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Quality Control in the Manufacturing of Cholam Malt Extract

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Malt extract possesses high nutritive value and is easily digested. Plain malt extract is administered not only to infants and invalids but also is used in pharmaceutical industry as a vehicle for fish-liver oils and mineral salts. Imported brands of malt extract are manufactured mostly from barley. Siddappa (1) reported that malt extract manufactured from *Cholam* or *Jowar* (*Sorghum Vulgare*) compares favourably with other standard malt extracts. The quality of the malt extract depends upon the care and precision with which the several processes involved in its manufacture are carried out. This was evident while manufacturing cholam malt extract at the Government Malt Factory at Coimbatore. Based on that experience certain suggestions have been made in this paper regarding the application of the methods of quality control in the different stages of manufacture of malt extract.

1. **Selection of grains:** The first stage in quality control starts with the selection of the right type of raw material. Before bulk purchases are made, it is necessary to test the grains for their suitability for malting. Seed viability i. e., the germination capacity of the sample, is a very important measure of its suitability for malting since the yield and quality of the malt extract depend upon the percentage of germination of the seeds. This can be rapidly assessed with the chemical 2, 3, 5–triphenyl tetrazolium chloride (2). Bulk purchases should be made only after satisfying that the samples have a germination capacity of over 80% and the grains are well-developed, uniform in size and yellow in colour. Stocks stored in pits should not be purchased as they have very low germination capacity. Cholam grains generally retain their viability for about one year when they are stored in suitable godowns taking necessary precautions against any insect attack.

2. **Malting:** The manufacture of malt extract involves three stages, viz., (i) germination (ii) partial roasting at controlled

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temperature and grinding (iii) mashing and concentration. Strict control has to be exercised over all these processes to get a product of good quality. For germination, the cholam is graded, washed with lime water to free it from bitter resins and tannins present in the husk and then steeped in water for 24–30 hours, with intermittent aeration, changing the steeping water twice or thrice. The grains are then drained and couched for 5–6 days at controlled temperature of 67–69°F. Since this is a very important stage in the process, strict quality control is necessary to see that the grain absorbs the maximum amount of moisture and is well aerated as, otherwise, the germination and consequently the yield of extract will be low. Further, during germination also, proper care should be taken to see that the grains are sprinkled with the right amount of water and that the growth is arrested by drying in the sun when the acrospire is $\frac{1}{4}$" long, which will usually take 5–6 days at 67–69°F. Although malting at ordinary temperatures may be cheaper and may give fairly satisfactory malt extract, it is to be borne in mind that vigorous enzyme formation and thorough modification of the grain will occur only when the malting is conducted at the proper controlled temperature of 67–69°F.

The sun dried malt, which is known as green malt, should be analysed periodically for its diastatic activity in terms of lintner degrees, saccharification time and cold water extract by standard methods (3) in order to ensure that the germination process is being carried out efficiently. A part of the green malt has to be roasted at 135–140°F for 3–4 hours to develop the characteristic malt aroma. This process also requires careful control. The green and roast malts are ground to a coarse flour of 40–50 mesh. Fine grinding should be avoided as it not only causes difficulties in centrifuging and filtration but also often results in impairing the keeping quality of the finished product, because fine particles of starch, that might pass through the filter, will facilitate the growth of mould in the extract during storage.

The water used for mashing should be tested before hand for freedom from metallic contamination or other substances which may affect the quality of the product. It should be of moderate hardness, containing only 20–40 parts of dissolved salts per 1,00,000 of which calcium sulphate or chloride should form the major proportion. Carbonates in excess of 1–2 parts per 1,00,000 are undesirable as they have the effect of making the reaction alkaline. When water conforming to the above standards is used for mashing, a pH

of 5·8–6·0, which is the optimum for cholam malt amylase activity, is obtained by the action of weak acids of the malt itself. The temperature of mashing also is of great importance in determining the quality of the final product and great care should, therefore, be taken to see that it is always maintained between 58–60°C. Any attempt to get higher yields of extract by resorting to mashing at higher temperatures should be avoided as they lead to an unattractive, cloudy product which has very poor keeping quality.

The thick mash left after decanting the clear liquid is generally centrifuged, and the centrifuged liquid mixed with the clear supernatant liquid and heated to about 80°C to facilitate quick filtration. The hot liquid should be filtered quickly under vacuo on a bed of activated carbon to prevent the development of an unattractive colour and high acidity in the finished product. The clear filtrate is then concentrated in vacuum stills at about 64–68°C to a final concentration of 78–82% soluble solids. The progress of concentration should be followed with the help of a suitable refractometer. Towards the final stages of concentration, the temperature should be kept below 60°C in order to avoid the development of any dark colour and caramelised taste in the extract. Every batch of the final product should be tested for uniformity of quality and, if need be, they should be blended suitably to get a standard product for the market.

The laboratory examination should consist of both organoleptic evaluation and chemical analysis. In the former case, caramelised taste and metallic flavours should be looked for. The chemical analysis should consist of the determination of (1) refractive index and total soluble solids (2) specific gravity (3) acidity (4) total proteins and (5) total reducing sugars expressed as maltose. The data should generally conform to the limits proposed by Siddappa (1) for cholam malt extract.

Refractive Index	...	1·4950— 1·5000
Total soluble solids by Refractometer at 28°C	...	80 —82%
Specific gravity	...	1·40 —1·45
Acidity (expressed as acetic acid)	...	0·6 —0·8
Total proteins	...	2·8 —3·2
Total reducing sugars expressed as maltose	...	65 —75

Malt extract contains maltose toge... ...h other constituents like dextrin, dextrose and small amounts of other carbohydrates. Of the reducing sugars present, maltose should naturally constitute the major proportion. The estimation of these individual reducing substances is not possible by the ordinary volumetric method of Lane and Eynon. The separation and estimation of maltose and dextrose can, however, be effected by the paper chromatographic technique. A biochemical method (4) also has recently been reported for the accurate estimation of maltose and dextrins in malt extract. These methods are not, however, quite suitable for routine control of the quality of the product at the factory. They will, however, be useful as indicators of any adulteration of malt extract with glucose syrup, etc. The estimation of ash and phosphoric acid also will be of additional value in detecting any adulteration of the product.

The quality control does not stop with the production at the factory alone. It extends to other fields such as packing, storage and distribution, which are incidental to the marketing of the finished product. Malt extract is generally reinforced with vitamins A and D, derived mostly from fish liver oils. The blending of these liver oils of high potency requires careful technical as well as analytical control. Stirring is to be conducted in an inert atmosphere to reduce losses in the vitamins. The oils as well as blended extracts should be analysed for their vitamin content to see that they are upto the standard. The final product should be packed preferably in amber coloured bottles to minimise losses of vitamin A during storage and distribution. Care should also be taken to ensure that there will be neither leakage nor spoilage of the product in the bottles. The bottles should be stored in a cool and dry place to avoid frothing of the extract and occasional bursting of the bottles. The success of the industry will depend to a large extent on the care which is taken to control the quality of the product at every stage the of process, right from the field down to the consumer.

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BOOK REVIEW

Genetics

Professor Darlington's book starts with an amusing history of the science of heredity, from the Bible to Darlington, with excursions to telegony, the Kammerer case, and Lysenko. It builds up a WELTANCHAUUNG explaining the riddles of the universe in terms of chromosome and genes, and ends with a new gospel designed to cure scientifically the evils of our time. Thus, problems old and new — cancer, evolution, language, criminality, race, the classes in human society, divorce and homo-sexuality, Freud, the belief in immortality, the rise and fall of civilization, and the indeterminacy principle — are solved by saying that it is all due to the genes. The principle that what is genetically determined is rather a normal of reaction than manifest characters seems to be by-passed in a rather cavalier fashion.

Professor Darlington is, however, highly successful in giving us a mythology of the gene, where those little nucleic acid dots play a role similar to that of fairies, furies, and gods in the times of old.

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(N. K. I.)