General Introduction.

Yeasts are generally believed (1) to include the ascospore forming organisms in the family Endomycetaceae and the imperfect genera included in the monographs by Lodder (2) and Diddens and Lodder (3). Nindisch (4,5) Roberts (6) and Vartichak (7) postulate that organisms such as Taphrina defermans and Ascoidea rubescens are so closely related to the family Endomycetaceae that they should be included in yeasts.

Guilliermond (8), Stelling-Dekker (9) and Kluyver (10) assert that yeasts constitute a group of primitive Ascomycetes. Graumann and Dodge (11) Henrici (12) and many others ~~support~~ (13, 14, 15) support the same point of view. Bessey (16) considers the yeasts as reduced forms arising from certain genera in the Euasomycetes, but this has obtained little support from mycologists. Zender (17) Krassilnikove (18), and Guilliermond (19, 20, 25, 26) and Wallerstein and Schade (21, 27) others are of the opinion that yeasts represent a heterogeneous group of organisms derived from several different sources.

Since the last two decades there is such a rapid progress in the knowledge on yeasts that every alternate year calls for a review of all the latest findings in the field. The present literature has been very well reviewed by Joslyn (19) Neuberg (20) Brandt (21) and Nickerson (22, 23). Stephany (24) and

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and of von Loesecke (24) have compiled extensive lists of selected references of publications dealing with the manufacture of yeast.

The yeasts are of great interest to the chemist, the biochemist, the micro-biologist and the botanist; not only because they are the simplest form of life which gives them a peep into the ~~curious and mysterious~~ functions of life but also because this uni-cellular organism produces many ~~con~~ commercially important metabolites. Formerly Yeast was utilised only for the production of wine, ethyl alcohol amyl alcohol, glycerol, etc. but the analysis of the yeast cell, raised its value to an assimilable food material because of its protein and vitamin contents.)

The nutritive value of the ~~organism~~ yeast induced the scientist to a rigorous study of the conditions which favour ~~an~~ its abundant growth, and also gave an impetus to the search of such strains of yeast which utilising cheap materials for growth, give a high yield of dry yeast.

In the chemical laboratories of the Allahabad university, Allahabad (India), this search resulted in the isolation of the Dhar yeast from local toddy. The morphological investigations and physiological studies disclosed this to be a new variety of yeast (25). The Dhar yeast under non-aerated conditions ~~in~~ ~~in abundance~~ grows well in sucrose, glucose and maltose but it does not grow in lactose,

Dhar yeast can utilise maltose fibly and cannot use lactose as the food of carbon. It is in accordance to the Kluyvers (47) generalisations concerning the fermentation characteristics of yeast.

[For the matter of page 4]
general nature.

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The Dhar yeast can grow even on starch as the source of carbon. [For the matter of page 7]
12 first lines 7+8+7

[The Dhar yeast can grow in culture only on minerals nutrients, sucrose, & some amino acids as nitrogen. The utilising the various minerals used as the food of yeast on the metabolism of this yeast has been studied. This seem to be a most neglected side of yeast of studies and our knowledge in this topic is still very limited

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It produces very little ethyl alcohol in these cases. In fact, it can grow in abundance in cultures containing only ethyl alcohol as the source of carbon (26) Trikal and Santon (27) and Kayser and Demolon (28) have also reported that yeasts can utilise ethyl alcohol as the source of carbon for growth. [2]

The Dhar yeast as compared to many strains of yeast gives nearly twenty times more yield of dry yeast, in the same period of growth (29) Even the little alcohol formed in the beginning of its growth is later on taken up for the cell growth. The other yeasts in comparison produce an appreciable amount of alcohol. However Dhar yeast generates a good quantity of acids, most of which is succinic acid.

Yeasts can be divided into two broad groups. One is known as food yeast and the other fodder yeast. Food yeast is used primarily for human consumption as a food constituent, whereas fodder yeast is given to animals. Both the yeasts are produced under similar conditions, except for the raw materials used and the final treatment of the products.

Food yeast is a rich source of protein and vitamins of the B-complex. When dry, it contains about 50 per cent of protein. This food yeast when used in the proper proportions with other foodstuffs, makes a satisfactory and nutritious supplement to the

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2)

~~food~~ of persons whose normal diet is lacking in animal proteins and vitamins of the B. complex.

Fodder yeast is generally prepared from waste-liquors ~~materials surplus~~ or low-cost carbohydrate materials. ~~While these waste~~ So ~~these~~ waste sulphite liquors of industry are ~~not only~~ utilised for the production of such a valuable food material for farm animals and ~~its production~~ utilisation aids in the alleviation of stream pollution.

A strain of Torulopsis utilis is commonly employed in the production of food and fodder yeast. However in Germany, Torula pulcherima, Monilia candida, candida arborea, mixed Torula and Oidium lactis have also been used. ⇦

The ~~yeast used for~~ food yeast should have the following characteristics. It should be of high protein ~~content~~, and vitamin content. It should ~~be one of high~~ grow rapidly, give a good yield and be palatable. It should be grow under normal conditions and in cheap raw materials.

The Dhar yeast is quite palatable, it grows quickly and produces a high yield of dry yeast. Its nitrogen content is quite high which goes to prove that the protein content ~~must be~~ is of a high value. It can grow ~~easily~~ luxuriantly in

[The Dhar yeast can use ammoniacal nitrogen as the source of nitrogen. ~~How this can also utilize the nitrogen of nitrate & urea for its nitrogen need~~. ~~It~~ Pasteur was [matter of page 16] right 17+18]

[~~Put here~~ the matter of page 18]

sulphite liquors and other cheap raw material under non-aerated conditions at the room temperature. such as ~~sugary~~ solutions ~~the raw materials~~ or starch hydrolysates. Because it can grow in ethyl alcohol, the sulphite liquors of ~~the paper~~ industry which contain ethyl alcohol in low concentrations can also be used with advantage for growing the Dhar yeast.

Another important property of the Dhar yeast, which increases its commercial importance, is its ability to fix atmospheric nitrogen under certain conditions. By adjusting the conditions of the culture, this yeast can be made to lose nitrogen from the medium or to fix atmospheric nitrogen. It has been observed (30, 31, 32, 33, 34) that some yeasts can fix atmospheric nitrogen, and ~~this has been reported to~~ sometimes it has been reported that the same yeasts do not fix ~~at mo~~ nitrogen. (35, 36, 37) This apparent anamoly is clarified by the extensive study of the influence of several factors on the nitrogen metabolism of the Dhar yeast. The C/N ratio of the culture (38), the concentration (39), the hydrogen ion concentration, and the source of carbon and nitrogen, all these ~~have~~ greatly affect the metabolism of the Dhar yeast and its nitrogen fixing property. Under some conditions, the fixation of nitrogen is

(Ed) See the left side of page 3 of this manuscript.

& quite appre high.

In higher plants, ammonia is not so important as a source of nitrogen like the nitrates. But in the nutrition of yeast, ammonium salts play an important role while nitrates are generally not assimilated. In this thesis nitrate assimilation of Dhar yeast has been compared in detail with ammonia uptake. The growth and metabolism of the Dhar yeast in cultures containing different nitrogen sources, such as urea, nitrates and ammonium salts have also been studied under various conditions.

The mutation of micro-organisms is a topic which is receiving much attention these days. ~~the~~ Recently pure mutations have been achieved by using chemicals ~~too~~ only. A detailed study of the various changes produced by the introduction of different chemical agencies has been carried out with the Dhar yeast (40). Some of the mutated varieties have been found to give a better yield than the non-mutated ~~vari~~ yeast. It is also observed ~~found~~ that ~~on~~ repeated~~ly~~ growing of the mutated variety in a normal media, helps the organism in its effort to revert to its original form. ~~(20) qualitative (20)~~.

Many minerals are essential for the growth of yeast, But in a certain concentration.

Put in the matter for 12, 43

~~But the increase or decrease~~. The effect of the increase or decrease of the concentration of the minerals have been studied so far, with the growth of yeast ~~in consideration~~ as the chief consideration, ~~The effect produced on~~ and the changes in physiological and metabolical properties have not ~~been~~ received the full attention they merit (41). The ~~effect of the~~ influence of the concentration of Calcium (42), magnesium, phosphate and Zinc (43) ions on the metabolism of the Dhar yeast has been extensively studied ~~but~~ in this thesis.

There are some micro-organisms, which utilise the energy liberated by the oxidation of some inorganic substances like ferrous salts (44) hydrogen, carbon monoxide, methane, mangous salts, ammonium salts, nitrites etc. The Dhar yeast is also capable of utilising the energy liberated for fixing the carbon dioxide of the air for cell materials, when grown in cultures containing oxidisable inorganic substances, under aerated conditions. ~~However, the growth of yeast is seen only for a short period. after which the yeast star died. This is because~~ The Dhar yeast, ~~the~~ from all these studies is found to have some very important and useful properties. It can be

The more we probe into the mysteries of the micro-organisms, the more we feel ~~like~~ as Newton felt — like a little boy on the sea-shore, searching for and picking up shells and finding each one prettier and than the last. ~~and~~.

Hydrolases and Oxidoreductases

CH

$CH_3 \cdot CH_2 \cdot CH_2 \cdot CH_2 \cdot CH_2OH$ < normal butyl carbinol, pentanol (1) or pentanol

$CH_3 \cdot CH_2 \cdot CH_2 \cdot CH(OH) CH_3$ < methyl, normal propyl carb, pentanol (2)

$CH_3 \cdot CH_2 CH(OH) CH_2 CH_3$ < di ethyl carbinol, pentanol (3)

$CH_3 \cdot CH_2 \cdot CH(CH_3) - CH_2(OH)$ < Secondary butyl carbinol, 2 methyl butanol (1)

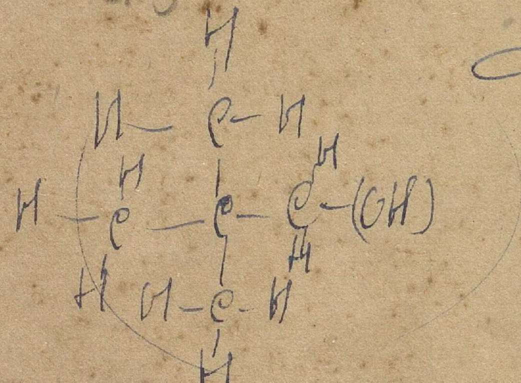
$CH_3 \cdot C(CH_3)(OH) \cdot CH_2 \cdot CH_3$ < Ethyl dimethyl carbinol, 2 methyl butanol (2)

$CH_3 \cdot CH_2 \cdot CH(OH) \cdot CH(CH_3) - CH_3$ < methyl isopropyl carb, 2 methyl butanol (3)

$CH_3 - CH(CH_3) - CH_2 \cdot CH_2(OH)$ < Isobutyl carb, ~~2 methyl carb~~

$CH_3 - C(CH_3)(CH_3) - CH_2OH$ < Tertiary butyl carbinol, 2,2 dimethyl ~~carbinol~~

~~The~~ ~~the~~ ~~Structural~~ Formula



CH_2OH
$CHOH + HI$
CH_2OH

CH_2OH
$CHOH +$
CH_2OH

CH_2I
$CHOH$
CH_2I