SCIENCE NEWS

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SUGAR FROM WOOD WASTE

CARBOHYDRATES, taken directly or indirectly, whether by human beings or animals, are essential for nutrition. They represent a concentrated product of the energy of the sun. After undergoing certain changes they serve as fuel to produce the various kinds of energy which sustain life. In plant-life nature produces carbohydrates in different forms, some of them being directly serviceable for digestion on the part of most animals, others fit for use only by innumerable sorts of so-called lower organisms, especially by microbes.

The various carbohydrates differ only very little among themselves as regards their elementary composition, but these small differences divide them into two classes by reason of their vastly different mercantile value.

Agriculture, by gradual development in the course of thousands of years, has produced in very large quantities a rather small number of species containing carbohydrates in such form as makes them available for use as food for human beings or for cattle. Nature produces still larger quantities of carbohydrates which are digestible as such only in small part in the stomachs of men and beasts. Their main representative is the wood-pulp which is contained to a very large percentage in the waste products of agriculture, especially in wood. Immense quantities of such waste products are at disposal, in this country especially in form of corn-stalks. A considerable part of such waste wood, as we know, is not used in an economical way. In producing lumber, at least 40 per cent. of the wood falls off as waste, being used either not at all or at best as fuel. Burning up wood means destruction of cellulose, that inner chemical substance of wood, so valuable commercially.

The present enormous request for print paper steadily diminishes our stock of wood in the present, while seriously endangering our future supply. A possibility of turning the forest waste into human nutriment or fodder for cattle might considerably influence agricultural and forest policies in vast territories of the world.

In the course of such reflections the question arises whether it might not be possible for chemistry slightly to alter the cellulose molecule so as to bring it into such form that it may act in the stomach just like digestible carbohydrates of starch or of sugar. This can indeed be accomplished by merely adding one molecule of water to one molecule of cellulose—a simple chemical reaction which has been known for more than a century. Nevertheless, well-known insignificant chemical reactions, easily produced in the laboratory, sometimes involve enormous difficulties when it comes to putting them to test on a technical scale and at the same time on an economic basis.

A number of processes to realize chemically the reactions of hydrolyzing wood-pulp have been developed in the course of time, the first practical application having been carried through many years ago, in this country, near Chicago. The aim of all these processes has been to transform wood-pulp into a fermentable product, to be used in the manufacture of alcohol. All these methods have failed economically until now, because they have not yielded enough fermentable stuff.

While the production of alcohol has been the ultimate goal of processes of hydrolyzing wood-pulp at high temperature, the transformation of wood-pulp into foodstuffs has become the aim of a new technical method developed during the last twelve years under my supervision.

In Germany, some fifteen years ago, Willstaetter found by the action of highly concentrated hydrochloric acid that wood-pulp could be almost quantitatively transformed into soluble carbohydrates and finally into glucose. On the basis of these laboratory results, we worked out my process allowing a yield from every hundred parts of any dry wood about 75 parts of crude foodstuffs, containing 80 per cent. of pure carbohydrates. That means 60 per cent. of pure carbohydrates is obtained from the dry wood. This product proved to be of high nutritive value and equal to any other foodstuff of like starch concentration and particularly adaptable to the raising of pigs. Successful experiments have been made to transform the primary product, glucose, for nourishing human beings. We have succeeded in evolving a simple cleansing process for this purpose and have produced pure glucose.

Considerable difficulties had to be overcome during the twelve years of development of the technical methods and apparatus. The most difficult problem has been the separation and recovery of the highly concentrated hydrochloric acid, while no less serious and hard work on the part of a rather large staff of chemists, engineers and workmen had to be done to find the most practicable way of handling the wood, preventing leakages of hydrochloric acid vapors, constructing acid-proof vessels and attending to many other details. Rather large amounts of capital had to be invested before an initial technical plant could be operated without difficulties.

In Germany, which is not producing sufficient agricultural carbohydrates for cattle food and which has a rather large supply of waste wood, this new industry may become an important factor in its economics. But it may also prove useful to the United States where the problem of disposing of the waste material in the cornfields, for instance, begins to be a serious question on account of the increasingly destructive activity of the corn-borer.

Obviously, the particular technical problems in every country have to be studied separately and there is no denying the fact that it takes perseverance, faith and a good deal of optimism, not to speak of time, for preparing and developing a new industry of that kind. —*Friedrich Bergius.*

RADIOVISION

THE amateur radiovision enthusiast will soon have at least twenty-one stations broadcasting such programs, located all the way from Lexington, Mass., to Los Angeles, Calif. These are operated by eleven different broadcasters. Nine are now broadcasting, while two have their stations under construction. Several others have applied to the Federal Radio Commission for authority to enter this field, but so far have neither been granted a license to operate nor a construction permit.

Included in this number are three of the chief manufacturing firms. The Radio Corporation of America, in New York City, has three bands of 100 kilocycles width each. One is now in use, while the other two are under construction. The General Electric Company, at Schenectady, N. Y., is regularly broadcasting on three different frequencies, including 790 kilocycles, that of the WGY broadcast station. These are all on 10-kilocycle widths. The Westinghouse Electric and Manufacturing Co., of Pittsburgh, Pa., has been assigned two bands of 100 kilocycles width, at wave-lengths of 63 and 150 meters. The former is now in use, but on an irregular experimental schedule.

Though the Federal Radio Commission has recently issued a new order regulating radiovision broadcasting, this does not affect the present situation very greatly. One of the chief points is that it may be done freely, though with the necessary approval by the commission, on frequencies above 1,500 kilocycles, or wave-lengths below 200 meters, the lower limit of the broadcast band. Radiovision broadcasting on frequencies between 550 and 1,500 kilocycles, the present band of the broadcast stations, will be permitted, with certain limitations. One is that no band wider than 10 kilocycles may be used for the purpose. Another is that it shall not be done more than one hour each day, and that it shall not be done between 6:00 and 11:00 P. M., in order not to interfere with broadcast listeners.

All the present radiovision broadcasters are now using the shorter wave-lengths, except the broadcasting stations WGY, WRNY, WCFL and WIBO. None has bands wider than 10 kilocycles, as that is the width of all sound broadcasting bands. Of these stations, only WRNY has been broadcasting radiovision in the evening hours, so that appears to be the only station even slightly affected. However, the radio commission has announced that there will be further reallocations of the radiovision bands. It is believed that this action will be to limit all broadcasters to a very few bands, of 100 kilocycles each, and let them divide the time. In view of the limited power of most of these stations, and the fact that none broadcasts more than a short time daily, the necessary time division should be worked out to the satisfaction of all.

The Radio Manufacturers' Association recently adopted as standard the 48-line, 15-picture-per-second method, with the scanning across the frame from left to right and top to bottom, as one reads the pages of a book in English. Though some of the broadcasters have not yet adopted this standard, four are now using it and probably more will follow. Some of the stations are using fewer lines, or fewer pictures per second. This is done in an effort to get more varieties of light and shade in the limited bands now assigned. With the 100 kilocycle band that will be used in the future, ten times the width used by many present broadcasters, it will be possible to send considerable detail with the 48 lines and fifteen pictures a second.

Even the highest pitched sounds ordinarily heard are below 5,000 vibrations a second, and so may be sent satisfactorily in the present broadcast band. With radiovision, however, the number of vibrations required per second may be many times as great. Hence it requires a wider band. If the number of vibrations is cut by limiting the number of lines to the picture there is loss of detail, or if the number of pictures per second is lower, there is an objectionable flicker.

THE ERUPTION OF ETNA

AN eruption of Mount Etna, in Sicily, such as the one which broke out a few days ago and is still in progress, is more spectacular than dangerous, says Dr. Henry S. Washington, of the Carnegie Institution, the eminent American volcanologist. Dr. Washington has spent much time on the slopes of the volcanoes of the Mediterranean region, and knows Vesuvius and Etna with especial intimacy.

"Etna's eruptions have always consisted almost entirely of relatively quiet flows of lava," he stated in an interview to *Science Service*. "The violent steam explosions that characterized the eruption of Vesuvius when ancient Pompeii was destroyed, and in modern times made Pelee's outburst so terrible to the inhabitants of Martinique, are quite foreign to the Etna type of volcano. The clouds of "smoke" rising from Etna at present are merely incidental; they look ominous but contain no real menace.

"Lava flows, such as the present one, are frequent occurrences on Etna. They come every few years, and the inhabitants are used to them. They get out of the way until they stop, and it is very seldom that anybody is killed."

The non-explosive character of the Etna eruptions, Dr. Washington explained, is due to the chemical nature of the lavas. Etna lavas are mostly basaltic rocks. These, when melted, become a relatively thin and easy-flowing liquid, which permits steam and gas to bubble through and escape. The acidic lavas of the more explosive volcanoes, on the other hand, are thick and viscous, and hold steam more stubbornly, until enough force is piled up to cause a violent blow-off.

Whether the present outbreak of Etna will develop into a major eruption it is too early to tell. The two greatest lava flows of the Sicilian volcano in modern times took place in 1536 and 1852, according to Dr. Karl Sapper, leading German student of volcanoes. Old records tell of eruptions as early as 475 B. C.

Because Etna is the greatest volcano in the Mediterranean region, it was regarded by the people of classical antiquity as the chimney of Vulcan's forge, where the thunderbolts of Jupiter were hammered out. The name

of the lame blacksmith-god thus became the generic title for all fire-mountains; all volcanoes belong to Vulcan.

DISEASE IN INDUSTRY

NERVOUSNESS or nervous diseases are a frequent cause of sickness absence in industry, according to studies made by Dr. Millais Culpin, of London Hospital. Apparently these conditions have little or no relation to the work or working conditions.

Seven of the first twelve cases on the annual sickness records of one large firm showed losses ranging from 94 to 278 days because of nervous diseases. These latter were listed as nervous breakdown, nervous exhaustion, dyspepsia and nervous debility, heart and nervous overstrain. In this particular firm, the workers are reasonably well paid, working conditions are hygienic and the workers are not driven at their work. In firms where the conditions are less pleasant and the work is strenuous, the absence rate for diseases of this type is lower.

Dr. Culpin likens this type of nervousness to that which appeared as shell-shock during the war. Its basis is emotional, not physical, although the physical symptoms are very real to the patient. The worker's liking for his work plays a large part in determining the amount of absence due to nervous trouble. Among many workers examined, those who liked their work had very few absences due to their nervousness, even though they showed on examination the same kind and degree of nervous disease as workers with many absences who disliked their work. In the latter type the nervousness became the means for emotionally unstable people to escape an unpleasant situation.

If nervous people were forced to work or starve, many would work and be saved from nervous breakdown to which they otherwise succumb. Others would starve and some might find a speedier end.

A SEVEN-INCH HUMAN TAIL

A HUMAN tail of almost record-breaking length has just been discovered appended to a baby girl born at Knoxville in Tennessee, the state that outlaws evolution. This tail was reported to be seven inches long. The record is a nine-inch tail on a twelve-year-old boy from French Indo-China.

Only about twenty-five authentic cases of babies born with tails are known to science. However, every human being, including the late William Jennings Bryan, had a tail at an early stage of his life, according to Dr. Adolph H. Schultz, associate professor of physical anthropology at the Johns Hopkins University and research associate of the Carnegie Institution of Washington. Dr. Schultz has asked that the unique appendage be sent him for study.

Before birth, when man is in the embryo stage of his life, he has a tail one-sixth the length of his body. Generally this tail disappears before birth, though the rudiments of the vertebrae in it may be found in man's spinal column, where they are known as the small bones of the coccyx at the end of the spine. Occasionally the tail persists and appears externally, as in the case of this new daughter of the Fundamentalist state.

Man's evolutionary relatives, the higher apes, have even less of a tail than man himself, Dr. Schultz said. In the orangoutan the embryonic tail disappears more completely, leaving only two or three rudimentary tail vertebrae. In man there are four or five of these and sometimes six at the base of the spine.

When the tail persists externally, it has no bones, but is made up of nerves, blood-vessels and muscles. In man and apes it is evidence of evolution from a tailed ancestor.

ITEMS

CLEANLINESS is the exception and not the rule in dairy establishments, Milton E. Parker said at the meeting of the American Public Health Association. Ordinary methods of cleaning leaves a film of oil and sometimes a rough deposit, known as milk-stone, on tanks, pipelines pasteurizers and other equipment. This occurs even when the washing compound used has the power of killing germs. However, killing germs is not enough, for if traces of milk are left on the equipment, there is a chance for more germs to breed and get into the next batch of milk. Failure to clean thoroughly is the fault of the washing compounds in general use. Mr. Parker reported the results of experiments made with several alkali compounds and recommended crystalline tri-sodium phosphate as the most satisfactory for really cleaning dairy equipment. However, this alkali should not be mixed with carbonate or bicarbonate.

WHEN colds "run in the family" it is no sign that the family is constitutionally subject to colds. It may be that some member of the family is acting as a carrier, just as some people are typhoid carriers, suggests Dr. P. Watson-Williams in a report to *The Practitioner* of observations made on ninety consecutive patients. Sometimes one child is known for starting colds among his brothers and sisters. This same child may become immune to colds himself but still harbor cold germs and be able to pass them on to others. If he grows up and has a family, he may still be starting colds in the family, although they are no longer traced to him. The reason for this may be an unsuspected infection of his nasal sinuses, the honey-comb structures back of the nose and eyes. This same infection may be the reason for some children growing a second set of adenoids, when the first ones have been removed with the tonsils.

EVENTUAL propulsion of aircraft by motors operating on heavy oil fuel and self-igniting, on the Diesel principle, is forecast by experiments made by the Junkers aircraft concern. Experimental engines radically different from the ordinary powerplants of airplanes are understood to be under test and to have actually flown. The Junkers firm pioneered in all-metal aircraft and their airplanes to-day are different in appearance from the common type.