ENGINEERING-PHARMACY

Quinine from Green Bark

New portable extraction plant can take malaria-fighting drug and other important chemicals from cinchona trees where they grow in inaccessible forests.

See Front Cover

➤ A NEW weapon against malaria, promising better health to millions of civilians in the Americas, has been developed by the Cinchona Research Unit of the Engineer Board, U. S. Army. Major Robert Lee Kaye is commanding officer of the Unit and Lt. Silvio E. Ronzone is executive officer.

The weapon consists of a portable plant for extracting quinine and other anti-malaria drugs from the bark of the cinchona trees on the spot where they grow in almost impenetrable forests of Latin America.

If the portable extraction plants had been available before Pearl Harbor, they might have been used to produce, from cinchona trees growing in the Philippines, medicine for the malaria victims among the defenders of Bataan.

The medicine these portable plants extract is totaquina. Totaquina contains quinine and other related chemicals, called alkaloids, found in cinchona bark. It is considered a satisfactory remedy for malaria, though opinions may differ on its value compared to quinine and atabrine, the synthetic chemical now chiefly used for treating malaria.

A specific remedy for one form of heart disease is among the alkaloids of the cinchona bark. This drug, quinidine, has been very scarce since the Dutch cinchona plantations on Java were lost to the Japs. More quinidine for heart disease patients seems on the way, through the Engineer Board's cinchona extraction plants.

One of these cinchona extraction plants was recently exhibited in one of the Engineer Board's laboratories. Four of them will shortly be shipped to Latin American countries. One is destined for permanent location in Costa Rica, where the War Department and the Foreign Economic Administration have developed a cinchona plantation from seeds developed in the Philippines by Col. Arthur E. Fischer and flown out by him just prior to the Japanese occupation.

The plant consists of three fabric bags, shoulder-high and about as wide, jungle-green in color, watertight and resistant to acid and alkali. With these are three tall metal cylinders, three smaller fabric bags suspended from an overhead wooden rack, a small gasoline motor pump and a set of fabric drying trays, racked one above another with space between to reach about shoulder height.

The whole thing weighs 1,500 pounds and the necessary chemicals for one month's operation weigh another 1,000 pounds. The plant breaks down into units small enough for mules or men to carry over the mountain trails through the Andean rain forests. It can be operated by one intelligent man with the assistance of native laborers. Names of different parts of the equipment are painted on in Spanish, and some parts are painted in different colors for ease in directing operations by those who cannot read.

The principle of operation, and the key to the success of the plant, is contained in the tall metal cylinders known as ion exchangers. In these are fine particles of material which looks like charcoal but is not. The name of the material is a military secret, because the Army also uses it for many other purposes. It is no secret that this and similar materials from coal or resins can adsorb either negatively or positively charged ions, according to the electric charges they carry. Charcoal can be made to do this, too.

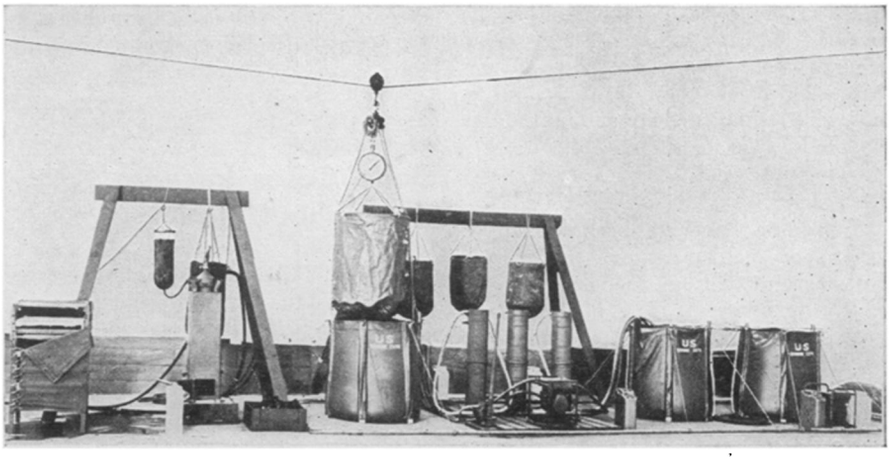
Unlike charcoal, however, the ion exchanger used for totaquina extraction will, when sodium hydroxide is added, reverse its tendency and drop the positively or negatively charged particles. Alkaloids such as quinine behave as cations, carrying positive charges, when in acid solution. This was discovered accidentally by chemists working on the purification of alkaloids.

The fresh cinchona bark, therefore, is cut into small pieces and dropped into an acid in one of the big jungle-green bags and the mash agitated long enough to extract and charge the alkaloids. It is then pumped through the cylinders containing the ion-exchange material. Alkali is added to release the alkaloids; next alcohol is added, and the dark wine-red liquid is poured on the drying screens. From these it is collected as a pinkish powder which can be further refined to white. This is totaquina. Even a tiny pinch has the bitter taste characteristic of quinine.

Totaquina can also be extracted from the bark by treating with acid and alkali alone. This "bathtub" method, as the Army engineers call it, is much less efficient, but can be used with very simple equipment. Old porcelain-lined bathtubs could literally be used, or barrels or pottery jars. Vinegar might furnish the acid. For a small health center it might be efficient enough and the cost would be very low.

Another extraction plant has also been developed by the Army for use with a hand pump instead of a gasoline motor.

All these methods were designed for



PORTABLE PLANT—Totaquina for treating malaria can be extracted from fresh green cinchona bark in the forests where the trees grow with this 1,500-pound, portable extraction plant developed by the Engineer Board, U.S. Army.

HARVESTING—"Quineros" strip cinchona trees of their bark for use in making anti-malaria drugs.

extracting the malaria drugs from fresh, green cinchona bark. This is where a great saving in money is made. The Dutch got quinine from cultivated cinchona trees yielding a high percentage of quinine and growing in accessible plantations. Cinchona trees are native to Latin American countries, but grow in dense forests that can only be reached over rough, muddy mountain trails.

Totaquina and quinine have previously been extracted only from dried, ground bark. That meant, in the case of the Latin America trees, packing the bark out by mule or man-carry over indescribably difficult trails. The bark could not be dried where the trees grow because of the constant rainfall. One ton of the dried bark, which cost $65 to ship from a Latin American port of embarkation to the United States, might not yield as much as 40 pounds of quinine alkaloids. One of the difficult trails is shown on the cover of this SCIENCE NEWS LETTER.

Totaquina has long been known as "the poor man's quinine." Its present cost, when made from dried bark shipped to this country, is $16 per thousand doses, or about one and one-half cents per dose. Most of the 300,000,000 malaria sufferers in the world each year cannot afford any such expensive medicine. If they use totaquina, they use a home-brewed tea and cover the taste, if possible, with alcoholic beverages of some kind, which, incidentally, helps to extract more totaquina.

Quinine, selling at $90 per 1,000 doses when the government last bought any, and atabrine, even at the present government price for large quantities of $4 per 1,000 doses, are also out of reach of the poor people in malaria regions who need a malaria medicine most.

Totaquina can be produced from fresh bark on the spot by the Engineer Board's new method, however, at a cost of $3.80 per 1,000 doses. This is about one-third of a cent per dose, and atabrine bought by individual patients in retail quantities today would cost about four cents a dose. The Engineer Board's third-of-a-cent per dose figure, moreover, is based on U. S. labor costs with the gasoline motor ion exchange process. The "bathtub" process, with native labor, should bring the price down much lower.

Science News Letter, August 4, 1945

PUBLIC HEALTH

Polio Cases Increase Throughout Nation

➤ INFANTILE paralysis cases increased throughout the nation during the week ending July 21. The total number reported to the U. S. Public Health Service was 369. The total for the previous week was 254.

The 369 figure, however, is considerably below the 568 cases reported for the corresponding week last year.

States reporting the largest increases were New York, New Jersey, Pennsylvania, Virginia, Massachusetts and Texas. Tennessee, where cases had begun to swing up, reported a slight decrease.

Science News Letter, August 4, 1945

As seeds respire, they will not *germinate* unless they have a sufficient supply of oxygen.

New stainless steel *vacuum containers,* used to carry hot soups and cold beverages for passengers in airplanes, weigh one-half as much as those formerly used and protect the temperature of the liquids at any altitude.

SCIENCE NEWS LETTER

Vol. 48 AUGUST 4, 1945 *No. 5*

The weekly Summary of Current Science, published every Saturday by SCIENCE SERVICE, Inc., 1719 N St., N. W., Washington 6, D. C. NOrth 2255. Edited by WATSON DAVIS.

Subscriptions—$5.00 a year; two years, $8.00; 15 cents a copy. Back numbers more than six months old, if still available, 25 cents. Monthly Overseas Edition: By first class mail to members of the U. S. armed forces, $1.25 a year. To others outside continental U. S. and Canada by first class mail where letter postage is 3 cents, $1.25; where letter postage is 5 cents, $1.50; by airmail, $1.00 plus 12 times the half-ounce airmail rates from U. S. to destination.

Entered as second class matter at the postoffice at Washington, D. C., under the Act of March 3. 1879. Established in mimeographed form March 18, 1922. Title registered as trademark, U. S. and Canadian Patent Offices. Indexed in Readers' Guide to Periodical Literature. Abridged Guide, and the Engineering Index.

The New York Museum of Science and Industry has elected SCIENCE NEWS LETTER as its official publication to be received by its members.

Member Audit Bureau of Circulation. Advertising Representatives: Howland and Howland, Inc., 393 7th Ave., N.Y.C., PEnnsylvania 6-5566 and 360 N. Michigan Ave., Chicago, STAte 4439.

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