

ADDRESSES AND CONTRIBUTED ARTICLES

Alcohol and the Chemical Industries¹

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To appear before a gathering of representative industrial chemists engaged in practically every branch of chemical activity and to call attention to the essential relationship of the alcohol industry to the other chemical industries would, at first thought, seem so elemental and unnecessary as to be almost absurd. The chemist knows that alcohol as a solvent bears the same relation to organic chemistry that water does to inorganic chemistry. It may be regarded along with sulfuric acid, nitric acid, and the alkalis as among the chemical compounds of greatest value and widest use.

To enumerate to the chemist the compounds in the preparation of which ethyl alcohol is necessarily used, either as solvent or as the reacting ethyl group, would almost amount to a reading of Beilstein. To the layman might be mentioned a variety of useful things such as anesthetic ether, quinine, paint, varnish, ink, smokeless powder, dyes, liquid pharmaceuticals, motor fuel, and, properly to end up with, embalming fluids.

If a chemist is asked the question: "Why can we not get along without alcohol," he becomes bewildered. It starts a train of thought similar to what might be started if the question were asked: "Which element can be dispensed with most readily, oxygen, hydrogen, or nitrogen?" Chemical industry to-day without alcohol would be impossible. As well imagine structural engineering without steel or cement.

The past, present, and future status of industrial alcohol under our laws is what I wish to discuss briefly. A review of this industry in its change from a beverage to a nonbeverage industry will assist us in properly visualizing its present position.

EARLY LEGISLATION ON DENATURING OF ALCOHOL

In 1906 Congress, realizing the necessity of relieving from the high beverage tax the alcohol used for industrial purposes, passed the first act permitting the withdrawal of alcohol free of tax from distillery bonded warehouses for use in the arts and industries, and for fuel, light, and power, provided it were so treated that its character as a beverage was destroyed and it was rendered unfit for use in liquid medicinal preparations. We must bear in mind that at this time intoxicating liquors were paying a large part of the Federal revenue and the first authorizations for the use of denatured alcohol were very conservative. The first year showed a denaturation of about 1,000,000 gallons. This largely went into varnishes, shellacs, and felt hat manufactures, and for domestic fuel purposes, such as spirit lamps. Each succeeding year saw additional formulas for completely denatured alcohol and specially denatured alcohol authorized, and the extension of these formulas to many additional products.

It was early seen that in order to cover many specialties particular formulas must be authorized, as the general formulas for completely denatured alcohol were of such a character as to render them of little use in many special industries. Hence, there was inaugurated the system of authorizing specially denatured alcohol and handling it under the permit and bond system which enabled the Government to keep a record and control of it from the time it was denatured until it was finally used in some specific manufacturing process.

In 1913 Congress passed an act permitting the manufacture of alcohol for denaturation only, and further provided that the alcohol should be treated so as to render it unfit for use as an intoxicating beverage. It should be particularly noted that the only

condition laid down in the 1913 Act was that the alcohol be rendered unfit for beverage use. No limitation as to its use in the arts and industries, or for fuel, light and power, or prohibition against its use for liquid medicinal purposes was set out.

Since the 1913 Act, the Department has authorized the use of specially denatured alcohol in medicinal preparations solely for external use. Tincture of iodine and the official soap liniments were among the earlier authorizations.

With the opening of the war in Europe in 1914 the withdrawal of alcohol free of tax for denaturation increased rapidly. When we became involved in 1917 it became a question of sufficient capacity to supply the demand. Alcohol, ether, and acetone, for smokeless powder, and, at a later date, alcohol itself for the manufacture of poisonous gases, were required in immense quantities. The old beverage whiskey industry, which had not heretofore produced high-proof alcohol, was called on, and by installing re-distillation columns in many whiskey plants our alcohol-producing capacity was further enlarged.

OUR PRESENT CONDITION

The end of the war naturally left us with a greater capacity than we required for normal needs, but the development of many chemical industries during the war, producing dyes, pharmaceuticals, and various chemical specialties heretofore supplied principally by Germany, had so enlarged and broadened the use of denatured alcohol that the withdrawal for denaturation was several times greater in quantity than pre-war figures. Coincidentally, the Food Control Act, the War Time Prohibition Act, and, finally, the National Prohibition Act itself wiped out the use of high-proof alcohol for the manufacture of intoxicating beverages. Title III of the National Prohibition Act provides for the denaturation of alcohol by the admixture of materials that render the alcohol or any compound in which they are authorized to be used unfit for use as an intoxicating beverage. No authorizations have yet been made, however, for the use of a denatured alcohol in a preparation that may be intended for internal use.

Our present production is something like 60,000,000 gallons per annum. We occupy a peculiarly favorable position as to raw materials and distribution; our seaboard plants, utilizing Louisiana, Cuban, Porto Rican, and Hawaiian molasses, are particularly fitted to supply the industrial needs of the East and extreme West; our Middle West plants, utilizing corn and molasses, can likewise obtain raw material close at hand and dispose of their product in their local territory. We have the largest molasses and grain alcohol plants in the world. During the past year a number of breweries have installed alcohol recovery plants incidental to the manufacture of cereal beverages.

In touching on the present alcohol industry we cannot ignore the question of national defense. The chemist foresees the next war as one of gases, aeroplanes, and high explosives. Much has been said of the necessity of a self-contained dye industry with its useful peace-time production which may be immediately converted into offensive and defensive weapons in time of war. We may well place the alcohol industry in the same position, for not only is its production necessary in peace-time activities in order to sustain these other chemical industries, but it must be in a position to expand at once in war time. It is of great importance, therefore, that we keep these facts in mind and lose no opportunity as chemists to educate others in the fundamental relations of these industries to the national welfare.

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At present not less than two-thirds of the total production goes into denatured alcohol, largely for technical uses. These uses, as stated before, are the development of some fifteen years and have no relation to prohibition, nor are the consuming manufacturers affected in any great degree by the National Prohibition Act. At present there are five formulas for completely denatured alcohol and fifty-three formulas for specially denatured alcohol. The specific products in which the use of tax-free alcohol has been authorized number several thousands.

THE PROBLEM OF THE FUTURE AND ITS POSSIBLE SOLUTION

The balance of the production, that goes to the trade as pure alcohol, is the crux of the present trouble. The National Prohibition Act at present may be said vitally to affect and be affected by about one-third of the total alcohol production. An industry that may be one-third crippled; a law that may be only partially enforced, and a consuming manufacturer who spends a substantial part of his time endeavoring to protect himself from thieves constitute what the chemist might term a system not in equilibrium. Let us see if a little further chemical treatment cannot assist in the restoration of equilibrium in this system. The constructive solution of this pure alcohol problem is, in my opinion, the most vital question affecting the enforcement of prohibition, the industry producing alcohol, and the trades using it to-day.

The National Prohibition Act, under Title II, defines alcohol along with whiskey, wine, and beer as an intoxicating liquor. Every chemist knows that 95 per cent ethyl alcohol cannot be used as a beverage, but the comparative ease with which it may be diluted and converted into a beverage has caused it to be classed as an intoxicating liquor. On the other hand, Title III of the National Prohibition Act provides for the protection and encouragement of high-proof alcohol for industrial purposes. In view of the dual purpose of this law, it has become extremely difficult to administer the handling and use of high-proof alcohol in the pure state for industrial purposes.

To say that the handling and use of pure alcohol in the trade during the last year and a half has been unsatisfactory to the enforcement of prohibition, to the legitimate user, and to the producer of alcohol, is to put it mildly. On the assumption that the enforcement of prohibition will be increasingly effective, one naturally seeks to find a remedy for the common ills and troubles.

Is it possible to treat practically all alcohol at the industrial alcohol plant or denaturing plant with some compound or material that will render it unfit for use as an intoxicating beverage, protect it from the thief and bootlegger, and make it fully as available, or practically so, to the manufacturer as pure alcohol? In other words, while the sociologists and reformers are engaged in the laudable work of denaturing men's thirsts and appetites, may we not hasten the day of that accomplishment by denaturing the alcohol itself?

If I should say that alcohol treated as above is denatured alcohol, the question might at once be asked by a chemist, as well as by a layman not familiar with the legal term denatured alcohol: "Why, I thought denatured alcohol was poisonous, contained wood alcohol, and smelled bad. How could you use it in medicines or articles of delicate character?" The first formula of denatured alcohol authorized after Congress passed the original denatured alcohol law in 1906 was ethyl alcohol to which were added approximately 9 per cent wood alcohol and 0.5 per cent of kerosene. The present conception of denatured alcohol was formed, to a large extent, from a knowledge of this first and most widely used denatured alcohol. It is essential to know that the term denatured alcohol is merely a legal term, and that the denaturant used need not only be nonpoisonous but may simply be one or more of the compounds which enter into the final manufactured product. These denaturants may be medicinal compounds, if the alcohol be subsequently used for medicinal purposes, or they

may be other chemical compounds rendering the alcohol suitable for technical purposes.

A barrel of pure alcohol, tax paid, costs from \$250 to \$300. When converted into bootleg whiskey and sold at current quotations of \$10 per quart it returns approximately \$4000. This tremendous profit is a lodestone that attracts the thief or the criminal. If this alcohol were denatured, this conversion into bootleg whiskey would be impossible.

The present policy of the Department has resulted in the recent issuance of a number of formulas for specially denatured alcohol for external pharmaceuticals, perfumes, toilet waters, etc. There is great room for improvement as to denaturants that may be selected, technical as well as medicinal. The time is now ripe for the chemists to convince the Government and the Public that they can successfully denature alcohol for practically all non-beverage uses, such as medicinals and flavoring extracts. This opens up an immense field for constructive research, involving problems both chemical and therapeutical.

It is obvious that the use as a denaturant of some specific drug will in no wise affect the therapeutic properties of the finished preparation of the same drug. Our present Formula 25 is a case in point. Iodine is used as a denaturant for alcohol to be subsequently used in the manufacture of tincture of iodine. The authorization of formulas where specific denaturants are used might, through multiplicity, become a difficult administrative problem, to say nothing of burdening the drug and extract trade. The ideal solution would be some solvent which, if mixed with alcohol, would render the mixture unfit for use for beverage purposes, to the extent that it could be controlled under the permit and bond system, and yet would have practically no appreciable effect on the physical character or therapeutic properties of the finished drug, fluid extract, or tincture.

It seems to me that the chemist with the aid of the therapist can here devote himself to a problem which, when successfully worked out in detail, offers a real solution of some of our present troubles. It is but natural that those charged with law enforcement will seek to correct unsatisfactory conditions by rules and regulations. It seems inevitable that regulations will be added to regulations. The physical presence of an agent of the Department wherever pure alcohol is handled in order to prevent unlawful diversion is impossible.

THE PART OF THE CHEMIST

What we, interested in chemical industries, wish is to get the alcohol industry on an absolutely nonbeverage basis as soon as possible. Then, and then only, can it prosper, and the legitimate alcohol user hope to free himself from the burdensome restrictions surrounding the traffic in intoxicating liquors. The technique of the present regulatory control, by the Internal Revenue Bureau, of the alcohol industry, both producer and consumer, can be made more efficient and less burdensome if the liquor phase can be disposed of. The Department can then bend its efforts to cooperation along strictly economic lines.

Those of you who are associated with educational institutions could perform a most valuable service to the country at the present time by devoting more attention to the problems involved in denaturation. Those of you who are engaged in industry and who are affected by the present situation of alcohol will, of necessity, continue to direct your attention to this problem.

It is the purpose of the Department to cooperate to the fullest extent with you. The law must be enforced. We believe it may be done in a way that will conserve the good while eliminating the bad.

As the chemist has demonstrated to the country in the last few years that the United States has the brains and resources to develop and maintain a well-rounded chemical industry, let us not confess our inability to solve the alcohol problem.