
## Chemistry Behind the Front

The November Atlantic contains an interesting and instructive article with this title, by Henry P. Talbot, professor of chemistry at the Massachusetts Institute of Technology, and one of the leading authorities of America along these lines:

**The Nitrogen Question**

"Among the various problems of chemistry which have been sharply emphasized by the war, none is more immediately vital and insistent than what is known as the "Nitrogen question." We absolutely must have nitric acid and ammonia, and these are nitrogen compounds.

Nitric acid, in combination with cotton, glycerine, or Toluene, produces gun-cotton, dynamite, and T. N. T. Without nitric acid there could be no explosives, and the nation would be at the mercy of its enemies.

The world's supply of nitric acid, heretofore has come from saltpetre, the only considerable supply of which is in Chile, where there are great beds of it. However large these beds are, they cannot last forever, and competent authorities have warned the world,—before the war,—that at the rate of consumption then going on, the supply would be exhausted in less than a hundred years.

But the availability of this Chilian supply depends, of course, on the consent of Chile and the menas and freedom of transportation; conditions of warfare might, and actually did, limit this source of supply.

**Nitrogen for Our Crops**

Now that peace is assured there will not be the same insistent demand for nitrogen compounds for war purposes, but the demands for agricultural purposes will persist—and increase.

Plant life demands for its support a certain amount of soluble compounds of nitrogen. These exist more or less in the soil, especially in virgin soil, but are increasingly lacking in old, worn out soils. The large amount of nitrate imported to these islands from Chile, for use on sugar lands, and the recent anxious fear lest we were going to be deprived of our usual supply, are a confirmation of the vital importance of these nitrogen compounds for agriculture.

Even before there was any forecast of immediate war, commercial chemistry was casting about for some independent source of supply within our own borders, or under our own control.

**Sources of Supply**

We live in an ocean of atmosphere some six or seven miles deep, composed very largely of nitrogen. There is about seven tons of nitrogen over every square yard of the earth's surface, so that we oughtn't to have to go to Chile for our nitrogen. The trouble is that the nitrogen in the air is inactive, and needs to be "fixed" before this great reservoir of inert nitrogen can be drawn upon. For this purpose two or three different chemical methods have been discovered. One, known as the Birkland-Eyde process, fixes the nitrogen of the air by means of an intense electric flame, melts it out of the air as it were. But this presupposes cheap electric current in quantity, current that is not in demand for some more profitable use.

Such conditions are found in Norway, and this process is more or less a commercial success there. It is also used to some extent in the vicinity of Niagara Falls.

**The Liquid Air Process**

Another method that is more immediately successful, is the liquid air process. It is a comparatively simple thing, by means of pressure and cold, to reduce common air to a liquid condition. On the return of this to the air condition the nitrogen boils off first, ahead of the oxygen, and can be thus secured almost pure. This can be readily combined with other constituents to make the nitrogen compounds required for both military and agricultural purposes.

**The German Process**

Still another process of much significance manufactures oxide of nitrogen by heating a mixture of air and ammonia; nitric acid can then readily be made from this. This is the process by which Germany during the war has made herself independent of Chilian nitrate beds, and supplied herself with the vast quantities of nitrogen compounds which were absolutely vital to her existence.

**The Cry for Potash**

Another vital prerequisite of agriculture and food production, is potash. And the potash question is nearly as serious as the nitrogen question. For many years the world's supply of potash has come from Germany, where there are vast deposits, known as Stassfurt Salts. With the outbreak of the war this source of supply was of course no longer available, and the world began to look about for other means of meeting its needs.

There are certain lakes, the chief of which is Searles Lake in California, from the alkali brine of which large quantities of potash are secured, but it is not of the best quality because of an admixture of borax. Another source that promises large results is the Portland Cement works, from which potash can be secured as a by-product. Still another source of commercial potash is the giant kelp, a sea-plant of the Pacific Coast. This plant is rich in potash and when dried and burned delivers up a goodly amount of the same. The burning of waste molasses furnishes another important means of recovering potash, as we here in Hawaii are proving to our own satisfaction.

**Substitute for Gasoline**

Among the less threatening or less immediate problems of a chemical nature there is that of a substitute for gasoline. There has been a phenominal increase in the consumption of this article during the last few years, from seven million barrels in 1900 to forty one million in 1915, and undoubtedly much greater extravagance since.

It stands to reason that the supply must be limited, and that it can't stand such depletion indefinitely. Ultimately, we will have to come to the use of alcohol as a substitute, which is entirely feasible, and thus will be able to keep up the supply. A notable discovery has been made by which sawdust and similar wood waste can be converted into alcohol.

**Scarcety of Platnum**

Another problem is the threatening scarcety of platinum. There are certain purposes for which platinum is absolutely essential. One of them, of great importance, is the manufacture of nitric and sulphuric acids. Platinum does not enter in, as a part, of either of these acids but it is a necessary adjunct, just as the minister is a necessary adjunct to a marriage. Platinum is also a necessary factor in electrical appliances, as for example the ignition points of an automobile battery.

Now, practically all the platinum comes from the Ural mountains in Russia, a source of supply which is now cut off from us. Until conditions change, or until science finds some suitable substitute for platinum, we will have to conserve that metal very carefully, and abstain from its use as jewelry for personal adornment.

A single instance may be given to illustrate the extravagant waste of natural resources continually going on in important industries.

**Shameful Waste**

At the great smelter at Anaconda, Montana, the sulphuric dioxide gas which escapes from a single stack in twenty four hours occupies a volume of 23 million cubic feet, and weighs 2000 tons and would make over 3000 tons of concentrated sulphuric acid daily. Incidentally the escape of gas into the atmosphere destroys vegetation utterly for miles around.

Slowly the world is waking up to the wonder and wealth of the fairy land of Nature by which we are surrounded, and also to the realization that the chemist is the magician with his wand who can call forth this wealth and wonder, and make it available for human use and enjoyment. And as the world realizes this more and more the chemist will more and more come into his own.