

THE ANTIFREEZE METHANOL HAZARD*

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The wolf in the clothing of the sheep still finds his counterpart in the world of modern commercial products. An old chemical of well-known danger to man, methanol, that is, wood alcohol, now stalks among us wearing the flaxx of new trade names. The extent of the danger inherent in wood alcohol when used industrially is well known to chemists, to physicians and to all students of industrial poisons. An authority among these last, Dr. Alice Hamilton, has termed methyl alcohol especially an American poison, stating with regard to methanol poisoning that, "There have been more industrial cases in the United States than in any other country."

This old danger now menaces the general public through its recent extensive use as an antifreeze mixture for automobile radiators. In previous years ordinary denatured alcohol containing less than 5 per cent. of poisonous wood alcohol was used in radiators of automobiles to prevent freezing. This small amount of the crude wood product did not develop into a health menace to the garage worker nor to the automobilist. But during the past few years the market price of methanol has been cut in half. It is now produced synthetically at the cost of only twenty cents a gallon. The total output for 1930 is estimated at from seven to ten million gallons. While its largest sale at present is reported to be in the production of formaldehyde it has also found an outlet in the products now sold as freeze preventives, while its concentration has been raised from the former 5 per cent. to 76.5 per cent. Ordinarily from 1 to 2½ gallons of the antifreeze mixture are used in the radiator, bringing the present average concentration to from 30 to 45 per cent. This is the proportion recommended by the manufacturers, but many automobilists are using larger amounts, creating a stronger mixture which brings the concentration to about 60 per cent. Then, too, the radiator capacity of the automobile may vary from 10 to 22

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quarts, yet the recommended proportion or percentage of methanol remaining constant, it naturally follows that the total amount of methanol to which the consumer is exposed is much greater in the case of large radiators than in the case of small ones.

These new antifreeze mixtures have been rendered marketable by creating for them new trade names, thus concealing the presence of their high content of wood alcohol, a name which, even to the general public, has come to have an ominous sound. Automobilists have been further misled by the frequent labelling of the product as "a completely dematurized alcohol" or as "84 per cent. alcohol," omitting the word *wood* or by the chemical names of methyl alcohol or methanol. The device of coining trade names is an old method of obscuring the presence of wood alcohol, the knowledge of which would impair its sale. Thirty years ago the Society for the Prevention of Blindness strongly opposed the use of the fanciful names of Columbian Spirits and Colonial Spirits as trade names for wood alcohol used in industry. The need for similar efforts has reappeared.

In December, 1920, the United States Bureau of Mines issued an Information Circular (No. 6415) pertaining to "The Effect of Methanol Antifreeze on Health." The investigation is being made by the Bureau at the request and with the assistance of the chemical industry interested in the manufacture and marketing of methanol. The whole trend of this circular is to minimize the danger arising from the use of wood alcohol as an antifreeze agent. From observations made to date this report concludes that, "There is no danger of poisoning from the reasonable use of methanol as an antifreeze for automobile radiators."

The effect of such an article is to be regretted. While it admits that only a preliminary study has been made, this fact will doubtless be overlooked by distributors of the methanol product and by the general public which ordinarily looks upon government publications as authoritative and final.

The studies up to date, upon which the conclusions are drawn, were made upon thirty six men working in four plants engaged in the manufacture of methanol. The men had worked in these plants for periods varying from a few months to fifteen years. It is not stated what proportion of the men had been employed for the longer

periods of time. Did the thirty-six men studied constitute the entire number of persons exposed to the methanol in those plants at that time? And what was the labor turnover in those plants? Had it been affected by any health injuries which might be attributed to the exposure to methanol? The examination of these men included a general physical examination, with laboratory tests on the blood and urine. The eyes particularly were examined. Mention is not made of any analyses of the expired air for its methanol content. A thorough study of the hazards of the industry requires an investigation of these problems and all quantitative data should be presented before conclusions are published—even in a preliminary report.

The Bureau of Mines is continuing its investigation, yet no plans are mentioned for studies on the effect of methanol fumes on children, pregnant women and other persons who by reason of illness may be particularly sensitive to toxic gases. Yet such persons form a large proportion of the automobile riding public and would be exposed to the hazards of the methanol fumes. The hazards for children especially should be studied. It is well known that the metabolic rate, volume of breathing and the rate of circulation in children are proportionately greater than in the adult. These facts render children more susceptible than adults to any toxic gas or vapor. Therefore, investigations which show no apparent injury suffered by adult healthy workmen when exposed to the fumes of wood alcohol are not conclusive for children. Laboratory studies of the effects of the methanol fumes should be made upon young as well as old animals before the antifreeze mixtures are declared harmless.

Thus far we have considered the dangers inherent in wood-alcohol by reason of its new use. We must not overlook the dangers involved in its misuse. That is—will not its increased use in the radiators of automobiles, its wider distribution, tend also to increase the number of cases of poisoning by attempts to convert into a leverage? On this point the Bureau of Mines circular is emphatic in stating that "all methanol whether made by wood distillation methods or synthetic methods, or whether it is crude, refined or highly purified, is poisonous when taken internally." The government report then recommends that "all antifreeze methanol

be brightly colored" to avoid such misuse. This recommendation, however, will hardly be followed by all producers until legislation requires it of them. Were methanol obtainable only in drug stores it would be promptly included under the laws governing the sale of all poisons, especially because it has a taste and odor somewhat similar to grain alcohol.

There are few poisons whose effects are so insidious and so difficult to diagnose in their pre-acute stage as methanol. The high degree of toxicity of methanol appears to be dependent upon its extremely slow destruction in and elimination from the body, continued exposure consequently resulting in a marked cumulative effect. In many fatal cases no definite symptoms develop for from twenty-four to thirty-six hours. The manifestations of acute poisoning are characterized by the combination of gastro-intestinal and visual disturbances. Abdominal pain, nausea and vomiting are rapidly followed by blurring of vision, partial or total blindness, coma, convulsions and even death from respiratory failure. The visual disturbance is apparently dependent upon optic nerve atrophy and consists of variability in visual acuity, concentric contraction of the color and form fields, pain and tenderness of the eyeballs, dilated sluggish pupils and muscular weakness resulting in diplopia and ptosis. The manifestations of chronic methanol poisoning are much more insidious and not so obvious. The gastro-intestinal symptoms may be so slight as to be completely overlooked and the condition may only be suspected by the occurrence of gradually progressive visual disturbances of the nature described above in individuals exposed to the poison.

In spite of the fact that certain large producers of methanol anti-freeze voluntarily label their containers so as to warn against its misuse, so important a menace to public health should not be left to the voluntary action of those who are interested primarily in the sale of the product. Legislation requiring the correct and conspicuous labelling of all methanol containers with the word "Poison" is an urgent necessity. Such labelling would help to minimize the danger of its being taken as a beverage. There would still remain, however, the danger involved in inhaling its vapors. The Bureau of Mines investigators do state, however, that "continued exposure to high concentration will cause serious poisoning."

We have been severely criticized by medico-legal authorities of Europe for permitting an industry to expose the public to a poison that may injure thousands until such time as the slow wheels of legislation will have been set in motion to prevent further harm. Similar criticism of our American tendency to delay governmental control of health hazards is expressed in an editorial of the *Journal of the American Medical Association* concerning the new hazards from toxic gases. The editor points out that "the American people are beginning to be protected as concerns the food they take into their stomachs. They have only inadequate protection of the air they take into their lungs." Even where laboratory studies have revealed these hazards, such knowledge is not self-enforcing and government ordinances are necessary to protect the public from its own ignorance of the danger. Therefore a maximum permissible concentration of methanol for this new use in the radiators of automobiles should be established, such concentration being determined by thorough studies made with reference to all types of persons likely to be exposed to the vapors. The general public should not exult in an experimental laboratory for the testing out of a new hazard for the sake of a new industry.

REFERENCES

- EDITORIAL: Another Gas Hazard, *Journal American Medical Association*, Aug. 30, 1930.
- HOWARD, CHARLES H.: Synthetic Methanol—A New Health Menace, *New Hampshire State Board of Health*, December, 1930.
- HAMILTON, ALICE: *Industrial Poisons in the United States*, The Macmillan Company, 1925.
- TRUMPER, MAX: *Memorandum of Toxicology*, 2nd Edition, F. Blakiston's Son and Co., 1929.
- FROELICH, PETER K.: Pressure as a Tool in the Chemical Industry of the Future *Industrial and Engineering Chemistry*, Vol. 23, No. 1. (January) 1931.
- SAVING AND YANT: The Effect of Methanol Antifreeze on Health, *United States Bureau of Mines Information Circular No. 6415*. (December) 1930.
- ZANCKER, DARTLING: REMUND, SCHWARTZ: *Ueber neue Aufgaben der Medizin für das Recht*. Aus dem gerichtlich medizinischen Institut der Universität Zürich, 1926.
- ZANCKER, H.: Die Bedeutung der flüchtigen giftigen Gase Sonderdruck aus der *Schweizerischen Medizinischen Wochenschrift*, 59. Jahrgang 1929, Nr. 12, Seite 325.