

## PURE YEAST IN BREAD. BY KATHERINE E. GOLDEN.

Since the introduction by Hansen of pure yeast into bottom fermentation brewing its use has spread to top fermentation brewing, to distilleries, and in fact, to all industries in which fermentation enters as a factor. This almost universal employment is due to the great benefits which accrue from the use of the pure culture. After methods had been devised for the separation of the yeasts it was determined that many which differed from one another very slightly, if at all, morphologically, possessed very distinct properties when considered physiologically. This was shown more particularly in the by-products formed. Many yeasts which give practically the same alcoholic fermentation differ very materially in the characteristics which they impart to beer, so that it was determined that the flavor or "bouquet" of a beer was due primarily to the yeast; that by changing the yeast, keeping all the other conditions constant, a different beer could be produced.

The use of the pure yeast has worked to the great advantage of the brewer, for after a yeast has been selected and careful consideration given to its being kept free from foreign organisms during the brewing, absolute certainty is felt as to the resulting product, definite strength of alcohol is obtained and a constant flavor insured; moreover, the product can be kept indefinitely without deterioration, and can be duplicated when desired. It is evident that where pure yeast is used, elaborate methods for keeping and storing can be dispensed with, for with the absence of foreign organisms there is nothing present in the beer to cause it to deteriorate.

The use of the pure yeast has worked to the advantage of distillers and others as well as brewers, for in distilleries a greater per cent. of alcohol is obtained and in the pressed-yeast factories a higher yield of yeast results.

To determine whether the same advantages which have been obtained in other fermentation industries could not be obtained also in bread fermentation, experiments were made along this line. The experiments are merely outlined in this paper, no details being given.

First, market yeasts were examined microscopically, chemically and in plate cultures. As a rule, the moist cakes, when taken fresh, had a small per cent. of dead-yeast cells, but had present many moulds and

bacteria. The dry cakes had few moulds, but had a large number of bacteria. All the dry cakes had alum present, not in sufficient quantity to act on the bread, but the alum evidently had been used as an antiseptic in the mash. Slack sponges were also made of the yeasts, and showed marked variations as regards time and extent of fermentation. This is a test that could be made easily by the housekeeper.

Pure cultures were then made of the yeasts. For this there were used eight moist cakes, six dry cakes, six yeasts from the air (four of these being red yeasts), two from cider, one from flour, four from fruits (grape, guava, persimmon and apple), two separated from corn smut and two from beer, making 31 in all. The pure yeasts were tested (1) for gas production, for which purpose beer wort was used in fermentation tubes; (2) for their action in solutions of sugars—sucrose, dextrose, lactose and maltose; (3) to determine the death limit of temperature for young and old cells; (4) for their fermentative action in slack sponges and stiff doughs, the latter being baked so as to determine the flavor imparted to the bread.

The yeasts were examined microscopically, and it was found that material differences existed among some, while others were so much alike as to be indistinguishable from one another. The wild yeasts and those from the dry cakes were, in general, smaller than those from the moist cakes, and they also developed a film sooner. The yeasts from the moist cakes were large and resembled the beer yeasts. The appearance of the yeasts when grown on solid media will sometimes show variations that aid in the determination.

In gas production there was also much difference, the moist cakes and beer yeasts producing more gas and in a shorter time, as a rule, than the others. Some of the air yeasts produced no gas.

In the sugar solutions there were peculiarities appeared, in that certain yeasts would grow vigorously in one sugar and not in another, the yeasts showing different preferences.

For determining the death limit the yeasts were taken when five days old, 21 days and 30 days, and were tested, beginning at 65° C., for three minutes, then running up until the death point was reached. The death point varied between 80° C. for five minutes and 95° C. for 15 minutes, so that every one of them would be killed in the baking, in even the short time required for biscuit.

In the sponges the characteristics of the yeasts appeared to good advantage, for not only could the fermentative action be easily determined, but also the particular flavor imparted and the keeping properties. The sponges were tested first with sterilized flour, then with unsterilized. Sponges made with sterilized flour were kept for weeks without giving off bad odors. They were then made with unsterilized flour. The odors generated during the fermentation varied from pleasant fruity odors through pungent odors, flat and insipid odors to decidedly disagreeable odors. Some of the sponges would remain in good condition for weeks, whereas in others, growths of moulds would appear in a few days or disagreeable odors were generated. The breads varied also, some being pleasant to the taste, some insipid and a few left a sharp or unpleasant aftertaste. Then the texture differed even with as nearly as possible the same amount of kneading; some were even-grained, while others would show quite an extent of irregularity in the grain. One thing that was quite noticeable in all the breads was the lack of any sourness, and on account of this lack when the breads are tasted, there seems something missing to which one is accustomed.

The experiments on the whole indicated that if the best results are to be obtained in bread-making the yeast will have to be selected with the same care that a yeast is for the fermentation of beer or other liquor. A yeast should possess certain properties to make it valuable in bread-making; it should have a fairly vigorous action, so that the fermentation would take place before any deleterious changes could take place in the dough; it should impart a pleasant flavor and without any disagreeable aftertaste, and should give an even, fine texture to the bread. All these qualities could be obtained by taking the same care in the selection of a yeast for bread that is now taken in the selection of a yeast for beer. Besides, there are great possibilities in the variety of flavors that can be obtained from the use of different yeasts. I presume the reason for the apathy that exists in regard to the selection of yeasts for bread-making purposes is due to the fact that a great deal of the bread is of home manufacture, and if not suitable, it is not so easy for one to change the base of supplies, so that a good deal of competition is eliminated.