

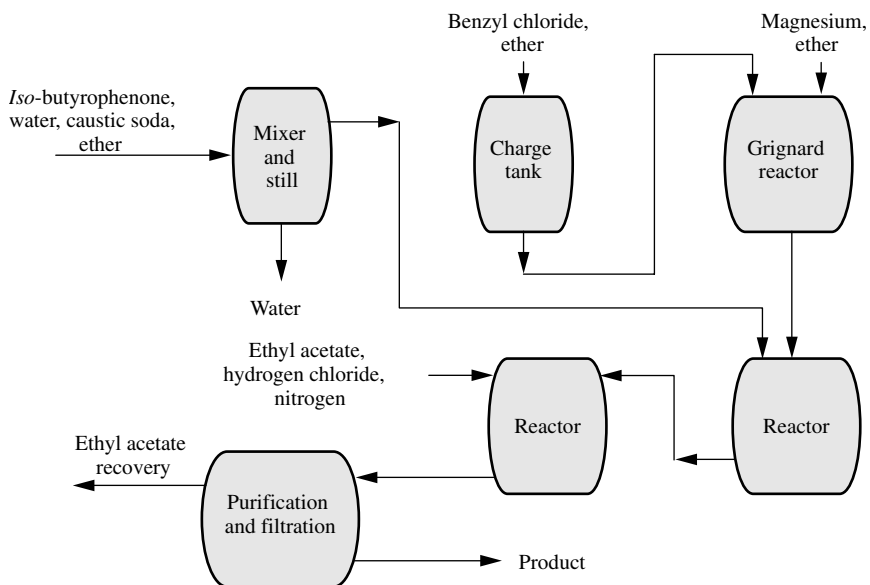
DARVON

Darvon®, *d*-propoxyphene hydrochloride, is a synthetic, nonantipyretic, orally effective analgesic, with similar pharmacological activity and effects to codeine. Darvon is not a narcotic but can be substituted for codeine, and is useful in any condition associated with pain. Chemically, this analgesic is not analogous to codeine or to morphine.

Darvon® is a stronger analgesic than aspirin but has no antipyretic effects. It is sometimes taken in combination with aspirin and acetaminophen. It has widespread use for dental pain since aspirin is relatively ineffective, but it is not useful for deep pain.

The manufacture of Darvon (Fig. 1) starts with relatively simple chemicals, but consists of many steps :

1. Formation of a ketone from propiophenone and paraformaldehyde
2. Coupling the ketone with benzyl chloride, using the Grignard reaction (and decomposition)
3. Resolution of the optical isomers by the use of *d*-camphorsulfonic acid in acetone
4. Splitting off the *d*-camphorsulfonic acid by using ammonium hydroxide and conversion of the desired α -dextro isomer to the hydrochloride; only the dextro isomer is active as an analgesic
5. Esterification of the α -dextro isomer with propionic anhydride
6. Isolation
7. Filtration
8. Drying

**FIGURE 1** Manufacture of Darvon.

DETERGENTS

Detergents have water-attracting (hydrophilic) groups on one end of the molecule and water-repelling (hydrophobic) groups on the other.

Detergents have been divided into four main groups: anionic detergents, cationic detergents, nonionic detergents, and amphoteric detergents. The largest group consists of the anionic detergents, which are usually the sodium salts of an organic sulfate or sulfonate. Detergents can be formulated to produce a product of the desired characteristics, ranging from maximum cleaning power, maximum cleaning/unit of cost, to maximum biodegradability. Usually commercial products are a compromise of the various desirable properties.

In a process to produce a detergent containing a sulfur acid function, the alkylbenzene is introduced continuously into the sulfonator with the requisite amount of oleum (Fig. 1) to control the heat of sulfonation conversion and maintain the temperature at about 55°C. Into the sulfonated mixture is fed

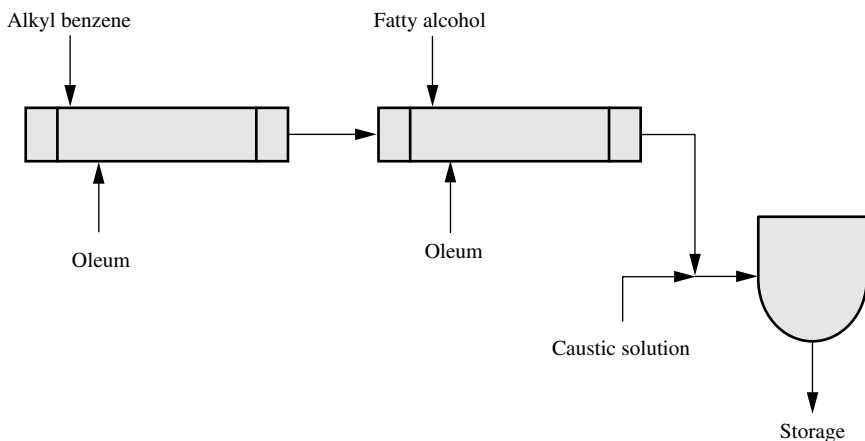


FIGURE 1 Manufacture of detergents by continuous sulfonation-sulfation.

the fatty tallow alcohol and more of the oleum. All are pumped through the sulfater, also operating on the dominant bath principle, to maintain the temperature at 50 to 55°C, thus manufacturing a mixture of surfactants. The sulfonated-sulfated product is neutralized with sodium hydroxide solution under controlled temperature to maintain fluidity of the surfactant slurry. The surfactant slurry is conducted to storage.

Detergents can be manufactured by other routes (Fig. 2), although the sulfonation-sulfation process appears to be the most popular.

Detergent builders are those chemicals that must be added to the detergent to sequester or complex the ions.

The first important commercial builder was sodium tripolyphosphate,

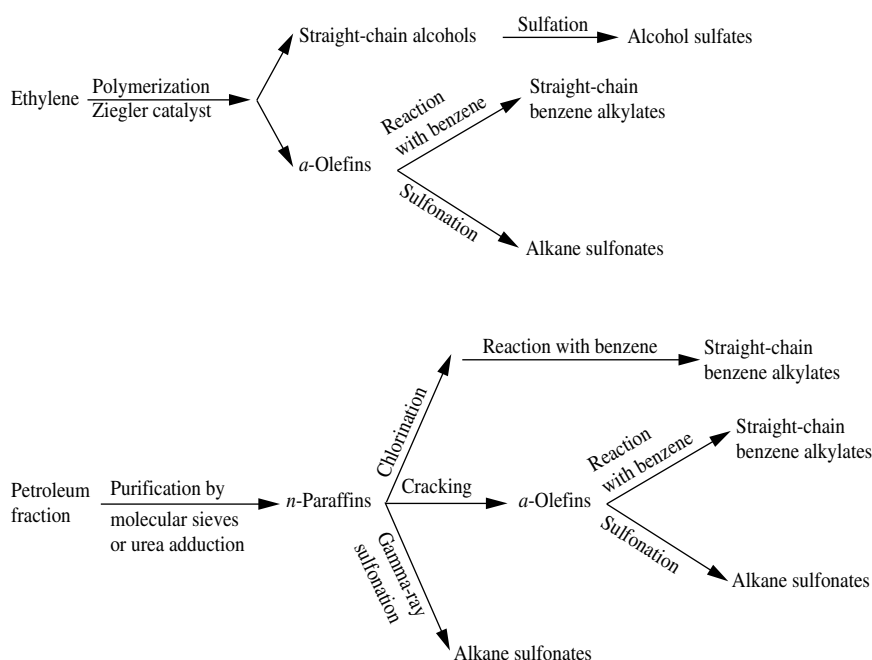


FIGURE 2 Alternate routes to detergent manufacture.

$\text{Na}_5\text{P}_3\text{O}_{10}$, first used with Tide[®] detergent in 1947. In the late 1960s phosphate builders came to be seen as an environmental problem. Phosphates pass unchanged through sewage works and into rivers and lakes. Since they are plant nutrients they cause blue-green algae to grow at a very fast rate on the surface, causing oxygen depletion (*eutrophication*). The search for phosphate substitutes began, and some states banned their use.

Ethylenediaminetetraacetic acid (EDTA) is a good sequestering agent but its cost is excessive. Nitrilotriacetate is effective but has been suggested to be teratogenic and carcinogenic. Sodium citrate is harmless but does not work well. Benzene polycarboxylates are expensive and are not biodegradable. Sodium carbonate is not successful in hard water areas. Commercial use of zeolites and poly- α -hydroxyacrylate is just beginning. Sodium sulfate occurs as a by-product of any sulfate or sulfonate detergent, but has limited use as a builder, as does sodium silicate. The present breakdown of builders used in detergents is sodium carbonate, 40%; sodium tripolyphosphate, 31%; sodium silicate, 9%; zeolites, 7%; sodium citrate, 3%; and other, 10%.

DIAZEPAM

*See **Benzodiazepines**, **Valium**.*

DIAZODINITROPHENOL

See Explosives.

DIETHYLENE GLYCOL

Diethylene glycol is produced as a by-product, along with triethylene glycol, in the manufacture of ethylene glycol from hydrolysis of ethylene oxide.



It is separated from the ethylene glycol and from triethylene glycol by vacuum distillation.

Diethylene glycol is used in the manufacture of polyurethane resins, unsaturated polyester resins, antifreeze blending, triethylene glycol, morpholine, and natural gas dehydration.

See Ethylene Glycol and Triethylene Glycol.

DIETHYL SULFITE

See Sulfurous Acid.

DIHYDROXYACETONE

Dihydroxyacetone ($\text{HOCH}_2\text{COCH}_2\text{OH}$, melting point: 89°C) is made by the action of sorbose bacterium fermentation of glycerin ($\text{HOCH}_2\text{CHOHCH}_2\text{OH}$).

Dihydroxyacetone is an ingredient of suntan lotion that creates an artificial tan. It is also valuable as a chemical intermediate and as a catalyst in butadiene-styrene polymerization.

DIMETHYL SULFITE

See Sulfurous Acid.

DIMETHYL TEREPHTHALATE

Dimethyl terephthalate (melting point: 141°C) is prepared by oxidation of *p*-xylene and subsequent esterification with methyl alcohol (Fig. 1).

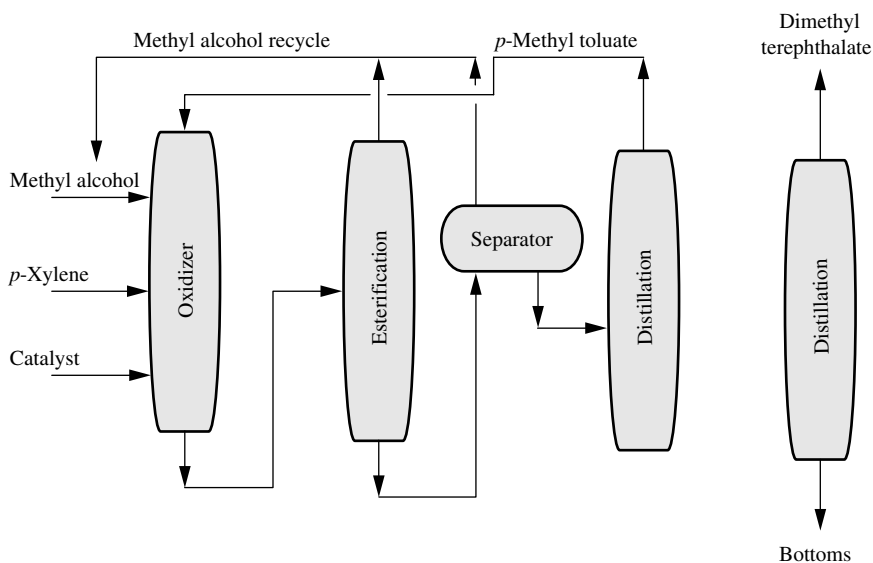
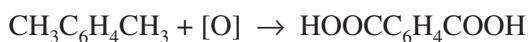
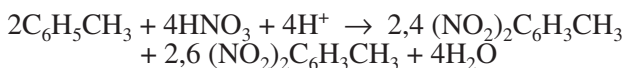


FIGURE 1 Manufacture of dimethyl terephthalate.

2,4- AND 2,6-DINITROTOLUENE

The dinitrotoluenes [$\text{CH}_3\text{C}_6\text{H}_3(\text{NO}_2)_2$] are manufactured by the nitration of toluene that gives a mixture containing 65 to 80% of the 2,4-dinitro derivative and 20 to 35% of the 2,6-dinitro compound.



If the pure 2,4-compound is required, mononitration of toluene followed by separation of pure *p*-nitrotoluene from the ortho isomer, and then further nitration of *p*-nitrotoluene gives the pure 2,4-dinitro isomer.

Nearly all the dinitrotoluenes are hydrogenated to diamines, which are converted into diisocyanates to give toluene diisocyanate, a monomer for polyurethane. A small amount of the dinitrotoluenes is further nitrated to the explosive 2,4,6-trinitrotoluene (TNT).

DIPHENYL ETHER

Diphenyl ether (diphenyl oxide) is obtained as a by-product in the manufacture of phenol from chlorobenzene and caustic soda.



Diphenyl ether is used in the soap and perfume industries because of its great stability and strong geranium-type odor.

DYAZIDE

Dyazide[®], a diuretic, contains both triamterene and hydrochlorothiazide. Triamterene is a diuretic and is known to increase sodium and chloride ion excretion but not potassium ion.

A number of thiazides can be synthesized from appropriate sulfonamides by cyclization with dehydration. Conversion to hydrothiazides increases their activity by a factor of 10.

Dyazide is used in conjunction with a hydrothiazide, which is an excellent diuretic but also gives significant loss of potassium and bicarbonate ions. If the triamterene were not included, potassium chloride would have to be added to the diet. Hydrochlorothiazide is an antihypertensive agent as well but, unlike other antihypertensives, it lowers blood pressure only when it is too high, and not in normotensive individuals.

DYES

A dye is a colored chemical that can impart color to a material or other body on a reasonably permanent basis. Most dyes contain considerable unsaturation, and some part of the dye is usually in the form of aromatic rings with nitrogen unsaturation of several types common to many dyes. The quinoid structure appears frequently, although other dye families are available.

It is possible to classify dyes by using the *Color Index* that classifies dyes according to a dual system. An assigned number defines the chemical class and a generic name identifies the usage of application. However, it is convenient to use the application classification used by the U.S. International Trade Commission for application classes:

1. Acid dyes
2. Azoic dyes
3. Basic dyes
4. Direct dyes
5. Disperse dyes,
6. Fiber-reactive dyes
7. Fluorescent brightening agents
8. Food drug and cosmetic colors
9. Mordant dyes
10. Solvent dyes,
11. Sulfur dyes
12. Vat dyes

Acid dyes derive their name from their insolubility in acid baths. They are used for dyeing protein fibers such as wool, silk, and nylon; also leather and paper.

Azoic dyes, the “ice colors,” are made on the fiber by coupling diazotized materials while in contact with the fibers. Low temperature keeps the diazonium compound from decomposing until ready to couple.

Basic dyes are mostly amino and substituted amino compounds soluble in acid and made insoluble by making the solution basic.

Direct dyes are used to dye cotton directly, that is, without the addition of a mordant.

Disperse dyes are applied to difficult-to-dye materials as very finely divided materials that are adsorbed onto the fibers, with which they then form a solid solution,

Fiber-reactive dyes react to form a covalent link between dye and the cellulosic fiber which they are customarily used to dye.

Fluorescent brightening agents are used to provide greater brilliance than can be obtained with soap, textiles, plastics, paper, and detergents.

Food, drug, and cosmetic colors consist of a carefully controlled group of regulated materials. Purity and safety are rigidly monitored; some dyes are *listed* and some are *certified*.

Mordant dyes (and lakes) are dyes combined with metallic salts (mordant means bitter) to form highly insoluble colored materials called *lakes*.

Solvent dyes are dyes that are soluble in alcohols, chlorinated hydrocarbon solvents, or liquid ammonia, and there appears to be considerable promise in dyeing the difficult-to-dye synthetics, polyesters, polyacrylates, and triacetates, from such solutions.

Sulfur dyes (sulfide dyes) are a large, low-cost group of dyes that produce dull shades on cotton. Sulfur dyes are usually colorless when in the reduced form in a sodium sulfide bath but gain color on oxidation.

Vat dyes have complex chemical structures that are (for the most part) derivatives of anthraquinone or indanthrene.

DYNAMITE

Dynamite was originally made by absorbing nitroglycerin into kieselguhr, a type of clay. Modern dynamite generally includes wood flour, ammonium nitrate, or sodium nitrate to absorb the nitroglycerin. Such a mixture is easy to handle and can be made to contain as much as 75% nitroglycerin and yet retain its solid form.

Because of the demand for a nonfreezing dynamite for use in cold weather, dynamites containing other materials designed to lower the freezing point of the mixture are used, for example, glycol dinitrate ($\text{CH}_2\text{ONO}_2\text{CH}_2\text{ONO}_2$). Such nonfreezing dynamites have potential as *straight* dynamite. Nitrocellulose can be gelatinized by nitroglycerin, and the resultant firm gel is commonly known as gelatin dynamite.

The ability to act as a combination plasticizer and explosive makes nitroglycerin and the similar diethylene glycol dinitrate (DEGN) useful in plastic explosives and smokeless powder manufacture.

Almost without exception the nitro compounds and nitric acid esters used as explosives are toxic. The degree of toxicity varies widely with the material in question, but most are capable of causing acute distress if taken orally. Nitroglycerin has a small medical use as a vasodilator.

See Nitroglycerin.