Making the Most of Our Natural Resources

By Edwin E. Slosson

That the United States may sign a declaration of independence of European control of potash fertilizers was the cheering message brought to the meeting of American Chemical Society at Detroit by Prof. E. P. Schoch and H. E. Sellards of the University of Texas, who discussed the details of the discovery of immense beds of potassium salts in Midland County, Texas. Here the Standard Potash Company of Dallas has just completed their second cored well and struck the same beds as their first well three miles away. At a depth of 1980 feet an eleven-foot bed of soluble salts was found, mostly potassium sulfate, carrying ten per cent of the fertilizer ingredient, potassium oxide. Below the 2150 level the drill ran into layers totaling eight feet of a still richer sulfate, polyhalite, which carries sixteen per cent. of potash. The sulfates are better material for plant food than the chlorides contained in the European beds. The depth of the Texas beds is greater than those worked in Stassfurt, Germany, and Alsace, France.

Post-War Monopoly

Before the war the world was mostly dependent upon the German mines for potash fertilizers and when France took over the Alsace deposits it was at first hoped by American farmers that competition would bring down the price. But the Germans and French while political enemies proved to be financial allies and so the European monopoly remains until the southern fields give America a home-mined source of this indispensable plant food.

Another of our undeveloped natural resources is also likely soon to be made available. This is the lignite or brown coal of which extensive deposits are known in North Dakota and Texas. The utilization of this fuel has been impeded by its high amount of moisture and its friable structure. But Dr. Schoch has invented a process that will dehydrate lignite in lumps by heating it in heavy oil. The experimental plant now in operation turns out ten tons a day in a form suitable for furnace or domestic use.

The Conversion of Coal

The world is entering upon a new era in chemistry when coal and oil will not be burned up in their natural form but will be used as the raw material for making more valuable substances. There are many reports of researches on the new methods of liquefaction of coal and its conversion into artificial motor fuel or alcohols, such as have been recently developed in Germany and France. The first step in the production of such synthetic substances is usually the combustion of coal in a limited current of air to form carbon monoxide, which is the poisonous component of automobile exhaust gases, but which may be made into a substitute for gasoline in making the auto go. The laboratory of the U. S. Bureau of Mines at Pittsburgh has been experimenting on the effects of various compounds of cobalt, copper and other substances acting as catalysts to promote the combination of the carbon monoxide with hydrogen to produce methanol and liquid hydrocarbons out of these two gases. The higher the pressure the better the yield. In the University of Michigan Prof. Alfred H. White and Frank W. Hightower have been studying the use of nickel as a catalyst in converting a mixture of carbon monoxide and hydrogen into methane, which formerly was found free in this country in the form of natural gas but which is now getting scarce.

Another triumph of synthetic chemistry was announced by Dr. William J. Hale and Dr. E. C. Britton of the Dow Chemical Company, Midland, Mich. This is a new and more economical method of making phenol from benzene by the action of chlorine or bromine compounds at high pressure and temperature, four thousand pounds and 650 degrees Fahrenheit. Phenol, more commonly known as carbolic acid, is chiefly used in the manufacture of bakelite, which is extensively employed for insulation in electrical apparatus and as gear material in automobiles. The other component of bakelite is the familiar disinfectant, formaldehyde, which may be made synthetically from coal. The United States consumes about fifteen million pounds of phenol a year.

More About Automobiles

The future of the auomobile has naturally filled the minds of many of the members of the American Chemical Society. What will be the next step? was a question often discussed.

First and most fundamental is, how long will the fuel hold out? According to J. B. Hill of the Atlantic Refining Co., Philadelphia, the most vital problem is producing "a substitute for gasoline. While there is no immediate prospect of serious gasoline shortage, it is nevertheless certain that the petroleum resources of the world are not inexhaustible and that the time will come when we must have another source of motor fuel to supplement or replace gasoline."

Two methods of making gasoline artificially have been worked out in Germany. The Bergius process gets forty gallons of motor fuel from a ton of coal by employing hydrogen under a pressure of three thousand pounds per square inch. The Fischer process makes from water gas a liquid sold as "synthol."

Importance of Rubber

"The railroad owes its early growth to the lack of rubber chemistry and the automobile to its discoveries," said William C. Geer, of New York, For the first self-propelled carriages were truly boneshakers. Twenty-five years ago a tire that ran 4,000 miles was regarded as a good investment. Today the tread will stand 10,000 miles and the cord twice that. A tire has to stand some ten million flextures in ten thousand miles.

No other substance is so tough as tire material. Steel gives way in a tenth the time. Brass or leather would wear out much sooner. But Mr. Geer predicted still lighter and tougher tires in the future, also tubing insoluble in gasoline and oil and rubber paints to which water and ice will not cling. He saw no need for synthetic rubber but Charles F. Kettering of General Motors was more sanguine on this point. He said that he did not believe that the rubber tree had in mind the needs of the tire manufacturers when it developed its lymphatic system any more than a hen laid eggs for omelets. Sometime the chemist may improve upon rubber or even make a better fried egg.

The possibility of getting your automobile repainted while you wait and changed to match your lady's

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gown comes from the invention of synthetic lacquers in place of the old varnishes made from natural gums and resins. These lacquers are mostly made from cotton by the action of nitric acid and dissolved in mixtures of various alcohols, ethers and oils. A new synthetic resin made from coal-tar naphthas was commended to the chemists by Prof. Allen Rogers of Brooklyn and Clifford Banta of Philadelphia. It is called cumar, is cheap and gives a hard glossy surface, waterproof, acidproof and alkaliproof to a high degree and therefore very resistant to weather.

Anti-Freeze Compounds

The specifications for the ideal anti-freeze compound were presented by Prof. D. B. Keyes of the University of Illinois. The chemists are in search of something to prevent the freezing of water in the radiators at any expected temperature. It should not corrode any of the metals about the engine or rot the rubber. It should not smell bad or attack the lacquer. It should keep well and not cost too much. It is hard to find a chemical that will not fail in one or more points. Salts such as calcium chloride corrode all comon metals. Sugar is sticky stuff. The alcohols vaporize too easily and besides methyl alcohol gives off poisonous fumes and ethyl alcohol has a tendency to be turned to other purposes. Glycerine thickens up too much in cold weather and the supply is limited since it is made from soap fat. Another compound hitherto known only to the chemists has more advantages and fewer disadvantages. This is ethylene glycol, which is a cross between alcohol and glycerine. It freezes at lower temperatures, does not clog up the radiator pipes, or reduce the boiling point of the water and can be made in unlimited quantities from cracked petroleum. But it does soften rubber and has a high initial cost.

Safer Kinds Of Glass

The need of the automobile for plate glass has led to the rapid development of this industry until now about half of the plate glass made in the United States goes into autos and the industry ranks fifth in value. But E. Ward Tillotson of the Mellon Institute, Pittsburgh, pointed out that the automotive engineer wishes he could find a less breakable glass. Several large companies are now experimenting with a laminated glass, composed of two sheets of thin plate glass with a sheet of celluloid cemented in between. Such a sandwich sheet is less liable to be shattered by a shock and when it is cracked the fragments of the glass do not fly about since they are stuck to the middle sheet. But the celluloid is apt to become yellow by sunlight and peel off at the edges. The composite plates are of course more costly.

One of the novelties in auto glassware is a rearview mirror by which the driver can see the cars following but is not dazzled by the glare of their headlights. The reflecting surface is made of lead sulphide instead of silver and cuts out more than sixty per cent of the brightest rays.

The Chemistry Of Life

The resurrection of the dead is no longer a miracle. It is in some cases the achievement of modern medicine. Recently a youth who had been lifeless for fifteen minutes was revived by an injection of adrenalin. In the future many persons will be likewise resurrected. But such renewals of the vital processes cannot be expected in all cases, any more than every dead auto can be started by cranking. So death remains in the end unconquered.

This was in substance the announcement with which the session on biochemistry was opened by M. L. Crossley, chairman of the division of dye chemistry.

This was followed by the discussion of a question almost as startling, for Prof. Treat B. Johnson of Yale considered the possibility of the origination of life in the laboratory. He quoted Huxley's anticipation in 1870: "I think it would be the height of presumption for any man to say that the conditions under which matter assumes the properties we call vital may not some day be artificially brought together."

In the fifty-seven years since Huxley expressed these views much has been accomplished in artificial synthesis by chemists but Prof. Johnson concludes: "We have still a long road to travel and not until the composition and structure of our cell constituents can be more thoroughly established than is possible at present, can we hope to anticipate the realization by Huxley."

A creature capable of living on sulphur and air was mentioned by Prof. Johnson. This creature is a bacillus which dwells in sulphurous water and thrives on it. It has no need for sunlight as do other plants for it gets its energy from the combustion of free sulphur which it converts into sulphuric acid. It can live and even grow in a solution of sulphuric acid of normal strength that is fatal to most vegetation. Some such simple and self-sufficient organism, capable of living entirely on inorganic materials, may well have been the earliest form of life on earth, and the connecting link between the mineral and vegetable kingdoms. These sulphur bacteria take the form of long threads or active spirals. They grow in the soil and sometimes are found in a muddy pool in such luxuriance as to give it a purple hue. Researches now in progress on these curious creatures may throw light on the way by which sulphur gets from the soil up into the plant cells and so may be of practical value to the modern agriculturist.

More Woe For The Bugs

A new fumigant that deals inexpensive death to clothes moths, beetles, grain weevils and other insects withhout the fire risk or the endangering of human life present in the use of other fumigants was announced by R. T. Cotton and R. C. Roark, of the Bureau of Chemistry, U. S. Department of Agriculture. It has a long name, ethyl ester of monochloroacetic acid, and is not yet produced commercially. As used, it is mixed with an equal quality of the common chemical carbon tetrachloride. Three to four pounds allowed to volatilize will kill the insects in a closed space of a thousand cubic feet. In cost it will compare favorably with those fumigants now in use, selling for about thirty cents a pound. It was predicted that the new fumigant will save many lives now lost through the use of deadly hydrocyanic acid gas. No fire danger is present in the use of the new insecticide, whereas carbon disulphide now commonly used in grain fumigation is dangerously explosive when mixed with air.

For iron, eat peas, beans and other fresh legumes. This is the dietary advice provided by data presented by Dr. W. H. Peterson of the University of Wisconsin to the chemists. In the course of his researches he has analysed many foodstuffs for their iron content and he found that in general the legumes rank highest. Dried fruits, cereals, nuts and meats are all fairly high in iron, but fish, milk, potatoes, onions, fresh fruits have little of this food factor which is believed to encourage the growth of red corpuscles in the blood.

Science News-Letter, September 17, 1927