CHEMISTRY

Phenol Now Made in America By German Raschig Process

Chemical Important in Manufacture of Explosives And Plastics Yields a Minimum of By-Products

See Front Cover

SYNTHETIC phenol, needed in manufacture of plastics and also of some explosives, can now be made in large quantities from air and two common chemicals, benzene and hydrochloric acid, in a new plant just opened in North Tonawanda, N. Y. It assures American manufacturers of an independent and controlled source of the important compound.

Built in the past two years, costing more than $2,000,000, the plant is housed in several large buildings, with towers and distillation units connected by forty miles of pipe. Three miles of the piping is made of glass porcelain or rubber, to withstand the corrosive action of hot acids. Its capacity is 15,000,000 pounds of phenol per year. Yet the most modern control methods are employed, so that only six men and a supervisor are required for its operation.

The new plant is part of Durez Plastics and Chemicals, Inc. It uses the so-called Raschig process of phenol manufacture, which was invented in 1930 by Dr. W. Prahl and Dr. William Mathes, of the Raschig G. m. b. H., Ludwigshafen a/Rh., Germany. The Durez firm owns the exclusive United States rights to the process.

Though quite complicated, the Raschig process has two important advantages over older methods for the preparation of phenol, which is another name for carbolic acid. Its product is of high purity, considerably greater even than that approved for medical use. Unlike older methods, which yield at least several pounds of by-product for each pound of phenol, this gives less than a tenth of a pound of by-product for each pound of the desired chemical.

The process has two main stages. In the first, a vapor mixture of benzene, hydrochloric acid and air is converted to mono-chlor-benzene. In the second stage, this is mixed with steam which is converted into phenol and hydrochloric acid. The latter can then be used over again with a new batch of benzene. Also, the catalysts, materials which themselves are not changed, but which make certain of the reactions possible, are used many times.

In 1921, only 2,000,000 pounds of synthetic resins were produced, compared with more than 200,000,000 pounds last year. Those made from phenol have had the fastest growth and were the first to be made on a mass production basis it is said. Cameras, radios, brake linings, binders for plywood, telephones, paints and adding machines are a few of the common articles now made from them.

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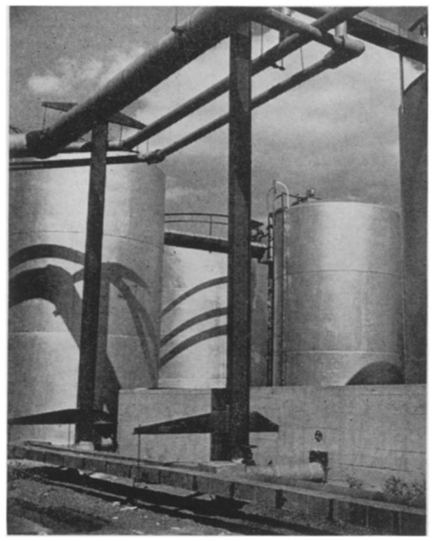

STORAGE TANKS

After synthetic phenol is made in the new Durez plant it is stored in these huge tanks prior to its use in making plastics.

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protoplasmic mass. The protoplasm streams in one direction for about 50 seconds, then reverses itself and streams back again. There seem to be several rhythms at work, but the 50-second one rules the dance.

The slime-mold moves from place to place by the very simple device of flowing forward a little farther each time, and not retreating all the way to its original position when it reverses. It is like the traditional penetential march of ancient pilgrims going to Jerusalem—three steps forward and two steps back.

Measurement of the force involved in the streaming was accomplished by caging a single strand of the slime-mold in a divided chamber, and applying pressure to one half of it, while the other half was left free. The pressure that will just stop the flow is considered a measure of its force. This proves to be the equivalent of a column of water 25 centimeters high.

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Dance of Four Stars

A STRANGE and intricate dance of four stars with the shortest part of the rhythm only a week long and the longest a million years, was described before the National Academy by Dr. Peter van de Kamp and Miss Janet M. deVilbiss of Swarthmore College.

Part of the circling star group has long been known. It is one of the visible stars in the constellation Corona Borealis, the northern crown, and has been considered a double star.

However, it now proves that one member of the double star is itself a double, with the two bodies quite close together and revolving around each other once in eight days. At a greater distance is another member, with a rotational period of about 1200 years. Finally comes the newly discovered fourth partner, a star too faint to be visible to the naked eye, and so distant from the rest of the system that its membership therein is traceable only by its apparent path, which would sweep it around the other three once in a million years.

Science News Letter, November 2, 1940

Diving Animals Studied

STUDIES on the physiology of diving seals, porpoises and manatees or sea-cows were reported to the Academy by Dr. Laurence Irving and associates, of Swarthmore College. They made their studies largely on animals in the great tanks at Marineland, Fla.

As soon as a seal dives, they found, its heart-beat drops to about a tenth of the normal rate. The hearts of porpoises and manatees, however, slowed down by only about one-half. On emergence, normal rates are restored.

Oxygen in the arterial blood is steadily exhausted during a dive, and when it reaches a minimum point the animal of course has to come up for air. Oxygen in

the muscles vanishes within five minutes, but is restored quickly in recovery. Blood flow in the muscles diminishes markedly during the dive, but apparently the brain's supply of blood is not diminished. Apparently the muscles get along without new oxygen during the diving period, burning part of their substance down to lactic acid, which rapidly passes into the blood as soon as the animal emerges and begins breathing air again.

Associated with Dr. Laurence in the research were Dr. P. F. Scholander and Dr. S. W. Grinnell.

Science News Letter, November 2, 1940

METALLURGY

Grain Size Affects Degree to Which Steel Can Be Hardened

Even Among Steels of Similar Chemical Composition, Larger Grains Are Found To Give Harder Metal

NEW studies of the factors which affect the degree to which steel can be hardened, important in preparing steel for armor and munitions, as well as for many industrial uses, were described to the American Society for Metals, meeting in connection with the National Metal Congress and Exposition in Cleveland. These researches were made by Dr. M. A. Grossman, director of research, and R. L. Stephenson, metallurgist, of the Carnegie-Illinois Steel Corporation.

The chemical composition of a steel has a lot to do with the extent to which it can be hardened, but it has been found that even those of similar composition may have different hardenabilities. This is determined by the size of the grains of which it is formed.

In their researches, Dr. Grossman and Mr. Stephenson found that larger grains gave a harder steel. They stated also "that the greater the hardenability of the steel, due to its chemical composition, the more was the hardenability affected by a change in grain size." The hardenability can be increased as much as 50% by changing grain size.

They presented to the meeting tables showing these relations in various kinds of steel. This information, it is expected, will prove useful in making possible a more accurately controlled degree of hardening of steel in various uses.

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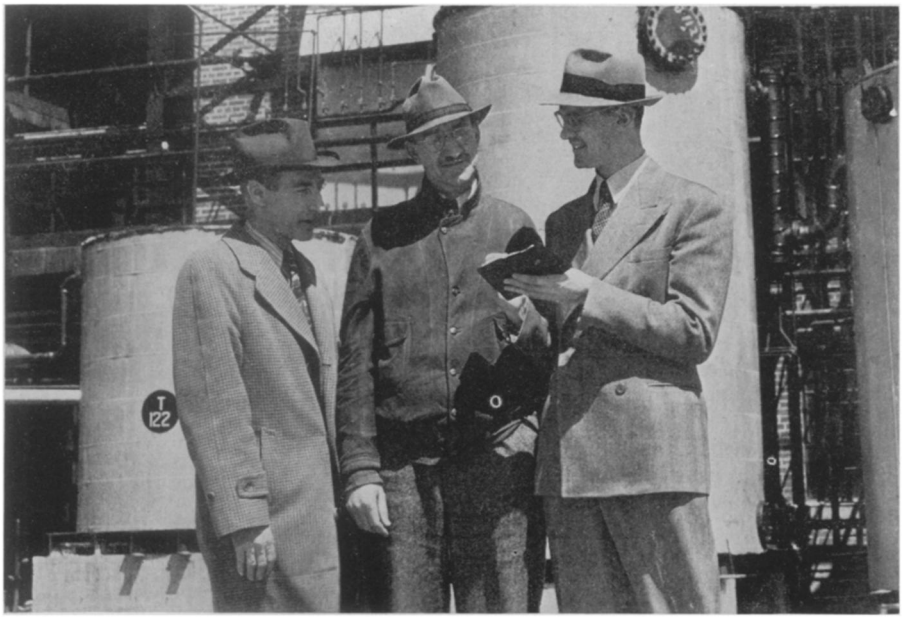

RESPONSIBLE

These three men were responsible for the design and erection of the new Durez synthetic phenol plant. They are G. M. Loomis, R. M. Crawford and Dr. W. Prahl. The latter, while connected with the Raschig company in Germany, was one of the original inventors of the process.

Stronger Stainless Steels

ABILITY of stainless steel used in airplanes to absorb vibrations, such as those from the engines, is less the stronger it is. This was reported by R. M. Brick and Arthur Phillips, of the Hammond Laboratory of Yale University, to the meeting.

However, both aluminum and stainless steel have their respective advantages, and the experimenters drew no conclusions as to whether or not one might supplant the other. They were concerned both with the fatigue of a metal, that is, the number of times it can be bent; and the damping, or vibration-absorbing power. The latter is very important in an airplane, because, unlike machinery on the ground, there is no foundation to absorb the vibration. This must be done by the structure of the airplane itself.

Surface effect, they find, is a considerable factor. Some types of aluminum alloy develop surface cracks under heavy vibration. Stainless steel, also, may have its fatigue strength impaired by surface effects. They point out that a finely polished surface, free from any channels made by the acid used in the final stages of manufacture, is important.

Science News Letter, November 2, 1940

Chafing Affects Strength

CHAFING between metal machinery parts, often neglected in past tests of metal parts, is an important factor in constructing airplanes and other kinds of machinery, Dr. George Sachs, assistant professor of metallurgy, and Peter Stefan, research assistant, at the Case School of Applied Science told the American Society for Metals.

The rubbing action between two closely fitted machine parts, they said, adds greatly to the total stress to which they are subjected. Examples are found in press fits, axle seats, propellor hubs and other important machine assemblies. If chafing is not considered, a simple test under static conditions of the material used may give a false idea of its strength. Even if a part's normal strength under continued stress seems ample, the