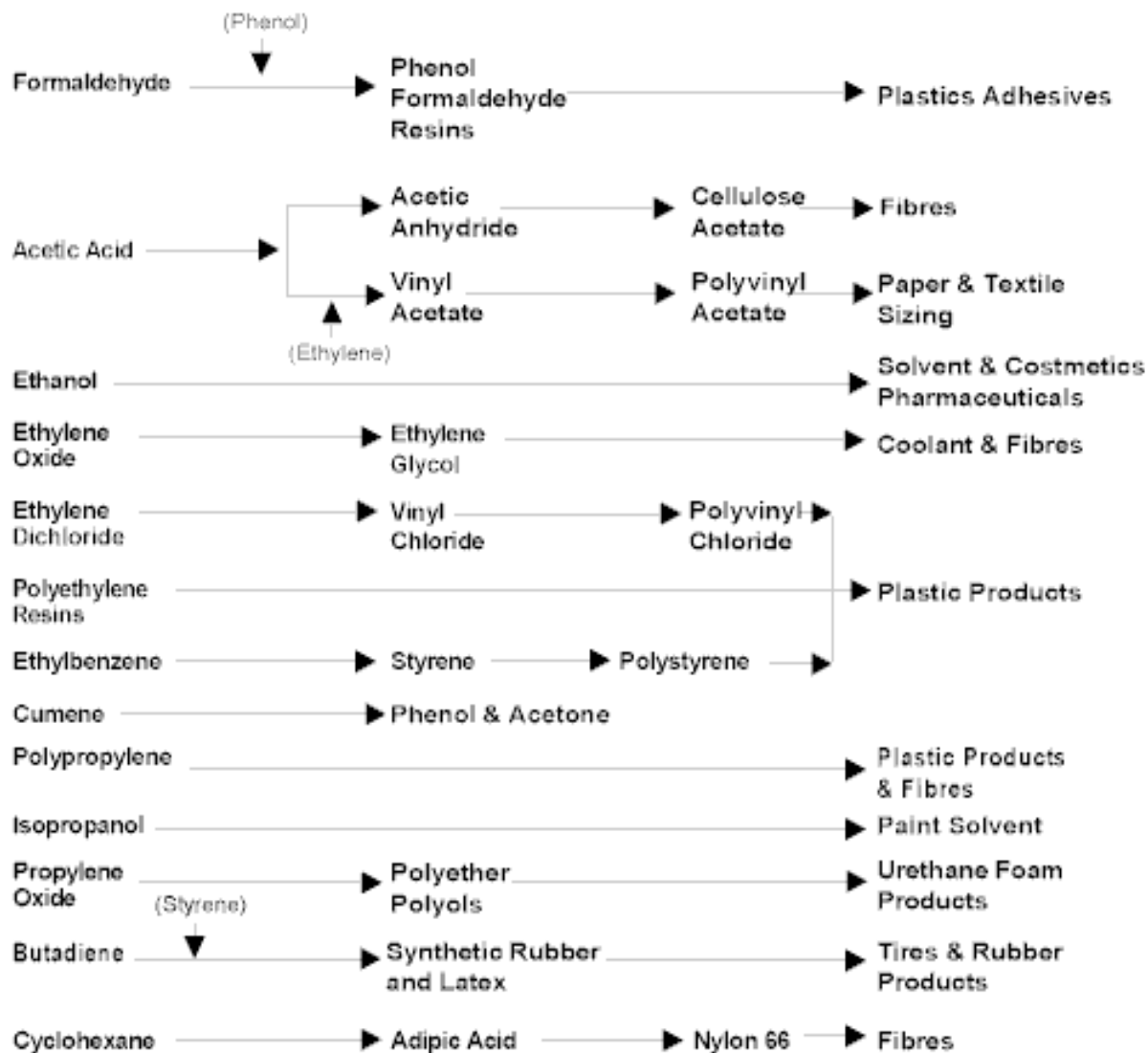


Table 1: Products From Petrochemicals

Table 2: Pharmaceutical Products Derived From Petrochemicals

Petrochemical	Pharmaceutical Product
Phenol, acids and anhydrides, alkanolamines, aldehydes	Analgesics, antihistamines, antibiotics, antibacterials, sedatives, tranquilizers
Esters and Alcohols	Fermentation for antibiotic manufacturing
Polyethylene glycols, hydroxyethyl celluloses and water-soluble ethylene oxide polymers	Tablet Binders and Pill Coatings
Ethanol, polyethylene glycol, phenylpropanolamine	Aspirin, penicillin, cough syrups

In 2000, there were sales of \$390 billion per year worldwide in the pharmaceutical industry. There has been a tremendous improvement in many aspects of life for people all around the world. First, the pharmaceutical industry has provided a host of opportunities for careers around the world, and sprouting new areas of academic disciplines such as biochemical and biomedical engineering. Second, the pharmaceutical industry has increased job opportunities by approximately 11.5% each year from 1970 to 2002. Pharmaceuticals have helped to curb epidemics by developing vaccines and antibiotics for diseases ranging from the common flu to AIDS. Further, pharmaceuticals are, in part, responsible for the 20-year increase in the human lifespan over the past half century; it is likely that this increase will _____ in the years ahead. Although many believe that this trend will slow, there is no evidence of this as noted by Nick Bostrom, the founder of the World Transhumanist Association:

Evidence for an ever-increasing human lifespan -- as a result of advances in medicine and improvements in quality of life -- is quite impressive. Not only is there mounting statistical evidence for a continued upward trend, there's evidence this trend is actually accelerating.

Unfortunately, developed drugs have also reduced the quality of life for many. One major problem with the recent surge in pharmaceuticals is patient addiction to their “better state of mind”, a result of chemical alterations in the human body. The most

commonly abused drugs include antidepressants such as Zoloft and painkillers such as Hydrocodone (vicodin, lorcet, tussionex, norco). Besides drug abuse, the process of producing these drugs causes environmental damage due to production of 133 million tons of CO₂ emissions (approximately 3% increase in a decade) and large amounts of liquid waste streams. Disposal of such biohazardous waste is very difficult.

Because of the boom of the pharmaceutical industry (an average of 10 filled prescriptions per person in the United States per year), medicine and improved health have become much more accessible for millions of people across the globe. With this new power in the patients' hands, the industry has to be careful because new drugs can easily be abused when put in the wrong hands. Such abuse is becoming a serious problem for pharmaceutical companies and government alike. As released by the Tufts Center for the Study of Drug Development, the average cost to develop a new prescription drug has reached \$802 million. This number is a stark increase from the \$231 million it took in 1987. Because of this huge investment required by the drug companies, the prevention of abuse has become a top priority and transformed into making such pharmaceuticals more expensive thus requiring Medicare plans to allow patients to pay for them. These consequent problems were seen by a 13% increase in prescription drug cost by the average patient over the past 5 years. Even Medicare beneficiaries are estimated to spend \$860 out-of-pocket per year on prescription drugs. This cost is much too high since most Medicare beneficiaries are age 65 and older – thus bringing the topic of drug abuse in the wrong hands as a top priority for the government, so that the injustices presented to the elderly citizens can be eliminated.

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