ganate or manganese dioxide. The reaction between permanganate and tetrabase is extremely rapid, whereas in the normal application of the test, where periodate is present, colour development may take several minutes. The tetrabase derivative responsible for the blue colour in aqueous medium can be extracted with chloroform. This solution is colourless and contains no manganese. On removal of the chloroform and addition of water, the blue colour reappears.

These results are in agreement with the suggestion that manganese acts in a catalytic role, tetrabase being oxidized by permanganate or manganese dioxide, and the reduced manganese so produced being re-oxidized by periodate. It is probably this latter reaction which determines the rate of colour development. To account for the quantitative nature of the test, it is clear that the reaction must cease after a certain amount of colour has been produced. With periodate and tetrabase in excess this can only be brought about by the loss of manganese from the system.

If the reaction is carried out at temperatures greater than 90° C., little or no colour is observed, although the blue pigment is quite stable to heat. On cooling, the addition of further tetrabase and periodate is ineffective, and additional small amounts of manganese produce colour intensities much less than those expected. Excess of manganese, however, produces the usual intense blue. It is suggested that in the oxidation of tetrabase a second substance in addition to the blue pigment is formed. This is soluble in water and is capable of complexing manganese, which is then lost from the oxidation-reduction cycle. At high temperature this second reaction is favoured, and this accounts for the inverse temperature-colour intensity relation which has been observed[4].

Although the method in routine use is capable of giving duplicate estimates differing by less than 5 per cent, extinction values per unit manganese may show unaccountable variations from day to day. Such variations are often associated with changes in the rate of colour development which, as has been shown, depends on the manganese oxidation cycle. This is strongly affected by the order in which reagents are added. When periodate is added last, the initial phase of colour development is very slow, the intensity/time curve following a markedly sigmoid pattern typical of an autocatalytic reaction. When tetrabase is added last, however, the initial development is rapid, with no early lag phase, and final intensities tend to be higher.

It has been shown that the oxidation of divalent manganese to permanganate in strongly acid solution is autocatalytic[5], and the results here suggest that a similar mechanism may be operating, the presence of a high-valency state of manganese being necessary for the reaction to proceed at maximum rate. It seems likely that this part of the reaction is responsible for many of the troubles which have been experienced with the test and a fuller understanding of the oxidation of manganous ions to permanganate at extremely low concentrations will be necessary if further progress is to be made in the use of the method.

In the course of this study it was observed that water from a 'Permutit' ion-exchange resin column, if used for making up reagents, may interfere seriously with results. This was in spite of the fact that water from the same column had been used successfully for some years previously. It is probable that traces of resin, which have been observed at a concentration of 3 p.p.m. in this water, were the cause of the interference.

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[1] Nicholas, D. J. D., and Fisher, D. J., Ann. Rep. Long Ashton Res. Sta., 115 (1950).
[2] Harry, R. G., *Chem. and Indust.*, **50**, 796 (1931).
[3] Harvey, H. W., *J. Marine Biol. Assoc. U.K.*, **28**, 155 (1949).
[4] Cornfield, A. H., and Pollard, A. G., *J. Sci. Food Agric.*, **1**, 107 (1950).
[5] Strickland, J. D. H., and Spicer, G., *Anal. Chim. Act.*, **3**, 517 (1949).

Use of Wooden Boxes for Breeding Mice

As a result of a personal communication made to one of us that the Roscoe B. Jackson Memorial Laboratory, Bar Harbor, Maine, U.S.A., had reverted to the use of wooden boxes in preference to metal boxes for breeding mice, and had thus restored their previous level of productivity, it was decided to investigate the most suitable pattern of box and its mode of construction.

The box now in regular use at the experimental mouse-breeding unit at Hampstead is made of imported cedar or other suitable hard wood. The internal dimensions are 12 in. long, 8 in. wide and $4\frac{1}{4}$ in. deep. The sides and ends are $\frac{3}{8}$ in. thick with mortised joints reinforced by brass pins; and the bottom is $\frac{3}{16}$ in. thick resin-bonded 3-ply wood also lined up with brass pins. The parts are held together with a phenolformaldehyde resin, and it is this resin, not the pins, that holds the box together. The resin is resistant to both water and heat. Plywood is necessary for the bottom because it does not expand laterally when wet, as does plain board. Warping will only occur if unseasoned wood is used; this, however, is hard to avoid, but we have found that only about one in twenty boxes gives trouble in this way, and then only if too little resin is used.

The lid of the box is of metal with a built-in basket for cubes, and a small bridge to support an inclined 12-oz. medicine-flat type water-bottle with a protected hole for the passage of the drinking-tube. Any preferred pattern of lid can be used with one proviso. The shoe-box type lid with an exterior flange is unsuitable, for it enables the mice to get at the edge of the wood and gnaw their way out. The lid must fit inside the box, the interior flange going down about $\frac{1}{4}$ in.; with such a lid gnawing is prevented.

Wooden boxes that have been in use for two years, being regularly sterilized by steam or boiled in water, are virtually as good as new; their lifetime is not yet known but it is certainly long.

A fuller report is being published elsewhere.

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