

Formaldehyde.

By GEORGE ROK.*

Formaldehyde, formic aldehyde, or formalin, was discovered by Hofman in 1869. In the formation of starches and sugars from the carbon dioxide which the plant absorbs from the air, it is believed that formic aldehyde is formed as an intermediate product. Chemically, it is prepared by the limited oxidation of methyl alcohol, or when calcium formate is subjected to dry distillation. The gradual oxidation of methyl alcohol occurs when a stream of air saturated with the vapor of methyl alcohol is drawn through a tube containing a copper spiral or platinized asbestos.

Formaldehyde is a powerful germicide, due to its combination with gelatinous and albuminoidal substances; in consequence of its chemical reaction with the various volatile products of decomposition it is a decided deodorant. Its great antiseptic properties were discovered by Berlitz and Trillat, who found that an addition of 1 in 50,000 was sufficient to prevent the development of bacteria in meat-juice. Leow recognized it as a powerful poison to vegetable protoplasm. Its non-poisonous character makes it extremely useful in preserving certain preparations, and in pharmacies, especially dispensaries where there is much dispensing done, it can be used in some cases with good results. This is particularly so where large quantities of fermentable mixtures have to be kept readymade, and often enough to last some days or even weeks.

In hospital dispensaries and establishments where a large amount of dispensing has to be done in a very short time, it is necessary to prepare beforehand many preparations which, in some cases, must last a considerable time, and, as may be expected, a preservative of some kind must be used, such as alcohol, salicylic acid, chloroform, and now formaldehyde. The addition of alcohol is costly, and, unless a large quantity be added, the preparation becomes sour, owing to the action of micro-organisms and natural ferments. Salicylic acid is objectionable in many ways. Camphor and chloroform have a taste and smell which many cannot tolerate, so there still remains to be found a preservative that can be used without having any particularly objectionable points. I have for a considerable time used chloroform, and, experimentally, formalin, in

all cases where my experience has taught me that a preservative must be used, such as in making fresh infusions and decoctions sufficient to last perhaps weeks, in the solutions of the alkaloids; mixtures which, if dispensed as written, would keep only a few days, whereas they are often expected to remain good for two or four weeks; mixtures which contain organic substances in which bacteria grows with extraordinary rapidity. Those containing ergot are very common in my case; these at times assume the appearance of mucilage in a few hours, and here something must be done. Almond-mixture is one which ferments after a few days, and patients often have enough to last them two weeks, and nothing keeps it so well as formalin—1 in 10,000 [of the 40 per cent. solution] will keep it sweet for weeks and cause no inconvenience to the patient. Milk is another fluid which gives trouble in hospitals, it often goes bad during one night; but as small a quantity as 1 in 50,000 will keep it for that time and give no unpleasant symptoms to the patients. Milk required for future analysis can be kept sweet for some weeks by adding four or five drops to each 100 c.c. It is stated to have the curious effect of slightly increasing the total solids in some cases, due probably to the conversion of milk-sugar into cyalactose.

For infusions and decoctions 1 in 1,000 to 1 in 3,000 answers best; but, taking into consideration the powerful effect formalin has on animal tissue, and how intensely irritating is even a weak solution, it is doubtful if the former strength can be adopted until its action on the human economy is better understood. When it is used for concentrated preparations the case is somewhat different, and no harm can possibly result from its use. It has the advantage of having little taste or smell in such small quantities, and thus differs from chloroform. For infusion, which it is an advantage to keep one or two weeks, it is decidedly useful; but when required to be kept longer nothing answers so well as chloroform, 1 in 500 or 1 in 1,000, such as for gentian, calumba, quassia, either single or four times the strength of the Pharmacopœia; these, when diluted, have little of the smell or taste of chloroform. When patients are put on digitalis, jaborandi, and a few others, and only small quantities of stock need be made, formalin answers well. Its power to destroy the bacteria of fermentation and putrefaction is its strongest point, and is thus of

great service in pharmacy for preparations which have a tendency to ferment. In breweries it has been found useful on account of its arresting secondary fermentation, although not interfering with the resulting quantity of alcohol produced; it also reduces the acidity, and thus enables the process to be conducted at a lower temperature. It cannot be said it is systematically adopted in this country for this purpose, but it has been used with marked success on the Continent. Antiseptic agents were used to preserve beer and other fermented fluids from the ravages of aerial ferments long before Pasteur explained the true cause of fermentations, and were protected under patents; hydrofluoric acid was one.

In the manufacture of mineral waters of a sweet nature it is impossible to exclude the germs of putrefaction from the materials and apparatus; consequently much turbidity is the result, and great is the loss to the maker. Most of the preservatives in common use have therapeutic activity or corrosive action on the metals. It is claimed that formalin will do away with these objectionable points, and 1 in 20,000 is considered sufficiently strong for the purpose. For washing the utensils 1 in 1,000 should be used; the mixture can be used over and over again, as long as it retains its characteristic odor.

Formalin has not been much used in medicine. As a spray and paint it has been found useful in diphtheria— $\frac{1}{2}$ to 1 per cent. as a spray and 1 in 500 as a paint. Glycerine agar inoculated with the bacillus and sprayed with formalin gave no growths. As an inhalation diluted with carbonic-acid gas it has been found beneficial for consumptives; if used too strong it may bring on hæmorrhage, etc. In ophthalmic surgery a 1 in 2,000 solution has been found useful for injury to the cornea and various forms of ulceration. Applied three times at intervals of two days it has been found useful in ringworm. In dentistry its weak solution is antiseptic and astringent.

It is excellent for keeping urine required for future analysis—it will keep it sweet for weeks. For preserving vegetable products a 1 to 2 per cent. solution has been found best; little of the fresh appearance is lost, and the odors are quite distinguishable after many months. Gelatine exposed to the vapor of the 40 per cent. solution for twenty-four hours becomes like leather, and insoluble in boil-

* A paper read to the Chemists' Assistants' Association, February 17th (slightly condensed).