The Great Lignin Mystery
Uncovered Years Ago in Paris, the Unsolved Problem of the Great By-product of Field and Forest Still Puzzles Chemists of To-day

By Louis Elsberg Wise

The casual tourist, wandering through the gray, ancient quartier of Paris, near the Porte St. Denis, may be surprised to see sprawling before him a massive, sombre old building. This is the Museum of Arts and Crafts, landmark of France's accomplishments in engineering and industry. Let him wander through the portals of that huge vault and he will view with delight well planned exhibits, historic apparatus and equipment, and delicate, precise miniature models of all types of machinery. It is doubtful, however, if he will stumble upon the bust of a chemist long dead and forgotten, who worked in the laboratories there a century ago. This bust, grimy and inconspicuous, commemorates the work of old Anselme Payen, who first uncovered the great lignin mystery in 1838. Payen had always taken a special interest in the chemistry of woody plants. He had treated wood with most of the reagents standing on the shelves of his dingy laboratory—alcohol, ether, acids and alkalis. And as a result of this insatiable curiosity he found that all the woods yielded the same resistant, fibrous substance known as cellulose—the substance which in one form or another enters the paper, rayon, cellophane, textile, explosive, lacquer and photographic industries of today. At the same time, Payen made another interesting though less sensational discovery. He found that in isolating this cellulose, in separating the tiny, individual cells from each other, he was always forced to remove—often to change or destroy—other components of the wood. These weaker, less resistant substances, which he christened les matières encrustantes, cemented together millions of cells in the bole of the tree, and also reinforced the cellulose within the individual cell. Les matières encrustantes were later renamed "lignin."

Payen studied his lignins patiently and tenaciously. Like all good chemists he strove to penetrate into the architectural pattern of the lignin molecule. There were only three distinct types of atoms present—carbon, hydrogen, and oxygen. Unfortunately, however, the molecule was built up of scores of these very atoms, and the permutations and combinations were baffling. So Anselme Payen failed, but it was a noble defeat after an exhilarating struggle. Scores of chemists since his day, equipped with far better and more delicate tools, have wrestled with the same problem with equal futility. Nearly a hundred years have gone by, and the mystery of lignin still lies well over the horizon.

Why then should lignin interest or disturb the layman? This question is best answered with a few bold statements. Lignin is one of the greatest chemical by-products that the forests have to offer us. Twenty to thirty per cent of dry wood is made up of lignin. It is one of the largest agricultural wastes in the world. From fifteen to twenty-five per cent of those wastes is composed of lignin. Considering the combined losses from pulp mills and agricultural products, probably forty million tons of lignin are lost annually in the United States alone. When, to this conservative statement, are added the facts that lignin, like cellulose, is an end-product of solar energy, free from tariffs and taxes, growing without benefit of technologist or technocrat, that it has a much higher fuel value than that of cellulose, that it is the probable forebear of soil humus, of peat, of lignite and of certain coals, and that it contains chemical groupings that point strongly towards its industrial usefulness, the reader will be alive to its present and future importance.

Forty million tons of waste lignin! What is it chemically? By what complex mechanism is it
Southern Louisiana, several great flocks wintering between the mouth of the Mississippi on the east and the Sabine on the west. An enormous flock dwells in the marshes off Main Pass, at the mouth of the Mississippi, another on Marsh Island to the eastward of the Chenier, while to the westward are other great flocks near Grand Chenier and in Cameron Parish. The geese wintering in the vicinity of Chenier au Tigre are particularly favored for they find an abundant supply of the three-cornered grass which is their main source of food—there is gravel in various places—and there are protected areas where they may feed undisturbed by hunters. The Louisiana Department of Conservation has taken a deep interest in the protection of these winter guests for it has the State Wild Life Sanctuary upon which many are found. Adjoining their area is the 26,000 acre Paul J. Rainey anctuary, which is controlled by the National Association of Audubon Societies, while next to that is a vast tract owned by E. A. McIlhenny.

The geese congregate in enormous flocks on these lands, and when the hordes are contentedly feeding, it is possible, with a favorable wind, to hear their contented murmuring for five miles. An occasional trapper crosses their domain from time to time and the masses of white-headed geese rise when he approaches too closely; they appear a black mass in the sky, and then swirl down to a new feeding spot a few hundred yards away.

Occasionally for no reason at all, apparently, the geese will leave this pasture or the adjacent Rainey sanctuary for the day. They probably have a desire for gravel; at any rate they rise in small bands of fifty or a hundred, mount into the sky, and flock after flock will trail off to the eastward, their resonant musical voices being audible long after they have disappeared from view.

But they are sure to return to the safety of these sanctuaries in the evening. Long before the sun has dipped below the glistening rim of the Gulf, they begin to appear, first as mere specks in the grey, and then flock after flock of calling birds. They fly high until directly over their favorite haunts, and then swirl down in funnel formation, an endless chain of geese which enlarges the flock upon the ground until the white heads of the birds make the marsh seem as though covered with snow.

Mr. F. R. Dickinson, vice-president of the Chicago Academy of Sciences, and I have made many field trips to the Chenier and its vicinity to secure motion films of the interesting animal life for the film library of the Academy. We have spent days with the hospitable Sagreras—sometimes just enjoying the balmy air of the Gulf coast, but usually wandering far afield with our cameras.

I am sure there are no flocks of geese elsewhere in North America, of any species, as are found of Blue Geese in these Louisiana coastal marshes, and yet, although so common in lower Louisiana, they are known to comparatively few naturalists. This seems strange at first but, when we consider that they have such limited wintering grounds and an almost unknown breeding place, far north of the Arctic Circle, it is not hard to understand.

It should be emphasized that in spite of the abundance of Blue Geese, their number would be woefully depleted if they were not protected upon these reservations; the Blue Geese have the distinction of being the only migrating game birds in North America which have successfully held their own—and they need the protection given them.

ADDITIONAL POLLUTION REGULATIONS

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drip pan or catch basin of galvanized iron shall be placed under the floor of each derrick, and all machinery of the drilling rig, in order to prevent the slightest quantity of oil from falling, dripping, or wasting into the water body.

If a steel barge, equipped with a derrick and drilling machinery, is used in the drilling of wells, these drilling barges shall be constructed so as to prevent the slightest quantity of oil, used for lubricating purposes, from falling, dripping, or wasting into the water body.

Rule 5. DRIP PAN UNDER EACH BOILER: All persons or operators drilling for oil, natural gas, sulphur or other materials, whose operations are located in fresh or salt water bodies, and who use oil for fuel, shall take the necessary precautions to assure the Commissioner of Conservation that no oil be wasted into the water bodies. The operator shall have a drip pan or catch basin of galvanized iron placed under each boiler which is using oil for fuel, in order to prevent the slightest quantity of oil from falling, dripping or wasting into the water body.

The foregoing are promulgated as regulations of the Department of Conservation, State of Louisiana, under authority of Act 127 of 1912, and hereby adopted effective April 15, 1934, the provisions of which are to be complied with within ten days from the date of its adoption.

State of Louisiana, Department of Conservation

By Robert S. Maestri, Commissioner.

April 5, 1934. James P. Guillot, Secretary.

Submitted and approved, Louisiana Department of Justice, James O'Conner, Assistant Attorney General.