

time I use only $\frac{3}{4}$ lb. of yeast for bitter ales of the gravity above mentioned, and $\frac{1}{2}$ lb. for the porters and mild ales. Working under these conditions, I obtain a yeast outcrop of threefold that used at pitching in the case of bitter ales, whilst mild ales of a specific gravity of 1030 give a yeast crop of four- to fivefold. In addition to this increased outcrop, the yeast is solid and vigorous, and even five or six days after being skimmed from the fermenting tun it is quite fit for pitching another gyle. In fact, it is my custom to pitch with this yeast five days old.

It is my intention to try the effect of further reducing the amount of yeast added at pitching, but for the next few weeks my experiments will have to be discontinued. However, I believe that my experiences, so far as they have been established up to the present, may prove useful and suggestive to other brewers, and hence I decided to offer them for publication even in their present incomplete state.

H. B. WOOLDRIDGE.

Air in Gas Used for Carbonating Beers.

THE work of Adrian Brown (*J. Chem. Soc. Trans.*, 1905, 87, 1395; this Journal, 1906, 12, 285) has demonstrated the stimulating effect of atmospheric oxygen on the reproduction of yeast cells. Practical brewers had long known the advantages attending the aëration of worts at an early stage of the fermenting process, and had carried this into effect by direct aëration, pumping, bucketting, etc. It may be added also that Pasteur fully recognised the beneficial effects of aërating wort. It is now, therefore, a well-established fact that the presence of atmospheric oxygen in wort promotes vigorous fermentation, the true explanation of the fact having been given by Adrian Brown (*loc. cit.*). The object of this article is to demonstrate that, so far as the primary fermentation is concerned, aëration is only admissible at the early stages of the fermenting process. In some systems it is carried to the point at which the attenuation has reached half gravity. Beyond this point the presence of oxygen is not only without benefit, but is actually harmful. I have dealt somewhat fully with this question in a previous paper (this Journal, 1915, 21, 512).

When air gains access to the fermenting vessel at a late stage of the fermentation process, some of the cells are carried back to that phase of development which they should assume at pitching, and reactions other than alcoholic fermentation, which are necessary for the development of what we call character, are brought to a standstill. A yeast taken from a fermentation which has been aërated at a late stage will

show a number of budding cells, which should never be present except perhaps in very small quantity in a good pitching yeast.

My attention has been called specially to the influence of oxygen in stimulating fermentation in connection with chilled, filtered, and carbonated bottled ales. It is a fact, which is not perhaps sufficiently recognised by practical brewers, that although most efficient filters and pulp are available, by none of them is it possible to remove the whole of the yeast cells and other organisms present in the chilled beer. Nor would this be desirable, for if anything approaching ultrafiltration were practised, colloidal particles might also be removed, which are known to help in maintaining character and condition. The point to which I desire to direct attention, however, is that if the beer is to remain bright for a reasonable period, the smallest traces of air must not be allowed to gain access to it. Air may be introduced with the gas used for carbonating the beer. Under these circumstances, a small number of yeast cells, which under strictly anaërobic conditions would remain dormant, in the presence of air multiply to such an extent that the beer throws a deposit, and may even become turbid. The precaution against this is to test every batch of carbon dioxide used for carbonating beer for the presence of oxygen. This is, I believe, practised by most brewers, and the apparatus required for the purpose is very simple. A sample of carbon dioxide should not contain more than one part in a thousand of air.

ARTHUR R. LING.

Nitrogen in Caramel; its Relation to Ropiness.

IN the manufacture of caramel of high tinctorial value ammonia is now generally used, either in the form of ammonium hydroxide, or as ammonium sulphate. The quantity of ammonia varies considerably, and although one firm may employ a large proportion of ammonium hydroxide and another a relatively smaller proportion, the colour value of the finished caramels may not vary more than one degree, if even that, although the ammonia, calculated from the nitrogen present in the finished caramel may, in one case, be equal to 7.7 per cent., whilst in the other it may be under 2 per cent. By this it will be seen a considerable quantity of nitrogen is added to the wort, which I have proved is not at all desirable in beers or stouts having a tendency to become ropy.

It is true that during the manufacture of caramel some of the ammonia may be driven off in the process, but a certain quantity is retained, it being chemically combined with the carbohydrates during