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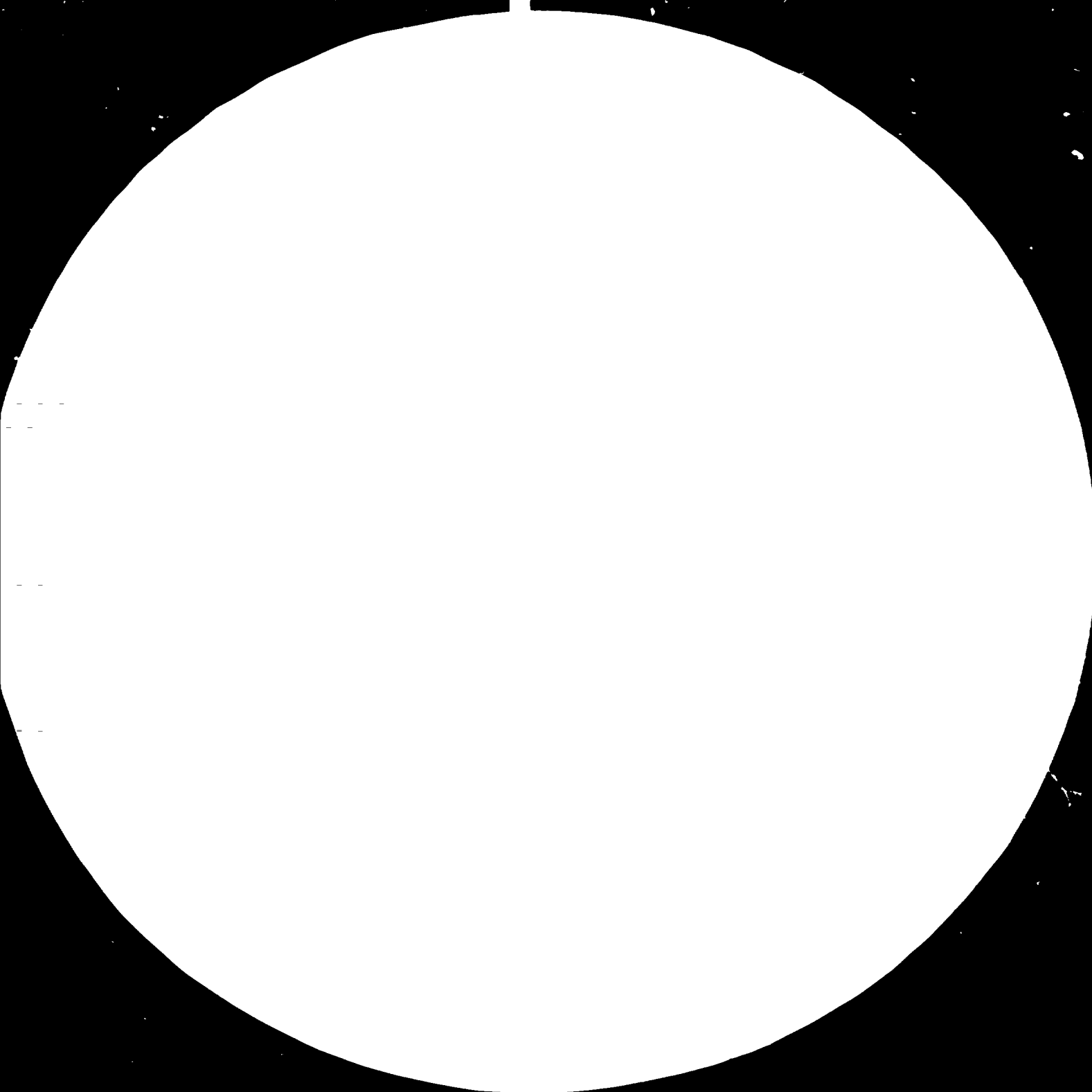

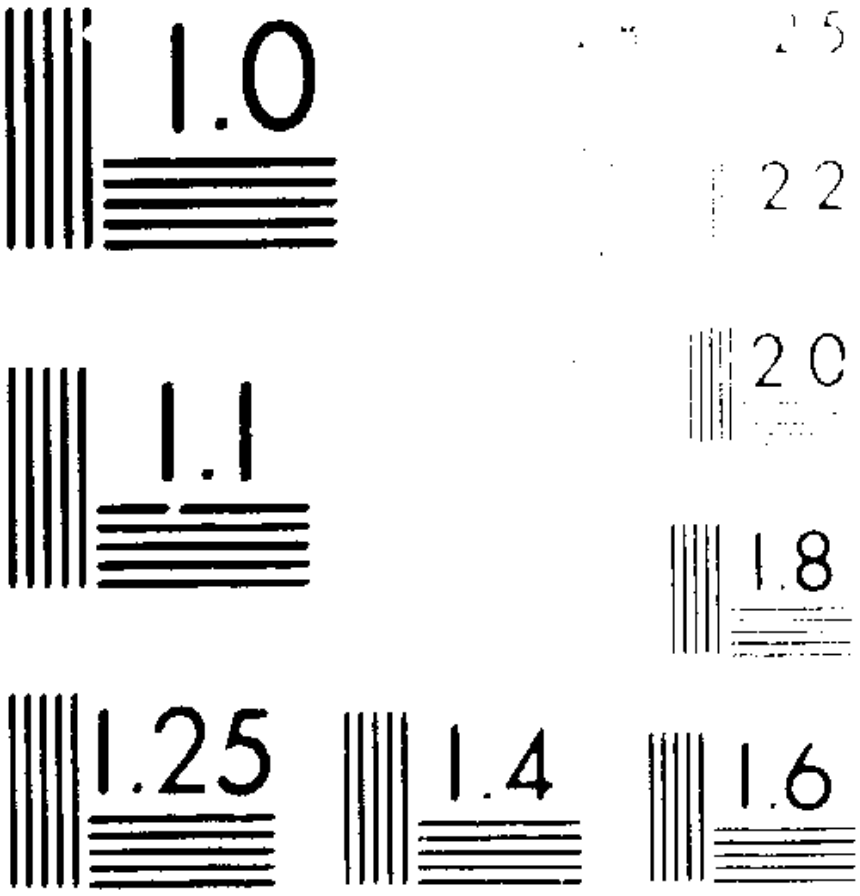
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Tanzania. ESTABLISHMENT OF FOOD TESTING AND QUALITY CONTROL LABORATORY.

UC/URT/79/202

UNITED REPUBLIC OF TANZANIA

Technical Report*

Prepared for the Government of the United Republic of Tanzania by the United Nations Industrial Development Organization

Based on the work of Odön I. Vajda, expert in Food Testing and Quality Control

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CONTENTS

GLOSSARY OF ABBREVIATIONS

CVL	=	Central Veterinary Laboratory
DB	=	Director of Bureau
FAO	=	Food and Agricultural Organization of the United Nations
FYP	=	Five Year Plan
LIDA	=	Livestock Development Authority
NAFCO	=	National Agricultural and Food Corporation
NCCO	=	National Cold Chain Organization
NMC	=	National Milling Corporation
QA	=	Quality Assurance
R and D	=	Research and Development
SD	=	Standards Department
TFNC	=	Tanzania Food and Nutrition Centre
TBS	=	Tanzania Bureau of Standards
TIRDO	=	Tanzania Industrial Research and Development Organization
TISCO	=	Tanzania Industrial Studies and Consulting Organization
UN	=	United Nations
UNIDO	=	United Nations Industrial Development Organization
UNDP	=	United Nations Development Programme

1. SUMMARY

According to the Job Description, the expert prepared a detailed Work Plan in agreement with the Management of Tanzania Bureau of Standards (TBS), which served the organization in the setting up of the laboratory for food testing and quality control, installation of equipment and selection of testing methods and procedures depending on the materials to be tested. Furthermore the introduction of practical tests and basic methods were initiated as well as the determination of some specific items. The training of the counterpart staff in up-to-date methods as well as in the organization and carry out of quality control was planned.

The expert made use of the previous assignment in Tanzania, at TIRDO last year October-November and utilized both the knowledge and experience which was collected during his visits to factories and organizations when making widespread contacts and in discussions with responsible persons and authorities of the related enterprises and organizations. These visits were continued during the period of the assignment in order to get familiar with the organization of quality control of the enterprises as well as with the national food inspection. He made investigations concerning the methods and instruments used countrywide and the level of food quality control and consumer's protection. The contacts, visits and discussions led him to the detection of the reasons inhibiting the improvement of food quality. Various reports and studies were read by the expert on the same aspect. The Food Law, the Standard Act, TBS papers and other regulations were studied including draft standards prepared by TBS standardization staff concerning various food items and their sampling and testing.

Taking into account both the experience and findings from the above mentioned activities and studies, the experience and recommendations originating from these might be summarized as follows.

The quality of the food commodities in most of the cases is not satisfactory and not constant and the variety of items is very poor and does not respond to the demands of the increasing urbanizing population. This is caused partly by the lack of food commodities.

The main reason for this is the low productivity of the agriculture, where the raw material for the food industry is coming from. In addition, the quality of the raw material is not satisfactory and it is oscillating. This creates great difficulties in the food processing industry.

The farmers and even the food producers are not interested in the improvement of quality due to such a price-policy, which does not make any difference between different qualities of agricultural products and processed foods.

The food standardization work of TBS is on a high level and it responds to the international practice and level. It meets the requirements of the up-to-date specifications and testing standards. However, the standards not being compulsory, do not have any power for enforcement on those who are producing substandard quality. The food standards are to become compulsory according to the regulations of the Food Act (No. 10, 1978). TBS Management published the food standards in the Gazette according to the Standard Act and it is expected, that in July 1982 all the food standards will become compulsory following the approval of the National Food Control Commission. TBS Management is making great efforts to prepare itself for this new situation.

The Food Laboratory of TBS established recently is well equipped and suitable to carry out all regular routine food quality control activities, but still the instrumentation shouldn't be considered as complete. The present staff's knowledge and experience concerning general laboratory work is satisfactory. However, it is highly recommended to increase the number of university-graduated specialists as well as the technicians. A 1: 3 ratio between these two categories of staff would be advisable.

The training of the present staff was carried out according to the Work Plan prepared by the expert, taking into consideration all the difficulties which were present. This type of training of the present and future staff is to be continued deepening their experience in the special food analytical work.

The number of standards, specifications as well as the standard methods of testing is limited. The selection of internal testing methods would be a good contribution to the build-up of a uniform testing method-system and could be used as a basis for a Uniformed Testing Methods Book in the future. The standard testing method and even the mentioned internal testing methods should contain more than one method for the same testing or analytical procedure and there should be one reference method, which must be applied in any deciding process. The accuracy and reproducibility is to be marked for each one.

The Food Laboratory's work should not be limited to the analysis and control of those commodities for which standards mark is requested to be licensed. The proving of the testing method intended to be standardized is in every case recommendable and a regular control of food commodities has to provide basic data for the specification standards.

The establishment of a data-bank is recommended as well as the very close cooperation between Food Laboratory and the SD of TBS and with other statal or parastatal institutions involved in food control and inspection.

The shortage of food specialists indicates the urgent establishment of a food science and technology specialization at the graduate and post graduate level.

The factories in general, do not have an adequate quality control organization. It is highly desirable therefore, that TBS should assist in the establishment of up-to-date quality control systems within the factories and undertake the laboratory training of the technical staff for the food industry.

The library of TBS is very poor in books on food technology, food-analysis and microbiology. The supply of these books according to the expert's proposal is highly recommended.

2. INTRODUCTION

a) The preparatory work and mission framework background

During a visit of UNIDO Secretariat staff to the United Republic of Tanzania the Government expressed interest in UNIDO assistance for the establishment of laboratory facilities for testing and quality control of food products. The laboratory facilities were primarily intended to serve the testing and quality control demand of the existing and future food industry by providing the services which individual plants are unable to establish themselves either because of their small size or because of the shortage of qualified personnel and facilities.

The services to be provided by the laboratory for the economical and quality improvement of the local industrial production are directly related to the production process and processing technology and they might be summarized in the following main points:

- strengthening the existing industrial laboratories and training of their personnel
- inspection of raw materials, raw products, processed foods, imported products, export-goods with respect to their composition, and other quality factors, including chemical, physical and organoleptic characteristics
- control of processing, technology, storage, transport, marketing, including the sanitary inspection, the scheduling of technological operations with special respect to the production and equipment efficiency, to the improvement of technological processes and adaptation of modern technologies to local conditions
- preparation of specifications and testing procedures in written form, formulation and application of standards
- preparation of statistical control procedures and schedules, collecting basic data for specifications, pricing, inventory and budget policy, making trouble shooting, proposals for economic utilization of raw materials and new products, maintenance and control of instruments

It was envisaged that on the basis of the proper and efficient utilization of the natural resources it would be possible to process most of the crops in the factories of the country helping to reach the self sufficiency in food by 1981. It is to be mentioned that the situation has changed meanwhile and the present circumstances do not respond to the expected development. The confirmation of this statement may be found in the Chapter III. Findings.

The main and characteristic products of Tanzania's food industry are as follows:

- coffee, cashew nut, cloves, tea
- various vegetable oils, clove-stem oil
- fruit and vegetable products, juices, purees, jams, marmalades, sauces
- spices and condiments: curry powder, turmeric, chillie etc.
- dairy products: milk, yogurt, ice-cream, butter
- meat and meat products, canned meat products
- beverages: beer, spirits, soft drinks, nectares, squash
- sugar, molasses, other carbohydrates: flour/maize, sorghum, millet, cassava, biscuits, pasta
- animal feedstuffs
- tobacco, cigarettes

The intention with the establishment of the Food Laboratory was to make a contribution to the improvement of the quality of food items, e.g. to solve the insect problems of cashew nuts, the grading of the sugar types of different quality, the grading of tobacco products, etc. It could be helpful also in acquiring higher consumer acceptable quality, meeting with international quality standards, eliminating various quality problems, such as the dark colour of tomato pulp, the misuse of thickeners in jams and marmalades, honey and syrups, the sale of unmatured spirits, the use of tallow in fats, the mixture of crude and refined vegetable oils, the use of flour of low gluten content, the lack of antioxidants in oils. Also, to control the use of food additives which are not well known, food colourings and the contamination by traces of heavy metals and pesticide residues, etc.

The immediate objective of the project was the establishment of testing facilities to serve the existing food processing industry by testing the composition, the nutritional value, the chemical, physical, and organoleptical properties of the various food products and ingredients and give assistance to the single plants in solving their technological and operational problems. Also expert services and training of the local staff were intended in order to introduce certain methods of testing and to build up the capacity of the local personnel to carry out the future activities according to the established objectives. These objectives were pointed out by the Government as follows: to improve the operation of the existing food industry through better quality of the food products, to improve the technological processes on account of the interest both of quality and economy, the development of new products, taking into consideration the specialities of the country and finally the promotion of the export.

The project input consisted of expert services and laboratory instrumentation for food and microbiological testing. The laboratory equipment was delivered by the Hungarian People's Republic as a Special Purpose Contribution to UNIDO.

The experts engaged had the duties to install and adjust the equipment and instruments and introduce various methods of testing according to the products to be tested. The counterpart staff was to be trained directly by the experts.

The TBS was entrusted from the Ministry of Industry with dealing with the food testing and quality control laboratory, consequently all the above mentioned aims and activities were carried out at this institution. In 1977, negotiations took place between the Ministry of Industries of Tanzania and the Swedish Industrial Development Authoritiy (SIDA) for the development of standardization and quality assurance activity of TBS. After carrying out some training courses, a contract was signed in 1979 between TBS and the Swedish Institute of Standardization (SIS), with an allocation of 70 million TSh within an aid programme for 1979-1985. The contract included the following activities:

a) The construction of TBS new headquarters, including offices, laboratory buildings (food and food microbiology, textile, chemistry, metrology);

b) Delivering of the laboratory equipment;

c) The provision of TBS with long term experts in various fields and with short term consultants for special tasks;

d) The training of fellows in Sweden and other European countries

The laboratory buildings were finished at the beginning of 1982. Until now 7 long term experts have been engaged at TBS and 53 million TSh have been spent. Two of the experts are specialized in food testing and standardization.

It should be mentioned that the coordination between TBS-UNIDO -SIS-Hungary was well established and in this way the activities were regulated and controlled.

b) Outline of the mission

The expert arrived in Tanzania on 11 February 1982 and prepared a detailed Work Plan based on the Job Description US/URT/79/202/11-01/31.7.C.(ANNEX 1). The main objectives of the mission were:

- to assist in the organization and setting up of the laboratory for food testing and quality control, including the installation and adjustment of equipment
- to make a selection of the methods and procedures suitable for the testing of the relevant food products
- to introduce and train the local staff on basic methods of food analysis and testing, such as the determination of ash, moisture and solids; the determination of the main components of food-stuffs, such as protein, fat, carbohydrates, sugar, caffeine etc; determination of physical properties, such as refractive index, density, consistency, colour, particle size, impurities, of those food commodities which are of the greatest importance either on account of local consumption or on account of export
- the sensorial evaluation of food should be emphasized and the methods of selecting panel-members as well as sensorial testing premises.

The report of the expert should set out the findings of the mission and present recommendations to the Government of further actions which might be taken.

The elaborated Work Plan (ANNEX 2) presented the following main goals:

a) the unpacking and installation of the equipment received, unloading of glassware and chemicals and putting them in order;

b) to become familiar and acquainted with all the prepared and drafted Tanzanian food standards, concerning the specifications and the testing methods as well;

c) to train the laboratory staff according to the following programme:

- to make them familiar with the instruments used in the every-day analytical work, like valorigraph, spectrophotometer, abbe-refractometer, polarimeter etc.
- to execute those analytical procedures, which can be found in the existing testing method-standards, as the analysis of oils and fats, spices, etc.
- to carry out the analysis which have special importance on account of being related to export goods;

d) to collaborate with the laboratory staff and specialists in food standardization for the establishment of sensorial testing standards with a general validity and for specific commodities;

e) to provide guidelines for laboratory work, including the system of collecting the data received by analytical work giving a possibility to establish a Data-Bank later on;

f) to give some lectures for the TBS staff and invited audience.

The Work-Plan was prepared in co-operation with Mr. Mwobahe, Director of TBS; all the staff-members interested in the implementation were informed.

Since the expert worked on another six weeks mission with the Tanzanian Industrial Research Development Organization (TIRDO) in October - November 1981, he had an opportunity to study various reports, regulations and studies. He had already visited institutions and plants having a relationship with food processing, food control, or food science. These visits were continued during the period of the present assignment, which enabled him to gain experience from 23 visits paid to various factories and organizations (ANNEX 3.). The collected information together with the discussions with the staff of the visited organizations provided a good picture of the Tanzanian food industry, food quality, food standardization and food control.

3. FINDINGS

a) Background information

The third FYP projected an increase in the agricultural production, however, it appears that the main problem at present is still the lack of raw material of the food processing industry. It should be mentioned that the agricultural products may be considered as raw material for the food processing, but also as raw food, according to the Tanzanian Food Law (Act No. 10, 1978). Generally the crops should be recognized as raw food or raw material after their separation from the plant, or in the case of animals, after slaughtering. The lack of raw material being the main problem for food processing, was corroborated by the managers of the various factories and institutions too. Comments on the lack of raw material are summarized below:

- The production of many agricultural products has decreased, e.g. that of different oil-seeds, of cashew-nut, the coffee production is partially substituted by the production of bananas etc. The reason might be found in prices which are the result of improper price policy.
- The losses of crops on account of the inadequate storage in some cereals may reach even 20 - 40% of the production.
- The self consumption of the farmer is very high; although the urbanization is progressing the percentage of rural population is still high. On the other hand, the farmer takes his excess products to the market and the food industry receives generally the rest, having unsatisfactory quality which has a big influence on the quality of processed finished products.

- The agricultural productivity is very low in some cases.
- The quality of the agricultural products is varying and generally they are not of good quality, mainly concerning meat, milk etc. This is the consequence of the price-policy, which does not determine the prices according to the quality.

As a consequence of the described situation the under-utilization of the food processing capacity is very common, in some cases not more than 30 percent (Musoma Dairy Plant) or 40 percent (Kilombero Sugar Mill). The insufficient quantity of processed food results in its poor quality.

Drawing the conclusions from the visits paid to the various factories, the details of which are contained in ANNEX 4, it may be stated that the situation of the food industry is very delicate at the moment and demands assistance. Many kinds of raw and accessory materials are missing, and if they are available, they do not have the adequate quality, as it was pointed out already. The steps that should be taken to assure the increase of agricultural productivity and production in general are mainly the responsibility of organizations and authorities other than TBS. But by all means, TBS might play an important role in improving the situation through standardization work and carrying out quality control activities.

The mentioned visits proved that the technical and technological level of the food factories varies. Some plants are installed with equipment of high technical level and, with sufficient supply, may operate with relatively high productivity and with goods of acceptable quality. But in a number of cases the production line is outdated and there are missing spare parts as a consequence of having very old types of machinery. The detailed survey of some factories, including individual production lines and advising on improvements of the technology, could form a part of the work of TBS' technical staff. The conservativism found in some factories concerning the applied technology might be reduced or eliminated through TBS carrying out the standardization work, working out the various codes of Practice and executing the quality control, even on the spot.

The number of products produced by different branches of the food industry is very limited. The improvement of the nutrition of the Tanzanian people gives the ground to amplify the scale of food products, mainly with higher nutritional value and adequate quality. This statement may be vaild in meat processing, dairy production, in the production of canned vegetables and fruits, of canned meals etc. Here again reference could be made to

TBS' possibilities to assist various branches of the food industry.

Organized quality control is missing in most factories and this situation cannot be explained away by difficulties of production. Organized and working control systems in single factories or for several factories of one single enterprise should be developed. The assistance of TBS in the establishment of such systems and the training of the control-staff is indispensable. The importance of the control and assistance concerning the hygienic conditions of production is emphasized in the Food Act.

Nearly every place visited had a need for theoretical and practical training of the industrial staff. TBS may have an important and efficient role to play mainly concerning the analytical and control practice carried out in its laboratories.

The visits paid to Tanzanian organizations led the expert to the conclusion that the coordinated collaboration, with harmonized programmes, between TBS, TIRDO and TFNC is of vital importance. The material and intellectual resources of Tanzania in the field of food science, technology and food testing cannot support parallel programmes and research on the same subject at different institutions.

The opportunity to interchange ideas with the Director of Post Graduate courses at the University of Dar-es-Salaam, Mr. Mshigeni and the overview of the system of education and training at the University made the expert understand that the Faculty of Agriculture, Forestry and Veterinary Science, Morogoro, offers courses leading, among others, to the degree of B.Sc. Agriculture. During the three year course the student may select subjects taught by the Department of Food Science and Technology, like food preservation and processing, food chemistry, food manufacture, food engineering, food packaging, food microbiology, food enzymology, food hygiene, food economics. There is a possibility, therefore, for training those students who are interested in the above mentioned subjects. The subjects, however, are not compulsory and the Faculty still does not graduate food specialists.

The visits to the various factories and organizations and the discussions during the period of the mission have shown a great need for graduate food specialists in Tanzania. The development of the food industry and of the institutions carrying out food control, testing, research and development have a great demand for food specialists not only at B. Sc. level, but also M. Sc. graduates.

b) The activity of TBS and its food laboratory- The quality of food commodities

The former chapter presenting the background information had the intention to give some explanation of the reasons and symptoms of the poor quality of food commodities. These may be summarized as follows:

1) the shortage of agricultural products and the unsatisfactory and inconsistant quality;

2) the unsatisfactory quality of the agricultural products is originating partially from the price-policy which does not support the prices according to the quality; the development of breeding animal and plants of better quality is missing, or is going on very slowly;

3) the quality control is missing in most of the food producing factories and even the national food control's capacity is very small;

4) the variety of food items is very small, though the natural sources of Tanzania offer the possibility to develop new branches of food production, including some commodities, which may find their place in the world market very easily and at the same time would improve the nutrition of the Tanzanian population;

5) the parameters of the commodities do not satisfy in many cases, the prescriptions of the national standards and international practice:

   - the composition is not corresponding with the demands, e.g. tomato is missing from the canned baked beans, the sugar's colour is in many cases dark brown etc.

   - the sensorial properties are very poor, e.g. those of the milk, of the sugar, of the canned baked beans, etc.

- the packing and labelling is unsatisfactory concerning not only the protection of the packed food, but the information is missing in many cases, which the consumer demands with full right and which on the other hand, the Food Act prescribes very strictly requesting satisfactory labelling containing all the basic information

- the weight/volume does not correspond in many cases to the nominal value, e.g. half-full bottles of beer might be found, sometimes the milk bag contains instead of half a litre only 400 cm^3 etc

- the microbiological state of the food commodities is not very satisfying and it is originating in many cases from the hygienic conditions during processing and trading e.g. the tea contains relatively big amounts of moulds, the same is also occurring in the spices, and the milk powder has microbiological contaminations in many cases etc.

All these factors may have a negative influence on the population and even create health hazards. The decrease and elimination of the food products of unsatisfactory quality is, therefore, indispensable.

The role of TBS in the improvement of quality

The standardization activity of TBS is executed according to the Standards Act No. 3, 1975 and its completion the Standards (Certification) Regulations 1981. The elaboration of food standards corresponds to the Food Act, which is a very good, up-to-date regulation of food processing food trading and food quality control.

The food Act established the National Food Control Commission which has among others, the following functions concerning food standardization:

5.(1) a) "to regulate, in accordance with this Act, the import, manufacture, labelling, marking or identification, storage and sale and distribution of food or any materials of substances used in the manufacture of food;

b) to prescribe minimum standards of quality in respect of food manufactured or imported or intended to be manufactured or imported into the United Republic;

c) to test or facilitate the testing of food manufactured in or imported into the United Republic."

Furthermore the Food Act orders the following:

5.(2) "In the performance of its functions, the Commission shall as far as is practicable, maintain a system of consultation and cooperation with:

a) the Tanzania Food and Nutrition Centre, established by the Tanzania Food and Nutrition Centre Act, 1973;

b) the Tanzania Bureau of Standards, established by the Standards Act, 1975."

The Standards Act 1975 regulates very accurately the standardization and control work of TBS. Without the demand of completeness those regulations should be cited which may touch the food standardization, food quality control and the improvement of food quality.

These quotations are as follows:

4.(1) a) "to undertake measures for quality control of commodities of all descriptions and to promote standardization in industry and commerce;

c) to make arrangements or provide facilities for the examination and testing of commodities and any material or substance from or with which, and the manner in which, they may be manufactured, produced, processed or treated;

f) to assist industries in setting up and enforcing quality control procedures."

(2) a) "have regard to the health and general welfare of the people of the United Republic."

The 17.- (1) (a) point declares the intention, that the Minister may, on the recommendation of the Bureau declare a standard for any commodity, or for the production, manufacture, processing or treatment of any commodity to be a compulsory standard. Further, the Minister may appoint any officer of the Bureau as an inspector for the purposes of this Act and an inspector may:

- enter upon any premises at which there is,or is suspected to be a commodity in relation to which any compulsory standard or standards mark exists
- inspect and take samples of any commodity or any material or substance used in the manufacture, processing or treatment
- inspect any process in connection with the manufacture, production processing of any commodity in relation to which a compulsory standard or standards mark exists.

The quotations by word and citation of the ideas of some paragraphs intended to introduce the big role of TBS in the improvement of food quality by the means of standardization and quality control. These two activities are inseparable one from the other.

The food standardization work of TBS concerning the specifications as well as the sampling and testing methods, represents a very efficient and good job. The commodity standards and the testing method standards are on a high level taking into consideration the standards of other countries and even the international practice. The standards are based on international prescriptions, mainly taking into consideration the ISO, FAO recommendations and some national standards, e.g. Indian standards and AOAC.

Notwithstanding that the food standards, according to the previously expressed opinion, are on a high level, some comments have to be made.

a) The number of the food standards is very limited, although a series of draft standards are under preparation this does not change the actual situation. The acceleration of preparing food standards, specifications as well as, sampling and testing methods would have an impact on the improvement of the food quality.

b) The food standards, in spite of the above cited paragraph of the Food Act, are not compulsory. The expert has got that information from Mr. Mwobahe DB, that the declaration of turning to compulsory standards those of food, is already launched and it may be expected in the second half of this year to have it. This period will be used for the preparation of the industries as well as TBS' own food laboratory to have the capability and capacity to carry out all the necessary testing.

c) The sampling and testing method standards have generally one method for one type of testing. It would be advantageous to have several methods for the same testing and point out one deciding reference method. Of course, at the same time the comparability, reproducibility and accuracy of the presented method must be indicated. This last demand has to be fulfilled in every case making a testing method standard. The testing method standard containing more methods for the same testing presents the possibility to choose that method which might be executed in any laboratory. This condition should be taken into consideration when making standardized testing methods. The data of reproducibility, comparability and accuracy have to be determined by mathematical - statistical evaluation of those data which were produced by the laboratory.

d) The same idea should be taken into consideration when making commodity standards: only such parameters should be placed into the standard which may be determined by a certain testing method and secondly, which can be produced by the given raw material and applied technology. The standard should contribute to the improvement of the manufacturing process.

The equipment and capability of TBS food laboratory

The food laboratory is placed in the new TBS headquarters, having a good and up-to-date construction, air-conditioning, with all the necessary infrastructure: water, sewage, compressed air pipelines, gas-pipelines, though the compressed air still does not work and the water supply is not satisfactory mainly concerning its pressure. The whole surface of the laboratory premises including the stores, sanitary rooms makes out round 300 m^2, of which the chemical laboratory occupies

60 m^2. It should be mentioned, that presently the space is satisfactory to carry out routine food analytical work, but taking into consideration the expected and by all means necessary increase of the staff (see later), furthermore the completion of the instrumentation, the area will not be sufficient.

The instrumentation and equipment of the laboratory, concerning the food analytical part as well as the food microbiology have to be considered as suitable to carry out all kinds of food testing, except the sensorial evaluation for which there is neither room nor outfitting.

The instruments, according to the coordination between UNIDO-SIS-Hungary-TBS, which was mentioned in Chapter 2, Introduction, are complementary without any overlapping. Without the demand of completeness the most important and valuable instruments are listed below:

Instrument	Main purpose
Muffle furnaces	Determination of ash-content
Precision pH-meters	Determination of chemical reaction
Water still	Production of distilled water
Various types of waterbath	Multipurpose use in analytical work
Sterilisers of different type	Sterilization for microbiological work
Drying cabinets (event. vacuum)	Determination of moisture, volatile comp.
Thermostates (anaerobic too)	Incubation in microbiological work
Crop grinder	Preparation of samples
Turmix	Desintegration and preparation of samples
Centrifuges	Multipurpose use for separation, sediment
Laboratory cooler combined with special thermostate	Adjusting demanded temperature
Titriplaques	Counting of colonies in microbiology
Insectophon	Determination of the insects
Soxhlet apparatus	Determination of fat
Kjeldahl apparatus	Determination of protein
Spectrophotometer UV and visible	Multipurpose use for the determination of any kind of components

Instrument	Main purpose
Atomic absorption spectrophotometer	Mainly for the determination of heavy metal traces
Thin-layer chromatography set	Multipurpose use for the determination of pesticide residues, colourings etc.
Universal shaking machine	Multipurpose use in various anal. proc
Apparatus for the determination of melting point	Fat analysis
Aphrometer	Determination of CO^2 content
Top plate balances	Weighing with less accuracy
Analytical balance	Weighing with analytical accuracy
Infrapid 31	Determination of fat, protein, moisture
Binocular microscope	Microbiology, determination of foreign matters
Abbe refractometer with ultra thermostate	Determination of refractive index and of total solids
Circular polarimeter	Determination of rotatory sugars or other rotatory compounds
Saccharimeter	Determination of sucrose
Infra lamp heater	Determination of moisture
Laboratory heaters, hot plates	Multipurpose use
Membrane filter	Microbiology
Digital colorimeter	Multipurpose use
Sieves set	Determination of particle size
Valorigraph	Determination of baking value of flour
MOMCOLOR colorimeter tristim.	Determination of colour

Apart from the above listed instruments additional orders were made by SIS for the completion of the equipment, e.g. homogenizator, Lovibond apparatus for the determination of the colour of oils, heating oven for the microbiology, thermostatic waterbath, equipment for the regeneration of solvents (distillation apparatus), autoclave, automatic pipettes.

The supply of glassware and the chemicals are adequate for the actual needs. In spice of the satisfactory situation at the moment, some orders were made by TBS and by SIS respectively, for an additional supply of glassware and chemicals.

It should be pointed out, that the provision of chemicals for the food laboratory has to be solved in the future, mainly after 1985 and this demands financial resources since the country has a production only of a few chemicals at the moment.

The staff of the food laboratory

The food laboratory forms a part of the Section Inspection and Testing which belongs to the Quality Assurance Department. The head of the food and microbiology laboratory is Mr. J. Bavu, chemist and biologist graduated in the USA and USSR. In the food laboratory only one specialist can be found apart from him; Mr. I. Arley, who is a laboratory technician. In the food microbiology there are two specialists; Mrs. K. M. Ahmedali, microbiologist, graduated in Bombay and Mr. C. I. P. Mwaya, laboratory technician.

All the staff members are well trained in laboratory and microbiological practice respectively and on account of this, there was no difficulty in the adaptation of special food analytical and microbiological methods. It has to be mentioned that during the whole period of the assignment the contact, cooperation and collaboration has been faultless and effective, with mutual understanding. However, it must be very clearly declared, that the present number of food laboratory specialists is very small and this might be a limiting factor of the efficiency of the laboratory's work. Even taking into consideration the small variety of food items, with this number of staff it is impossible to respond to all those requirements, which are faced by TBS' food laboratory according to the cited regulation and to the consumer's protection. The increasing of the staff is indispensable, particularly if the food standards become compulsory in July 1982, which is forecasted and is already mentioned above.

The work realized during the mission

1. Laboratory training

The arrival of the expert coincided with the delivery and unpacking of the instruments, of the glassware and the chemicals. This work had to be done in the first place together with the local staff, including the settlement of the equipment and the order making, this being the basic condition for laboratory work. The instruments were placed according to the coordinated installation plan, but it was necessary to take into consideration all the possibilities presented, e.g. to find out the placement of those instruments which need the three-phase power, the capacity of the electrical distribution had to be considered etc.

The installed instruments were adjusted, checked and proven together with the staff members. Without going into details, the use of the valorigraph was practiced including the evaluation of the valorigram and by this way the determination of the baking property of the flour.

The carbondioxide content of soft drinks was determined using aphrometer, the total solids by Abbe refractometer. The same instrument was used for the determination of the refractive index of some vegetable oil samples.

The determination of ash in tea was carried out as well as the moisture in tea, flour and vegetable oils.

According to the work plan, the analysis of oils was executed completely: besides the above mentioned refractive index, moisture, the unsaponsifiable matter, the saponification value and the Reichert Meissl number were determined too. The complete analysis of the vegetable oils followed the standard sampling and testing methods.

The use of the circular polarimeter was introduced, however, regular analytical determination of optically active matters could not be carried out due to the shortage of personnel and time.

Two types of spices were analyzed: curry powder and turmeric, ash, moisture and volatile oils were determined. These items have specification standards as well as, sampling and testing method standards.

The INFRAPID 31's calibration could not take place, because its lamp burned out and the spare part did not arrive. Anyhow, the instrument was introduced and the staff is now aware how to handle it.

The staff became familiar with the use of the Insectophone and with the photometer Spektromom 410 using it for the determination of caffeine, comparing with the results of the gravimetric method. The comparison did not take place during the period of the mission, on account of not having enough water-pressure for water-pump sucking, which is indispensable.

It should be stated that the skilfulness of the staff-members and their activity was excellent. There was no problem during the whole period with the adaptation of the methods, the adjusting and handling of the instruments, and equipment. The only problem was the extremely low number of the staff members already mentioned above.

2. Other Activities

2.1 In order to utilize the time at disposal some testing methods were drafted by the expert and handed to the Management of the TBS and to the Head of the laboratory.

Such methods were as follows:

Quick method for the determination of SO_2 (ANNEX 5/a)
Method for the determination of caffeine: a) gravimetric b) photometric (ANNEX 5/b)
Draft standard for the installation of preparatory and testing premises for sensorial evaluation (ANNEX 5/c)
Draft standard for the determination of the ability of testing taste, smell, colour (ANNEX 5/d)
Draft method standard for the determination of taste threshold (ANNEX 5/e)

The elaboration of such methods which are actually not available in the TBS testing method standards had the intention at the same time, to establish an internal TBS testing method collection, which may serve as the basis for the standardized methods after having them proven. Later on the compilation of a Unified Testing Method Book would be highly recommendable and for this purpose the collection of internal TBS method standards may be used.

The importance of proving the testing method in every case, fixing its accuracy and reproducibility, should be emphasized. This task has to be one of the tasks of the food laboratory of TBS:

2.2. The expert elaborated some guidelines for the laboratory work, which were discussed, completed and corrected during the meeting with the staff of the food and chemical laboratory.

Furthermore, guidelines were prepared and handed to the Head of quality control and certification concerning the main direction which should be followed when controlling or visiting factories.

2.3 Three lectures were presented to the interested members of TBS staff and some invited audience:

"Principles and Practice of the Application of Mathematical Statistics in the Processing and Evaluation of Data Received by Laboratory Measurements"

"The Role of Food Standards and their Implementation in Food Control and in the Development of Food Quality"

"The Organization and Institution of Food Quality Control. Food Quality Control - Food Quality Assurance"

The lectures were followed by vivid discussions.

4. RECOMMENDATIONS

The shortage and unsatisfactory quality of raw and accessory materials is the greatest obstacle in the improvement of food quality and the progress of food industry. The FYP forecasts the improvement of this situation. The development of the various branches of food industry depends to a certain extent on the production and on the quantity and quality of agricultural products.

The development and improvement of the technological processes and the establishment of quality control systems might lead to a better provision to the population in both the quantity and quality of the food, it may also have a favourable influence on the export marketing.

The Tanzania Bureau of Standards has a great responsibility and possibility to approach the above mentioned objectives, using its three most important means:

a) the standardization of agricultural products as raw materials or raw foods, of processed foods and of testing methods, furthermore the assurance of the implementation of the standards, as compulsory prescriptions;

b) the quality control and food testing carried out in its own food laboratory, taking into account the quality of the standardized food items, has to be broadened as soon as possible;

c) the training of its own and the industrial staff not only in the laboratory practice and the testing and analytical methods, but in the processing techniques as well.

It is very logical, that all these activities need a very close and well coordinated cooperation with the other institutions working in the same or similar field: TIRDO, TFNC, CVL (Central Veterinary Laboratory) to avoid overlapping and to assure the concentration of the forces.

Starting from this point of view and having all the experience laid down in the former part of the Report, the following recommendations are made:

1 The standardization of raw food stuffs, and processed foods

1.1 The increase of the number of food standards of raw food stuffs as well as of processed food is indispensable. The designation of the parameters have to take into consideration the possibilities of the agriculture, but should have a forcing power on the development of the quality both of the raw and the processed food.

1.2 It would be highly recommendable to establish a discrimination of the prices according to the different quality, the basis to which the standards might be, containing grading, or classification conforming to different qualities.

1.3 All the food standards are to be declared as compulsory standards, for which the steps were already taken and the regulations of the Food Act and Standards Act have to be correctly applied.

1.4 It would be worthwhile to mention that when having all the food standards as compulsory standards, it would be neither right nor logical to demand from the applicant the Standards Mark to produce a higher quality, than the average one, keeping in mind the influence on the price at the same time.

2. Testing methods, analytical processes

2.1 Having the need for a long series of testing methods which are not standardized presently, the compilation of various necessary testing methods is highly recommended. These should have the form of a testing standard with the inscription "Internal" and signed by the same code used for TBS standards. The collection of such internal testing method standards might form the basis of the future standardization work and could serve for the compilation of a Unified Testing Method Book in the future.

2.2 When adopting testing methods, either internal TBS or official standardized methods, the laboratory procedures have to be proven and by making a series of controls, the accuracy and reproducibility must be determined by mathematical-statistical calculations; this has to be manifested in the internal standard as well as in the officially issued standard.

2.3 The testing methods, either for internal use or for the purpose to be standardized, should contain more analytical processes for the same type of examination, giving a reference method which has to be applied in any unambiguous case. When standardizing testing methods, it should be taken into consideration that they have to be carried out in any laboratory and have to prove their accuracy and reproducibility.

2.4 The internal testing method-stock should be collected continuously and must serve as a document of the food laboratory, furthermore may be the basis of the standardization of testing methods. It is very reasonable, to give the same form to the internal testing method standard which is used as an official standard.

3. The food laboratory of TBS

3.1 The number of staff members of the food laboratory is unsatisfactory and the present personnel practically will not be able to complete the tasks and demands facing TBS. The microbiological staff presently is not so overloaded but the food analytical and control part has to be developed to a considerable extent. The increase in the number of university graduates is as necessary as that of technicians. The ratio between these two levels is recommended to be 1: 3. The whole number, including food microbiology, is recommended to be 12 persons, as a minimum, including 2 cleaners.

3.2 The control and analytical work of the food laboratory should not be limited only to the judgement of the quality of those commodities for which the applicants are asking Standards Mark. This is very important, but not the exclusive task of TBS taking into consideration the state regulations handled before.

By all means, TBS food laboratory has to expand its activities to the following fields:

3.21 to make control in the factories, on the markets and other distribution-places to prove whether the quality of the food items is corresponding to the prescriptions of the standards or not. In the case of substandard quality, the legal measures should be taken according to the regulations;

3.22 to provide assistance to the producers, where the defects of quality are originating from and what measures might be taken to eliminate these factors (trouble-shooting);

3.23 to assist the industry in the establishment of up-to-date quality control systems (organizations) and train the staff of such organizations (see later);

3.24 to test the testing methods both the standardized and the internal one, to see whether they are corresponding with the demands of accuracy, of re-producibility and whether the execution of the methods meets the possibilities of the laboratories carrying out the examinations.

The connection between the obligation to carry out these tasks and the necessity to have a suitable number of laboratory staff to respond to this obligation is obvious.

3.3 The data collected during the control and analytical processes represents great value both for standardization work and for the determination of the average quality of single food items. Even the suitable coding of the data may give a chance to evaluate and compare the quality of processing methods at the beginning of the laboratory work, Work-books have to be used with numbered pages and the code system of the data collection is recommended to be elaborated. The guidelines presented in ANNEX 6 and the punch card attached to the same was given with the intention to give some ideas for a code system of the data collection. Hereby should be emphasized

again the importance of the establishment of a Data-Bank in a very close cooperation with the other organizations, acting in the same field and already mentioned before.

3.4 All the mentioned activities demand a planned working system even taking into consideration unexpected tasks coming to the laboratory. It is recommended to free 15-25% of the whole laboratory capacity for this purpose.

3.5 The instrumentation, the equipment of the food laboratory, is responding to the demands of up-to-date routine work as it was already mentioned before. However, it is advisable to make a perspective plan for the development of the laboratory and to make some orders for purchasing instruments of great value, e.g. GLC, which is more or less indispensable when the determination of pesticide residues would be necessary. Hereby it is recommended to establish a regular supply of chemicals and glassware which needs foreign currencies, because only a few chemicals are produced within the country.

4. Training

The lack of food specialists within the country presents difficulties mainly considering the future and the completion of the local staff. None the less, importance has to be given to the continuation of training of the existing staff.

4.1 It is recommended that the Department of Food Science and Technology Morogoro, move to establish a three year course leading to B.Sc. Food Science and Technology as soon as possible. Furthermore, it is recommended that a two year postgraduate course and M.Sc. degree should be established at the same Faculty. (At the time of finishing the present Report, the expert was informed of preparatory work for such a study)

4.2 TBS food laboratory may be the suitable place for a testing method training not even for the specialists of Tanzania, but for other EA countries' specialists as well. As far as the expert is informed, such training was proposed on ground level as well as on middle level. The promotion of these courses, carried out on the spot is necessary.

The programme of both courses might embrace the basic analytical procedures in food laboratory practice as well as in handling instruments. The detailed programmes were already proposed and presented separately.

4.3 The training of TBS staff in Sweden and other countries is supported by SIS as it was pointed out in the Introduction. Taking into consideration the above proposed and the indispensable increase of TBS food laboratory staff, it seems to be necessary to extend the possibility of fellowships to countries, which have more developed systems and organizations of factory and national (state) quality control and which have progressed in various processes of food analysis. Such fellowships might be promoted either by the Government directly by bilateral agreements or by UN Agencies. The countries recommended are as follows:

Organization of quality control	Hungary, FRG, GDR
Determination of food contaminants	UK, Netherlands, Hungary
Polarography	CSSR
Spectrophotometry	UK
GLC	UK, Italy
Classic food analytical methods	Switzerland, Austria, Hungary

4.4 The internal training within TBS must be extended. It is recommended to have a twice weekly or monthly meeting which will review the laboratory work carried out and give an account of the special literature read during the period and the experience accepted during the laboratory work. For this type of internal training specialists of other Tanzanian organizations might be invited. Since TBS has a Training Commission, it is advisable to prepare an internal training plan for a semester or for a whole year.

4.5 The self training and the development of the individual needs an up-to-date library is required. Presently the library is very poor in books on food science-technology analysis. The expert gave a proposal for purchasing the most modern books in this field, which may be found in ANNEX 7. At the end of the list those periodicals which are necessary to follow the world's food science are enumerated.

5. ACKNOWLEDGEMENTS

The expert wishes to express his gratitude to his kind and helpful counterpart Mr. B. L. Mwobahe, Director of Tanzania Bureau of Standards for the perfect and successful cooperation during the whole period of his mission. The results of his work were mostly promoted by the willingness and readiness of help by Mr. P. Rwegoshora, Manager of the Department of Quality Assurance. Many thanks have to be given for the good cooperation of Mr. W. Moharo, Head of Inspection and Testing, to Mr. J. Bavu, Head of Food Laboratory and to the staff of the same: Mr. I. Arley, Mrs. K. M. Ahmedali and Mr. C. I. P. Mwaya. The cooperation with Mrs. F. Dias, Head of Chemical Laboratory was as successful as that with the Head of Quality Control and Certification, Mrs. B. Mutabazi.

The excellent cooperation with the members of the Swedish staff has to be pointed out, in the first place the very good contact with Mr. O. Engstrom, Team leader and with Dr. J. Movitz, Food Expert.

The expert enjoyed the real and valuable support of Mr. S. Henein, SIDFA and of Miss M. Nilsson Dag, UNIDO Officer, during the whole period of his mission.

Special gratitude has to be expressed to Mr. S. Zagar and Mr. N. Kiboya for their help and readiness in the multiplication of the lectures and the present report of the expert.

Finally the expert would like to give expression of his real gratitude to Mrs. L. H. Ebrahim for her efforts making the great amount of typewriting in excellent form.

ANNEX 1

UNITED NATIONS

UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION

UNIDO

26 September 1980

Request from the Government of the United Republic of Tanzania

for Special Industrial Services

INTERNAL

JOB DESCRIPTION

UC/URT/79/202/11-01/31.7.C

Post title Expert in Food Testing and Quality Control

Duration Three months

Date required March 1981

Duty station Dar es Salaam, with possibility of travel within the country

Purpose of project To assist in the establishment and operation of the food testing and quality control laboratory

Duties In close co-operation with the personnel of the Tanzania Bureau of Standards (TBS) and other experts working within the project, the expert will specifically be expected to:

1. Assist in the organisation and setting up of the laboratory for food testing and quality control, installation of equipment and selection of testing methods and procedures according to the products and materials to be tested;

2. Conduct practical tests on basic methods of food analysis, including the following:

   a) preparation of samples, sensory evaluation;
   b) determination of moisture, solids and ash;
   c) determination of the content of various components such as protein, fat, fiber, sugar, salt, alcohol, impurities etc.;
   d) determination of physical properties, such as density, particle size, refractive index, polarization, consistency, colour etc.;
   e) determination relevant to specific products, such as meat, dairy products, fruit and vegetables, oils, spices, coffee, tea, tobacco, sugar, beverages etc.;

..../..

Applications and communications regarding this Job Description should be sent to:

Project Personnel Recruitment Section, Industrial Operations Division
UNIDO, VIENNA INTERNATIONAL CENTRE, P.O. Box 300, Vienna, Austria

3. Train counterpart personnel in modern methods of food testing, laboratory analysis and quality control and their application to specific products and technological processes.

The expert will also be expected to prepare a final report, setting out the findings of the mission and recommendations to the Government on further action which might be taken.

QUALIFICATIONS — Highly qualified Food Technologist or Chemist with extensive practical experience in food testing and quality control, operation of testing laboratories and use of various laboratory equipment and methods

LANGUAGE — English; Arabic an asset

BACKGROUND INFORMATION — During a visit of a UNIDO Secretariat staff member to the country in June 1976, the Government expressed an interest in UNIDO's assistance for the establishment of laboratory facilities for the testing and quality control of food products. The project was selected from the portfolio of projects submitted by the LDC (Least Developed Countries) mission.

During the exploratory mission of a UNIDO consultant to the country in April 1979, a general assessment was made of the basic requirements in food testing and quality control and the testing methods, laboratory equipment and facilities required for this purpose were determined, according to the products to be tested.

The laboratory facilities for testing and quality control will be primarily intended to serve the existing and future food industry by providing basic services which individual plants are unable to establish themselves either because of their small size of because of the shortage of qualified personnel and facilities. The services to be provided by the laboratory will include the testing of raw and ancillary materials, semi-finished and finished products with regard to their composition and to their chemical, physical and nutritional properties, and will be directly related to the production process and processing technology. This will also include the testing of packaging material (such as tinplate cans), control instruments, condition of some equipment and tools and will be directly involved in the development of new products and in the improvement of technological processes.

The equipment to be provided within the project includes analytical balances, colorimeters, centrifuge, muffle furnace, infrared analyser, incubator, Kjeldahl apparatus, micro mill, ovens, microscopes, pH meter, polarimeter, saccharimeter, refractometers, stirrers, autoclave water bath, U.V. spectrophotometer, turbidity meter, recording dough mixer, water distilling apparatus, soxhlet extractor, colony counter, etc. Various pieces of glassware, chemicals, media, handbooks etc. will also be provided.

ANNEX 2

Dr. Odon I. Vajda UNIDO-Expert

Project title: Establishment of Food Testing and Quality Control Laboratory

Project number: UC/URT/79/202/11-01/31.7.C

Title of Job Description: Assistance in the Establishment and Operation of Food Laboratories of Tanzania Bureau of Standards.

WORK-PLAN

from 12.02. - 08.05.1982

According to the above specified Project and Job Description, the expert in food testing and quality control has to assist in the establishment and operation of the food testing and quality laboratory. This assistance was to be provided within the three months period in a close cooperation with other experts (Expert in Laboratory Instrumentation and Food Microbiologist) and executed in a common, well coordinated and strictly close cooperation with the staff of Tanzania Bureau of Standards (TBS).

The main outliness of the expert's work may be summrarized as follows:

1. He has to assist in the organization and setting up of the laboratory for food testing and quality control, giving assistance in the installation of the equipment and giving directions and instructions concerning the adequate use of them including the adequate evaluation of the received test results.

2. The expert is expected to introduce the laboratory staff into the practical tests of basic and essential methods including
   a) preparation of samples,
   b) sensorial evaluation,
   c) determination of the various parameters of the different food commodities, as moisture, ash, dissolved solids, etc.,
   d) determination of the different components, as fat, protein, carbohydrates, mineral components etc.,
   e) determination of physical properties, as density, particle size, refractive index, consistency and rheological properties, colour etc.

3. The expert is due to train the TBS laboratory staff in the modern, up-to-date methods of food testing, taking in consideration the above mentioned determinations and their application to specific products and technological processes.

4. Finally the expert will be expected to prepare a Terminal Report presenting the findings during the mission and recommendations for the Government of the United Republic of Tanzania.

After a stimulating interchange of ideas with Mr Mwobahe, Director of TBS and taking in consideration the directions received by the briefing in Vienna and in Dar-es-Salaam, the following detailed work plan was compiled by the expert.

1.) Unpacking and installation of the instruments, glass-ware and chemicals in cooperation with the other expert and with the personnel of TBS. Adjustment of the instruments instructing at the same time the laboratory staff to their use.

Dead-line: 25.02.1982 for unpacking and installation, continuously concerning the orientation of the staff.

2.) Make a survery of the food standards being in force, taking in consideration in the first place the analysis of those products, which have a specification and testing methods standardized.

Dead-line: 25.02.1982.

3) Conduction and instruction of the lab-staff to the analysis and practice of methods in the following fields:

3.1 Analysis of oils and fats according to the specifications TZS 48-55 : 1979, using and trying the accuracy and reproducebility of the methods prescribed in the standard TZS 54 (Part 1. - 2.) : 1979.

3.2 Analysis of some spices, respectively condiments, as curry powder, turmeric, ginger, black and white pepper, chillie, according to the specifications fixed in the standards TZS 31 : 1979, TZS 30 : 1979, TZS 45-46 : 1979, by the methods prescribed in the standard TZS 33 : 1979.

3.3 Calibration of the INFRAPID 31 processing approximately 60 samples with the instrument and on the other hand with classical methods determining the following parameters : fat (Soxhlet), protein (Kjedahl), moisture (Drying).

3.4 The instruction of preparation the necessary chemical solutions : normal and molar solutions, indicators etc., mainly for the determination of the components of oils and fats, and for the analysis of different sugars (sucrose, reducing sugars).

3.5 The determination of sucrose and reducing sugars with polarimeter and with Luff-Schoorl or Bertrand method.

3.6 Analysis of soft drinks:

determination of CO_2 with aphrometer and calculation in g/liter,
determination of the solid content with Abbe refractometer.

3.7 Analysis of tea and coffee :
sensorial evaluation,
moisture, using drying cabinet,
ash, using muffle furnace,
caffeine using fotometric method,
foreign materials.

3.8 Determination of baking value of wheat flour with VALORIGRAPH.

3.9 Determination of colour of meat and other foods with MOMCOLOR.

4.) Establishment of a sensorial test pannel, application of the method of selection of pannel-members, adaptation of qualitative methods of sensorial evaluation (triangel-test, duo-trio trial, pair-proof) and of the quantitative scaling and ranking methods as well.

5.) Beginning of the collection of internal testing methods for the purpose to elaborate an internal Testing Methods Book, which may be lateron the basis to the elaboration of methodical standards and a nationwide applicable Testing Methods Book.

6.) Establishment of a systen of collecting the data of control, making in this way a possibility to the establishment of a Data - Bank, which may be a very useful basis for standardization and for the revision of standards.

7.) To collect the main principles for a Laboratory Regulation, which has to contain the order and systen of the work in the Food Laboratory.

8.) It is intended to give some short lectures concerning the following subjects :

8.1 The Practice of the Application of Mathematical Statistics in the evaluation of laboratory-data.

8.2 The Implementation of Standards and Their Effect on Quality Assurance.

8.3 The Principles, Organization and Practice of State (National) Quality Control of Food.

The dead-line for points 3.(-8.) is 06.05.1982, having the situation which involves to make the different tasks parallel, depending from the possibilities presented.

The expert wants to mention, that according to his experiences the Work Plan is oversized mainly taken in consideration the full point 3.) with all sub-points (3.1-3.9).

The reason of doing so is in the former para mentioned situation. We don't have still a complete view over the possibilities for the laboratory work, concerning either the material means, or the personal capacity. According to the possibilities presented and searching and looking for all the facilities available, we have to select the tasks, which are executable.

Dar-es-Salaam, 19.02.1982

(Dr. Odon I. Vajda)
UNIDO-Expert

ANNEX 3.

Organizations, Institutions and Factories Visited

1. Tanzania Industrial Development Organization
   C.I. Tarimo Director General

2. University of Dar es Salaam
   Dr. K. Mshigeni - Director Postgraduate Studies

3. GLORIA Bakeries Ltd. - Dar es Salaam
   Mr. C.G. Nikitas - Director

4. TANGOLD Products Co. Ltd. - Dar es Salaam
   Mr. R.B. Hoza - Manpower Development and Administrative Manager
   Mr. S. Heze - Food Technologist

5. National Cold Chain Operations Ltd - Dar es Salaam
   Mr. E.G. Musoma General Manager

6. Tanzania Food and Nutrition Centre - Dar es Salaam
   Mr. H.M. Lukoo AG. Director F.S.T. Department
   Mr. C. Temalilwa - Biochemist I/C of Laboratory

7. Livestock Development Authority - Dar es Salaam
   Mr. J.P. Kimati - Director of Planning and Operations

8. Rajani Oil Industries Ltd. - Dar es Salaam
   Mr. A. Sivanandam - General Manager

9. EMCO Industries Ltd - Arusha
   Mr. C. Patel - Ag. General Manager

10. Tanzania Food Corporation Ltd - Arusha
    Mr. A.R. Dallos - Ag. Managing Director
    Mr. K.A. Flavell - Production Manager

11. Tanzania Dairies Ltd. - Arusha
    Mr. E.J. Nguma - Insurance Officer
    Mr. P. Gabriel - Senior Factory Foreman

12. Tanzania Breweries Ltd. - Arusha
    Mr. K.F. Mmbaga - Manpower Development Officer
    Mr. G.J. Mkolwe - Senior Brewer

13. Kilima Bottlers Ltd. - Arusha
    Mr. S.A. Dalal - Ag. General Manager/Accountant

14. Tanzania Food Products Ltd. - Arusha
    Mr. M. Shah - Factory Owner

15. Tanzania Packers Ltd. - Dar es Salaam
    Dr. A.K. Baluhi - General Manager
    Mr. S. Saidi - Factory Manager

16. Tanzania Industrial Studies and Consulting Organization
Mr. F. J. Zanghira - Economist

17. Food and Agricultural Organization
Mr. D. H. Wozab - Representative

18. Food and Agricultural Organization Livestock Development Project
Mr. B. O. Coles - Livestock Industry Coordinator

19. Food and Agricultural Organization Dairy Development Services
Mr. R. J. Donald - Dairy Economist

20. NMC - Siha Bakery Dar-es-Salaam
Branch Manager - Mr.Muhesi

21. Tanzania Breweries Ltd. Dar-es-Salaam Brewery
Mr.P.Mevada - General Manager

22. Coastal Dairy Industries Ltd.
Mr.Mpanilehi - Plant Manager

23. Government Chemist Laboratory
Mr. S. Katocha - Principal Chemist

ANNEX 4.

REPORT ON VISITS TO FOOD INDUSTRIES

GLORIA Bakery Ltd. is one of the small bakeries of Dar es Salaam. Production is down on account of lack of flour. They get more or less 270 t flour/month and their capacity is 35 t/day. The quality of the flour is not uniform which does cause technological problems. They would be very much interested on researches to find substituting cereals in the place of wheat flour e.g. sorghum or millet. The machinery is old and the hygienic circumstances are moderate. The quality of the bread is good. Of course, we could not see a big variety, but apart from bread, they produced some confectioneries. The Manager had some tests with flour mixes which were delivered by the National Milling Corporation, and according to his experience, there was no difficulty either in the production or in the quality of the products.

TANGOLD Products Co. Ltd. Dar es Salaam are producing bottled and canned fruit products: pulps, jams, sliced fruit, tomatoe paste. The main raw materials; mango, pine-apple, oranges, tomato and sometimes passion fruit. The capacity is not utilized since the supply of raw material is very uneven. The production period lasts for a longer time.but it is limited by the deterioration of the raw material. The greatest problem is the price policy; they pay 60 cents for 1 Kg of oranges. The farmer, if he can come to a market, can sell it for 1 shilling per piece. The factory is hiring trucks and purchasing raw material on the spot. There is no contract with any cooperatives or farmers. They have an interest in purchasing a farm to guarantee supply. The idea of vertical integration should be encouraged. The idea was raised by other managers also. The installation is not extremely old and was undergoing maintenance at the visit time. The expert proposed the production of concentrates, which could find export markets instead of a great amount of water, when exporting juices. The need for TIRDO services was presented:

- to get help in the elaboration of new types of products,
- to training their staff by TIRDO, and to assist in obtaining fellowships in developed countries.

National Cold Chain Organization Mr. Musoma, General Manager, noted that NCCO presently emphasizes cold storage of fresh fish. Exapnsion to be able to handle other produce requiring chilling or freezing is needed and the long range plans for the Organization include growth and diversification.

Livestock Development Authourity. Mr. Kimati provided detailed information concerning meat production and processing. The livestock in Tanzania are not efficient meat producers and therefore efforts are underway for the breeding of more productive types (F 1). The FAO Livestock Project and the FAO Dairy Project are playing an important role in this effort. It is also true that without concentrated animal feeding, the quantity and quality of meat will not change as much as desired. The farmer is not interested in the improvement of the quality of meat, since the same price is paid for any kind of meat. This statement was also made by the FAO Livestock Project Manager, Mr. Coles. At the moment meat processing is very limi+ Not more than 3 or 4 types of canned meat products are pro at the Tanzania Packers Ltd., which has been visited. At the moment they produce only canned juices, mainly pineapple juice and squash. We were told that sliced pineapple used to be processed. The greater part of the factory is in reconstruction and at the present there is no any chilling capacity. Mr. Kimati also mentioned the establishment of small-scale poultry processing based on local resources in some centres of poultry breeding.

It was very clear that the development of various processed meat products could be a contribution by TIRDO to the meat industry. The elaboration of methods of packaging either for meat or for dairy products would also be valuable. The expert appreciates the valuable information provided by Mr. Coles, Mr. Kimati, Dr. Baluhi, the Director of Tanganyika Packers Ltd. and from the technologist, Mr. Saidi.

Rajani Oil Mill. The mill is in reconstruction and expansion. They obtain raw material from GAPEX and are transforming cotton-seed, seeame, sunflower seeds and ground-nut. The importance of a vertical

integration as a tool in the assurance of sufficient raw material supply was mentioned again. The technological level of the mill is not high, but the work is well organized taking into consideration the difficulties caused by the reconstruction. The oilcakes produced have a relatively high oil content and therefore must be used with caution for animal feeding. The refinery was not in operation due to a lack of raw materials. They are using the waste water with its oil content in the production of soap. The expert believes this to be an experiment, but the produced soap was presented. This very ambitious factory has no quality control and they would appreciate the help of TIRDO in the establishment of such an organization. Another need is the elaboration of more up-to-date oilprocessing technology with less waste and more yield as well as some comparative data of the productivity in this field. This is a country-wide problem, as stated by the Hon. Minister of Industries B. Mramba at the briefing for World Bank President, Mr. Clausen, saying that Tanzania loses millions of Shillings every year by exporting oil seed cake with a very high oil content (Daily News 24.11.1981.

EMCO Industries Ltd., Arusha. This factory was closed for 5 months lacking a license for the import of glucose-syrup, which is not produced in Tanzania. They began production this month and they have enough raw material until the end of January. Therefore the plant capacity is not fully utilised and they are employing 17 workers instead of 75. The main goods produced are small candies of nominal quality. The manual work is characteristic for this small factory. They had a graduated technologist, but he returned to India not having adequate work here. This enterprise has another factory which produces soap. It is worthwhile mentioning that it has not produced for some months even though they have a brand new soap production line. When asked about the need for TIRDO services it was declared that first they must have the raw material and the accessory goods such as colorants, aromas etc.

Tanzania Food Corporation Ltd., Arusha. This is a well organized, up-to-date factory with a graduate expatriate technologist who had 16 years experience with Cadburry, England. The plant is producing biscuits and pasta. The equipment of both production line is modern and in good condition. They are producing only one type of biscuits, but applying various forms of packaging such as cartons, roll-packs etc. The technology is adequate; the only quality failure is non-uniform colour of the biscuits. This is results from the slow response of electrical heating for the ovens. In all other respects the production and the factory itself is an up-to-date, hygienically acceptable plant. The capacity is underexploited on account of the lack of raw material, primarily flour. This also effects the other production line : the brand new installation for pasta. The factory has two Italian lines, one a Braibanti, the other a Pavan, both modern technology but out of production for five months on account of the lack of flour. The whole factory made a very good impression from all points of view; organization, equipment, technology, technological discipline and management.

Tanzania Dairies Ltd., Arusha. The capacity of the plant is 50,000 liters/day but actual production is about 33,000 liters i.e. 66% utilization. Milk is collected in two ways. Factory vehicles travel to various cooled centres and some farmers bring their milk directly to the plant. The raw milk is examined by the small laboratory which makes physical, chemical, bacteriological and sensorial tests. The control is applied to the processed goods as well. It should be mentioned, that this enterprise owns 7 dairy plants of which this is the largest. They pasteurize at 72-78 ^{o}C. The average fat content of the raw material is about 3.5%, which is normal. The end-product contains 2.0% fat and the skimmed fat is transformed to butter. The plant produces ice cream and sometimes ghee as well. The impression of the organization, production, equipment, work discipline, quality control and quality of the products was very good. The hygienic conditions were consistent with the demands posed by the delicate procedures carried out in a dairy plant.

Tanzania Breweries Ltd., Arusha. We were given very detailed and profound information about the organization, technology, microbiological aspects etc. from Mr. Mkolwe. He is not a graduate scientist nor has he had fellowship in a foreign country with a developed brewery industry but was very well informed, and skilled. Eighty five percent of the malt is imported and this limits the production. The target for 1981 was for 1,200,000 hecto-litres of beer. Until now they have produced 100,000 hecto-litres in only one month. They use 7% sorghum in the place of maize, 8% barley and some sugar. The grade of fermentation regulates the alcohol content and the extract. The production is limited not only by lack of raw and accessory materials but by the age of the machinery. It is a second hand installation brought from Canada. They are working on reconstruction with the intent to quintuple the production. The quality of the different types of beers produced here (Kilimanjaro, Safari, Pilsner) is acceptable and a good quality control system is working. The hygienic conditions might be better, but there is some excuse on account of the reconstruction. Possible services from TIRDO, included a request for some special theoretical and practical training of the staff and they would be very pleased with assistance in obtaining study trips.

KILIMA Bottlers Ltd., Arusha. Discussions were with Mr. Dalal. The bottlery was established in the year 1968, but in 1973 was rebuilt with completely new installation which is up-to-date equipment even today. The capacity is 550 cases (13,200 bottles) per hour. The variety of the products; Coca-Cola, Fanta Orange, Ginger, Soda Club, Tonic, Spright. They are importing the concentrates, some chemicals, sometimes the crown-corks, the green bottles (not the white ones) and until recently even the carbondioxide. Now they have CO_2 production sufficient for the plant capacity. Not being fully utilized, the surplus CO_2 is sold. The quality of the drinks, as well as, that of the CO_2 purity (99.9%) is sufficient. They have 110 workers but the number would be greater if the full capacity could be utilised. There was one graduate engineer from India. The factory is well equipped, the production is well organized, quality control is working and the quality as well as the variety of the products is considered acceptable.

Tanzania Food Production, Arusha. A privately owned firm with a very small-scale production which is more an import and sales activity than a food processing installation. They used to import curry, safran etc. from India, but now there is no import license. They are milling gram-seeds and packaging those spices for which an inventory remains.

Tanzania Breweries Limited, Dar es Salaam

The factory's products are Safari, Kilimanjaro, Mdovu, Pilsener, Crown Lager beers, with an alcohol content of 5% and its original extracts come out to 10,5 Balling. The malt is imported, one part of the starch is besed on sorghum and millet, the maximum used amounts to 15%. The 22% of the extract may originate from adding sugar. Hop-concentrate is used, the natural hop does not come to more, than 15% of the total amount. The alfa-humulic acid amounts to 6-7 g/hl. They have the intention to begin the production of malt in May of this year. Fortunately the factory has an agricultural background: they possess a barley-farm. The Brewery belongs to those exceptional factories, which have a high utilization of their capacity: 98%, the production comes to 600 000 hl/year. The factory is working with 3 shifts, more than 110 workers/shift. 15 qualified specialist are working in the factory, not all of them have a University degree, but generally they make study trips to outer countries, mainly to those, where from the machineries are purchased. The factory has an excellent quality control organization, one branch-laboratory and one factory laboratory is existing with a very up-to-date instrumentation.

NMC - Siha Bakery, Dar es Salaam

The 60% of the raw material is imported flour, the production comes to 60 000 loafs/day. The whole capacity amounts to 80 000 bread/day, the utilization of the capacity is relatively not bad: 75%. 37 workers are working in one shift, generally the production is going on in two shifts. The total number of employees is 157. The technology is the usual: the preparation of the dough is not

followed by a fermentation process, the dough with a temperature of 32 - 35 C° is delivered to the distribution, where from it is transfered by a conveyor where is to be rolled out and then put in the form spred with margarine. In this form the dough is rested on 37 C° at a humidity of 84%. The oven is heated by diesel-oil, the temperature comes to 218 - 232 C° for 30 minutes. The testing or the quality control of the product is missing, although the quality of the bread is acceptable.

Coastal Dairy Industries Limited, Dar es Salaam

The capacity of the plant comes to 150 000 l/day, the demand is estimated to 100 000 l/day, the production amounts to 60 000 l/day. The dayly intake of natural raw milk does not exceed the 600 litres, -this figure was in 1970 12 000 litres. Nearly the whole production is restituted milk made of milk powder importei. They pay 3.70 TSh/litre when collecting it and ,50 cents more if delivered to the plant. The equipment is up-to-date Alfa-Laval, the temperature of the pasteurization 71-73 C°. The acceptance of the raw material is carried out according to the fat content and bacteriological quality. The final products are as follows: milk, its quality is not good, the homogenization is unsatisfactory, yoghurt, its quality is very good, using own starter-culture. The quantity of the yoghurt is depending on the packing material-supply, it comes usually to 1600 l/day. Cream is produced too, but only 50 l/day. Laboratory control is working, the fat content, the impurities and the microbiological state (coliform bacterias, rezazurin probe, total plate count) are tested.

ANNEX 5/a

CAFEINE DETERMINATION (in tea) - Photometric Method

Reagents:

1. Copper Sulphate Solution - 6.926 per cent
2. Potassium Ferrocyanide - 15.0 per cent
3. Sulphuric acid - 20.0 per cent
4. Iodine - 0.1 N
5. Methanol

Procedure:

Weigh 10 g of the sample. Add distilled water and make the volume to 50 ml. Boil for 5 minutes. Leave for a few minutes to settle. Transfer the solution into a 50-ml volumetric flask. Add 15 ml of distilled water and 3 ml of copper sulphate solution. Leave for 5 minutes in a waterbath at 70°C. Remove from the waterbath and add 1.2 ml of potassium ferrocyanide solution. Make the volume to 50 ml with distilled water at 20°C. Shake and filter.

Transfer 5 ml of the filtrate into a 100-ml beaker. Boil in a waterbath for 10 minutes. Cool, and add 2.0 ml of 0.1 N Iodine. Leave for 4 - 5 minutes and filter using G-4 sintered crucible. (A precipitate of cafeine periodate is left in the crucible).

Pour 25 ml of methanol to the precipitate in the G-4 crucible. Collect the filtrate in a 100-ml-flask. Wash the crucible with 25 ml water, collecting the filtrate into the 100-ml flask.

Determine the absorption of the yellow-coloured solution in a colorimeter at 465 nm. against blank.

Preparation of standard curve

Prepare the following concentrations with distilled H_2O:-

1) 10 mg/100 ml
2) 20 mg/100 ml
3) 30 mg/100 ml
4) 40 mg/100 ml

Procedure

Treat the standard solution as the sample starting from the addition of sulphuric acid. Read the absorption of the solutions at 465 nm. 1/ Plot the calibration curve, absorption against the concentrations.

1/ against blank

Determine the concentration of the sample from the calibration curve.

NOTE: Prepare a reagent blank using water instead of sample. Proceed as for the test starting from the addition of sulphuric acid.

Determination of Caffeine - Gravimetric

Apparatus:-

1. Soxhlet
2. Drying oven
3. Analytical balance
4. Evaporating basins
5. Separating funnel - 250 ml
6. Volumetric flask - 200 ml

Reagents:-

1. Chloroform
2. Copper sulphate - 20%
3. Ammonium hydroxide - 10%
4. Sodium hydroxide - 4%
5. Sodium sulphate - dehydrated

Procedure:

Weigh 10 g $\pm$ 0.001 g into an evaporating vessel. Add 5 ml of ammonium hydroxide and leave it for one hour. Transfer to a thimble. Extract this with chloroform for 3 hours. Then evaporate the chloroform. Add 50 ml of H_2O, boil. Transfer into a 200-ml volumetric flask. Wash the Soxhlet flask with 100 ml hot water. Cool, and add 5 ml of $CuSO_4$ and 5 ml of NaOH. Bring to volume with H_2O. Filter and collect 100 ml of the filtrate and put it into separating funnel. Add 50 ml chloroform shake once and then add 25 ml of chloroform x 2. Collecting the chloform layer, filter through water-free Na_2SO_4 in a Soxhlet flask previously dried and weighed. Evaporate the chloroform, and dry and weigh. Then weigh to constant weight until the difference in reading should be 0.002 g.

Calculation:- $$\% = \frac{2.100}{M_o} \times M_1 \times \frac{100}{DM}$$

where: M_o = weight of the sample

DM = weight of the moisture-free sample

M_1 = measured weight of caffeine

ANNEX 5/b

DETERMINATION OF SULPHUROUS ACID (SO_2)

(QUICK METHOD)

1 REAGENTS

1.1 0,1 N sulphuric acid.

1.2 Starch solution : g/1 + 200 g NaCl as preservative. The solution has to be boiled for ten minutes.

1.3 0,02 N iodine solution.

1.4 Di-sodium salt of ethylendiaminetetraacetic acid.

1.5 4 N sodiumhydroxide.

1.6 Acetaldehyde solution (6.9 g/1).

2 PROCEDURE

2.1 The determination of free and total sulphurous acid content has to be carried out at the same occasion by iodometric titration after twofold alkalic hydrolisis.

2.2 Put 50 g of the very carefully minced sample into a 500 ml Erlenmayer flask and dilute it to 200 ml with distilled water. Add 3 ml 0,1 N sulphuric acid, 5 ml of the starch solution and 30 mg of the di-sodium salt of the ethylendiaminetetraacetic acid. Make the titration using 0,02 N iodine solution until the blue colour is obtained. Note a ml consumption. (The correct titration might be checked by a back-titration using 0,01 N sodiumthiosulfate.)

After having added 8 ml of 4 N sodiumhydroxide, shake it vigorously and wait 5 minutes. Add 10 ml of 0,1 N sulphuric acid and make the titration using 0,02 N iodine solution until the blue colour is obtained. Note b ml consumption.

Add 20 ml of 4 N sodiumhydroxide and shake the flask vigorously only once and cool it. Add 30 ml of 0,1 N H_2SO_4 cautiously drop by drop with vigorous shaking. The bound sulphurdioxide gets free and might be titrated using 0,02 N iodine solution. Note c ml consumption.

Since certain substances are oxidized by iodine in acetic medium a so called correcting titration has to be carried out. By this action the same quantity of the sample has to be mixed with aceticaldehyde to bind the free sulphurdioxide. The flask must be stopped and let to stay for 30 minutes.

Add 3 ml of 0,1 N sulphuric acid and make the titration using 0,02 N iodine solution. Note $\underline{d}$ ml consumption.

$$\text{Free } SO_2 \text{ mg/kg} = 12{,}8\ (a-d)$$

$$\text{Total SO mg/kg} = 12{,}8\ (a+b+c-d)$$

Having redish coloured substances the application of a yellowish light-beam is highly recommended, e.g. a bulb with a potassium-chromate filter, or a sodium-lamp.

3 REMARKS

3.1 The value $\underline{d}$ at the so called correcting titration is generally very low (not more than 0,75 ml). But in the presence of ascorbic acid this consumption ($\underline{d}$ ml) may increase, since 1 ml of 0,02 N iodine solution responds to 1,75 mg ascorbic acid. This gives even the possibility to estimate the ascorbic acid content by the correcting titration.

3.2 This method may present a bit higher values of SO_2, therefore in the range of the upper limit-value is recommended to apply as a deciding method the Monier-Williams method, or its modified version (see AOAC.)

METHODS FOR SENSORIAL EVALUATION
PREPARATORY AND EVALUATION PANEL PREMISES

1 Preparatory room

The preparatory room is indespensable in all the cases, when the sample to be evaluated has to be prepared in some way and this fact is established in the concerning standard. The sample is to be prepared for sensorial evaluation in the preparatory room.

The preparatory room has to be ventilated in a proper way (e.g. a ventilation apparatus should be allocated over the cooking or frying space etc.)

The preparatory room has to be separated from the panel room in a way, that the smell and noise of the preparation work should not penetrate to the evaluation panel chamber. To approach this condition, it is suitable, practical to put the preparatory room directly on the side of the panel room and to make the connection between the two premises by a closable opening for dishing of the prepared samples. The preparatory room should be by all mean not so far from the panel room, that the state of the prepared samples could change during the transfer from the preparatory room to the panel room, e.g. the change of the consistency, the change of the temperautre influencing the sensorial evaluation.

It is reasonable to form four main parts within the preparatory room:

- One separate part of the storage of the samples, furthermore the same part might be used for the placement of the various instruments used for the preparation of the samples, as cooking, heating,

frying, cooling, disintegrating and other instruments (e.g. kneading, whisk machines);

- the other separated part should be for the washer containing two sinks: one for the cold and one for the warm water;
- the third part of the preparatory room is the pantry, having a cutless, well cleanable surface of table, where the prepared samples might be placed into the dishes of the same size and form and colour;
- finally one part serves for the storage of the means used for the sensorial evaluation. The cupboards, drawers used should be smell-less.

The walls of the preparatory room have to be covered with tiles, or with plastic slides, or with caste-stone, which should be excellently washable. Washable dyes might be used, too.

The illumination of the preparatory room should have 300 lx, the pantry 500 lx,

The installation of the preparatory room is demonstrated in Fig.1.

2 ROOM FOR SENSORIAL EVALUATION (TESTING PANEL'S ROOM)

The sensorial evaluation has to be done in the evaluation room.

2.1 The demands on the evaluation room

The evaluation room has to be free of smell and noise, the ventilation of it must be assured, it should be clear, but protected from direct sunshine. The room should be free from draught of air. The proposed temperature is 22-25C°, the relative humidity 60-70%. Air conditioner is recommended, if not available natural ventilation should be secured.

The covering of the walls should be clear, using pastel-shades, dark colours within the room should be avoided.

The working tables have to be illuminated by light sources, which respond to the characteristics of the tested product. The room itself has to be illuminated by such light sources, which give a light similar to the natural light. The intensity of the light has to be 500 lx.

2.2 The installation of the evaluation room

The installation of the room has to assure the accomplishment of the prescriptions of the standards concerning sensorial evaluation.

At least six working places should be installed, each one having a table and a chair. The working places have to be divided(by wooden-wall, or curtain).

The tables have to be easily and well cleaned, of light colour, possibly provided with water-tap and water gang used for the rinsing of the mouth. Having np possibility to build in the table the water-tap and the water-gang, it should be replaced by suitable vessels. The working place of the table must be as large, that the samples, the prescriptions, the report-formulars and other possibly necessary means could be placed. The measures of the table have to assure, that the serving personnel could place and change the samples and the taste-neutralizers without disturbing the jury-members.

A thermometer and a hygromether must be placed in the room, too. The possibility of the calculation of the result of the evaluation has to be assured either in the neighbourhood of the chairman, or in a separate chamber.

2.3 The panel members have to carry out their work without the possibility of the mutual influence, therefore they should sit either in a box, or should be separated by other means (see above).

The table of the chairman of the panel should be placed in that way, that during the testing he had the possibility to control the accomplishment of all the prescriptions at all the panel-members.

The variations of the placement of the panel-members are demonstrated in Fig. 2, 3, and 4.

As far as separating walls or boxes are not staying to disposal, the placement depends on the size and shape of the room and are proposed the following sitting-orders:

- place the panel-members with the back to another in one or two lines;
- form one half circle of the panel members across to the window.

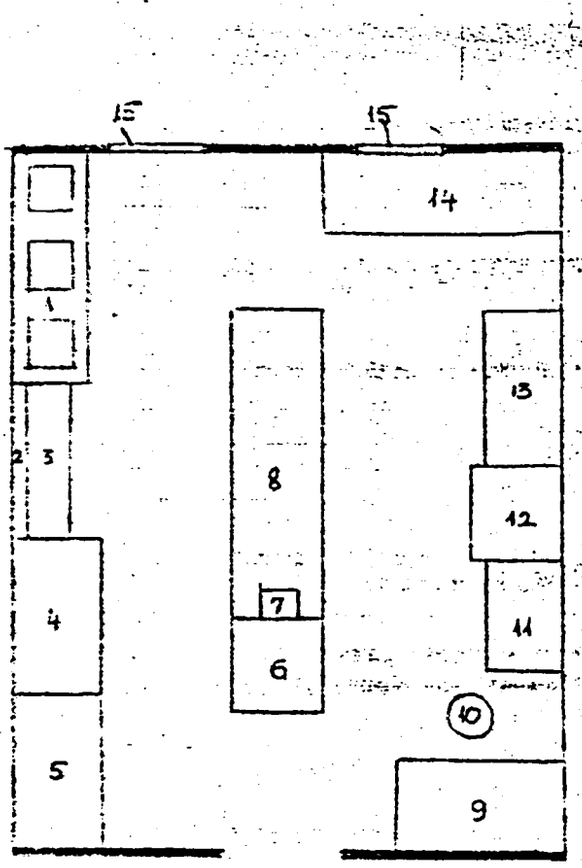

Fig.1.

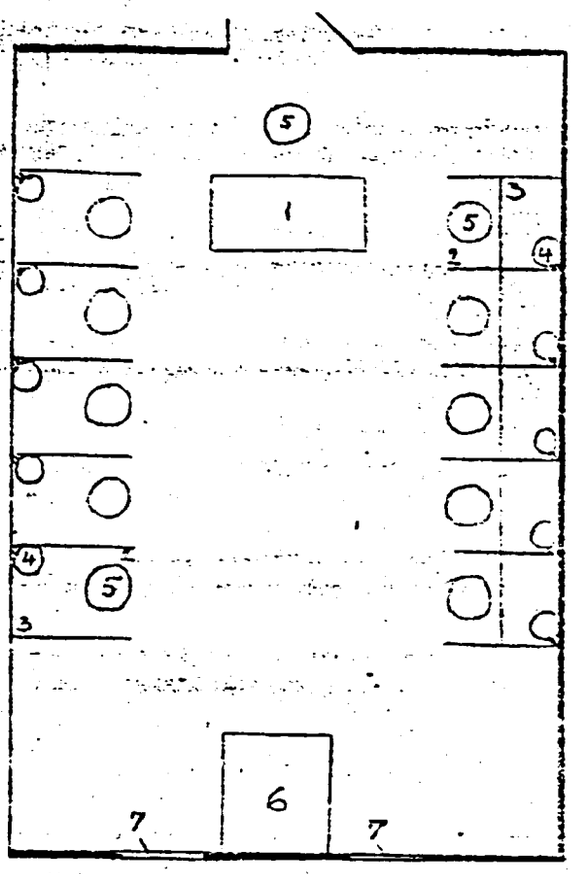

Fig.2.

Preparatory Room

1. Three-part washer
2. Dryer on the wall fixed
3. Table-flap drying vessels
4. Shelved cupboard
5. Cupboard with drawers
6. Refrigerator with deep freeze
7. Electrical distributor
8. Table for kitchen-machines
9. Table for administrative work
10. Chair
11. Infra-red heater
12. Fryer
13. Hot plate/water-bath
14. Serving table
15. Sliding window

Testing Panel Room

1. Table of the chairman
2. Box for testing
3. Working table
4. Water-tap with water-gang
5. Chair
6. Table
7. Sliding window

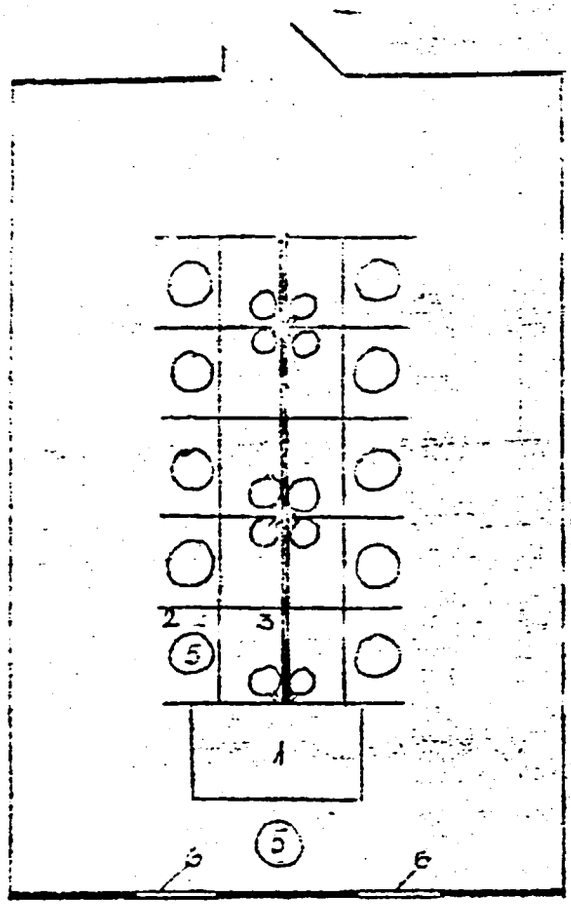

Fig. 3

Testing Panel Room

1. Table of the chairman
2. Testing box
3. Testing table
4. Water-tap with water-gang
5. Chair
6. Sliding window

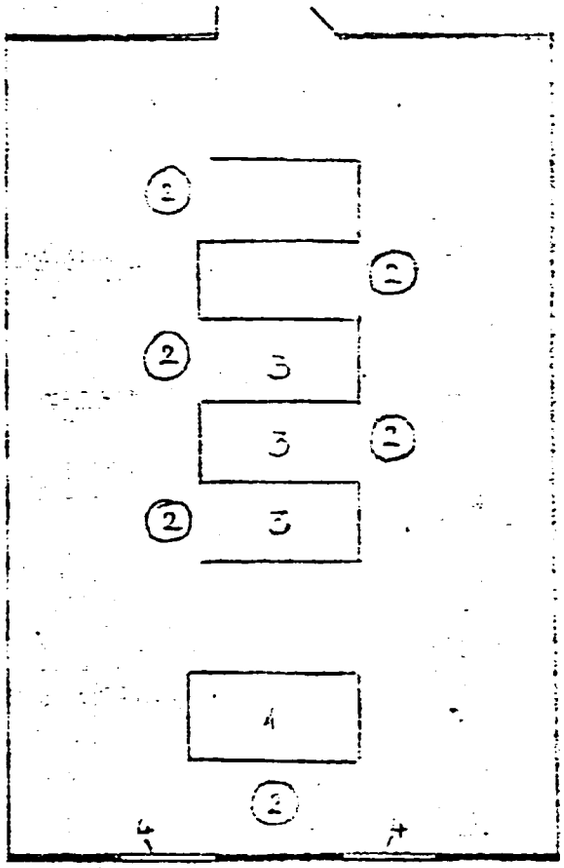

Fig. 4

Testing Panel Room

1. Table of the chairman
2. Chair
3. Testing table, box
4. Sliding window

ANNEX 5/d

SENSORIAL TESTING METHODS
THE EXAMINATION OF TESTING PANEL MEMBERS ON THE CAPABILITY OF TASTING, SMELLING AND COLOUR DETERMINATION.

1 THE DETERMINATION OF THE CAPABILITY OF TASTING

1.1 Means

Enamelled vessel 2 l
Smell-less filter paper (e.g.Macherey-Nagel MN 615)
Brown flask 200 ml with polished glass cork, hold in drying oven for 15-20 minutes on 105C°, stored opened.
Spoon of stainless steel, volume 5-10 ml
Watch-glass with a diameter of 12 cm.
Glass of 100-300ml (used for the neutralization of the mouth by tap-water)
Beaker of 400 ml (used for the rinsing of the spoon by tap-water)

1.2 Reagents

Sucrose AnalaR
Sodium chloride (dried for 1 hour on 105C°) AnaLaR
Citric acid, anhydrous, AnalaR
Quininsulfate AnalaR
Caffeine, anhydrous, pharmacopeal
Boiled water, preparation: 1 litter of tap-water has to be boiled for ten minutes in an enameled vessel, cooled, filtered through smell-less folded filter paper. The shelf life of the boiled water can not exceed two days.
Distilled water
Tap water

1.3 Testing methods

1.31 The examination of taste-identification

It serves to clear up the capability of the panel-member in the recognition of the four basic tastes at a very low level of concentration: sweet, salty, sour and bitter.

1.311 The preparation of the testing solutions

Four standard-taste solutions are to be prepared, having the following concetrations:

Sweet: 0,8% sucrose solution using boiled water
Salty: 0,15% sodiumchloride solution using boiled water
Sour : 0,05% solution of citric acid prepared with distilled water (the shel-life of the solution being very short, should be prepared only before the testing).
Bitter: 0,0008% quininsulfate solution, or 0,03% caffeine solution both prepared with boiled water.

The temperature of the solutions and of the water should be between 22-25C°.

From the solutions should be poured into the brown flask provided with code-numbers 150-150 ml.

1.312 The testing

Each one of the judges gets 9 solutions, one spoon, one glass and a beaker. Among the solutions the four basic tastes are presented twice each one and the 9th solution might be again one of the basic tates or the water used for the solutions.

The judges pour the solution from the coded flasks into the spoon. The spoon has to be put on the watch-glass after the tasting and should be grinsed and wiped.

The taste of the mouth should be neutralized using tap-water. It is recommendable to keep one minute pause between two tasteing. After having tasted an other standard solution, the previous one might not be tasted again (back-tasting not allowed).

The results are presented on the formular as Annex I.

1.313 The evaluation

The judge proved his ability when identified all the 9 solutions.

1.32 The examination of differences of concentration by pair comparison test.

The method should be applied to determine the ability of the judges, how reliable can they recognize very small differences of concentration.

1.321 The preparation of the solutions

The standard solutions:

Sweet :	20,0 g sucrose	200 ml boiled water solution
Salty :	10,0 g sodium chloride	100 ml boiled water solution
Sour :	1,0 g citric acid	200 ml distilled water sol.
Bitter:	0,08 g quininsulfate	100 ml boiled water solution
	1,0 g caffeine	100 ml boiled water solution

Testing solutions :

The amount of the standard solution fixed in the following table has to be pipetted into a volumetric flask of 1 000 ml and diluted until the mark with distilled water.

Basic tastes	Consentration pair g/ml		Amount of the standard solution	
	1.	II.	III.	IV
Sweet	0,80	1,10	80	110
Salty	0,15	0,20	15	20
Sour	0,05	0,065	100	130
Bitter quininsulf	0,0008	0,0016	10	20
caffeine	0,020	0,030	20	30

The solution should be prepared one-one and half hour before the testing.

1.322 The testing

150 ml of the concentration-pairs has to be poured into the brown flasks 200 ml with polished glass-corks. The flasks must be coded before. Each judge gets 5-5 concentration-pair of every basic taste, one spoon, one glass, one beaker and one watch glass. The tasting might be repeated. One minute pause between two tasting is recommended as well as, the neutralization of the mouth by tap-water.

The results have to be collected on the testing sheet see Annex M2.

The judge proved his ability when identified the difference in all the five cases.

2. THE TESTING OF THE ABILITY OF DISCRIMINATION OF ODOURS

The testing serves to verify the certainty of the judge in the determination of the discrimination of the various smells/odours of different chemicals.

2.1 Means

Volumetric flask 50 ml
Pipettes
Brown or colourless powder bottle 200 ml with polished glass cork

Smell-less steril cotton

2.2 Chemicals

Chemical	Concentration	Solvent
1. Ammoniumhydroxyde	1 vol %	water
2. Benzaldehyde	1 Vol %	ethanol 50 vol %
3. n-butyric acid	10 vol %	water
4. diacetyl	1. 10 vol %	water
5. acetic acid	8 vol %	water

	Chemical	Concentration	Solvent
6.	amilester of acetic acid	10 vol %	ethanol 60 vol %
7.	phenol	10 g/ml	ethanol 25 vol %
8.	vanillin	10 g/ml	ethanol 30 vol %

2.3 The preparation of the sample

A pinch of cotton is to be put into the powder flask (2cm high) and has to be dropped 0,5 ml from the chemicals on it. The flask should be closed and stored on 5-10C^0 until the beginning of the testing. Two series must be prepared of all the mentioned chemicals and are to be coded

2.4 The testing

The judges receive two series of the odours. 2-5 minutes pause is recommended between two perceptions. The results should be put on the sheet Annex M3.

The judge gets one point for each proper judgement. He proves his ability when gained twelf point of the possible maximum sixteen.

3. THE TESTING OF COLOUR DISCRIMINATION.

That capability of the judges should be stated, what certainty he has to put in order according to an increasing odour intensity the colour-solutions of different concentration.

3.1 Testing tubes of colourless glass, recommended measures: m=150 mm d = 15 mm

Testing tube-stand

3.2 Chemicals

Distilled water

Colouring matters : Light-green SF
Chrysoin
Azopurpure

3.3 The preparation of the solutions

3.31 Standard solutions

2 g of the colouring matter is to be put into a volumetric flask

100 ml and diluted until the mark using distilled water.

3.32 The amount of the standard solution presented in the table below is pipetted into the volumetric flask 100 ml and diluted until the mark using distilled water.

Colours: green, yellow, red	
Quantity of the standard solution ml	Concentration of the test solutions(g/ml)
0,20	0,0040
0,26	0,0052
0,33	0,0066
0,43	0,0086
0,55	0,0110
0,70	0,0140
0,90	0,0180
0,16	0,0232
1,49	0,0298
1,92	0,0384

10 ml of the test-solution shall be pipetted into the coded testing tubes.

3.4 The testing

The testing needs a good, edequate light. Each judges receives 30 testing tubes of which 10-10 are forming 1-1 colour serie. The judges have to put in order the tubes according to the increasing colour-intensity. The results are to be presented on the sheet Annex M4.

3.5 Evaluation

The judges proved his ability when the different colours are selected and put in order faultless.

ANNEXES

M1 Testing sheet of the recognition of tastes

Name..... Date..... Time.....

General condition of the judge .....

Task: Name exactly the recognized taste of each test.

Number of the flask	Recognized taste

M2 Sheet for testing concentration - differences
(Pair-comparison)

Name..... Date..... Time.....

General condition of the judge:.....

Task: Compare the pairs and name the recognized basic taste. Make a circle to the higher concentration.

Serie: Basic taste:

Serie number	Code number of the flask	
1.	1	2
2.	3	4
3.	5	6
4.	7	8
5.	9	10

M3 Sheet for the evaluation of smelling ability

Name..... Date..... Time.....

General condition.....

Task: Smell the testing matters and fix the code number of the flask responding to the odour.

Number of the flask		The name of the chemical	Description of the odour
		ammoniumhydroxide	pungent, like stable
		benzaldehyde	bitter-almond smell
		n-butyric acid	rotten butter smell unpleasent sweat
		diacetyl	butter-smell
		acetic acid	vinagre, sour pungent
		amilester of acetic acid	ester-smell, like nail-polish smell
		phenol	like carbol-smell makes remember to a hospital
		vanillin	vanilla, pleasent smell of a cake

M4 Sheet for colour discrimination

Name..... Date..... Time.....

General condition.....

Task: Order the test - tubes according to the colour and the increasing intensity

Order according to the increasing intensity	Number of the test tube		
	red	yellow	green
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			

ANNEX 5/e

SENSORIAL TESTING METHODS

DETERMINATION OF THE TASTE THRESHOLD

1. TERMINOLOGY

The taste threshold value represents the smallest concentration of the basic taste which might be recognized and identified by the judge unambiguously.

2. FIELD OF APPLICATION

The method may be applied :

- for the election of the judges who use to make special and complex sensorial testing tasks, furthermore for the selection of very taste-sensible panel members,
- for the training of judges, furthermore for the supervision of their capability of tasteing.

3. The threshold values of perception and recognition of the judges has to be determined using model water solutions.

4. The solutions must be prepared in the premises described in the "Preparatory and Evaluation Panel Premises".
Those may participate who are responding to the demands of "The Examination of Testing Panel Members on the Capability of Tasting, Smelling and Colour Determination."

5. MEANS

According to the above mentioned "TBS internal" standard draft, plus paper serviette.

6. CHEMICALS

According to the above mentioned "TBS internal" draft standard.

7. PREPARATION OF THE SOLUTIONS

7.1 Stock-solutions

Sweet : sucrose solution of 5 %. 25 g of sucrose dissolved in 500 cm^3 boiled water.

Salty : Sodium calorine solution of 1 %, 5 g sodium chloride dissolved in 500 cm^3 boiled water.

Sour : citric acid solution of 0,5 %, 1,25 g citric acid dissolved in 500 cm^3 boiled water.

Bitter : Caffeine solution of 0,1 %, 0,5 g caffeine dissolved in 500 cm^3 boiled water. 0,01 % solution of quinine-sulphate, 0,25 g quinine-sulphate dissolved in 250 cm^3 distilled water and 25 cm^3 of it dissolved to 250 cm^3.

7.2 Testing solutions

The quantities taken from the table below have to be placed into a volumetric flask of 250 cm^3 and diluted until the mark at the temperature 20 ± 2 C^o.The temperature of the solutions presented to the judges is according to the above mentioned draft standard. The stock solutions might be prepared with 48 hours before the testing,the testing solutions with 24 hours earlier and both are to be placed into the refrigerator.

Table 1.

The serie of concentration of the testing solutions.

Sweet sucrose		Salty NaCl		Sour citric acid		Bitter			
						koffein		quinine sulph.	
Stock sol. cm^3	concentr. g/100 cm^3	Stock sol. cm^3	concentr. g/100 cm^3	stock sol. cm^3	concentr. g/100 cm^3	Stock sol. cm^3	concentr. g/100 cm^3	Stock sol. cm^3	concentr g/100 cm^3
7,5	0,15	5	0,02	2,5	0,005	9	0,0036	2,5	0,0001
10,0	0,20	10	0,04	3,75	0,0075	11	0,0044	5,0	0,0002
12,5	0,25	15	0,06	5,0	0,0100	13	0,0052	7,5	0,0003
15	0,30	20	0,08	6,25	0,0125	15	0,0060	10	0,0004
17,5	0,35	25	0,10	7,5	0,0150	17	0,0068	12,5	0,0005
20,0	0,40	30	0,12	8,75	0,0175	19	0,0076	15	0,0006
22,5	0,45	35	0,14	10,0	0,0200	21	0,0084	17,5	0,0007
25	0,50	40	0,16	11,25	0,0225	23	0,0092	20	0,0008
27,5	0,55	45	0,18	12,5	0,0250	25	0,0100	22,5	0,0009
30	0,60	50	0,20	13,75	0,0275	27	0,0108	25	0,0010
32,5	0,65	55	0,22	15,0	0,0300	29	0,0116	27,5	0,0011
35	0,70	60	0,24	16,25	0,0325	31	0,0124	30	0,0012

About 170 cm^3 of the solutions has to be put into the brown flasks of 200 cm^3 supplied with sliffed glass-cork.The flasks must be coded. E.g.the basic tastes might be coded by Roman numbers or by capital letters,the concentrations by serie-numbers : I/1,I/2,or A/1,A/2 etc. The single series might be begun with pure solvent,but these must be coded as well.

8. TESTING

The leader of the examination makes the judges acquainted with the task.The testing is executed by using tea-spoon.Each of them gets one serie of one basic taste,one spoon and tap-water in a glass.The spoon should be put on a watch glass and after each testing must be rinsed using tap water and dried.The judges are to be informed to keep one minute pause between two testings and is useful to neutralize the mouth using tap water.

After having tasted the next member of the concentration serie, the former sample must not be tasted /back-tasting forbidden/. Between the testing of the different basic tastes the judges must have a pause of 30 minutes.

9. EVALUATION

The smallest basic taste concentration must be determined still perceived and identified by the judge.The judge proved his capability identifying the basic tastes in the following concentrations :

sucrose	0,40 g/100 cm^3
Sodium chloride	0,12 g/100 cm^3
citric acid	0,03 g/100 cm^3
caffeine	0,01 g/100 cm^3
quinine-sulphate	0,0006 g/100 cm^3

ANNEX 1.

Testing formular for taste threshold determination.

Name:..... Date:.... Time-point:.....

General condition:

Task : Test according to the serie-order the increasing taste intensity. Sign the sample of which the basic taste character can be identified unambiguously.

Serie number	Taste perception
1.	
2.	
3.	
4.	
5.	
6.	
7.	
8.	
9.	
10.	
11.	
12.	

ANNEX 6

General Outlines for TBS' Food Laboratory

The main goals of the Food Laboratory are as follows :

a./ testing and forming a judgement of the quality of all food commodities presented by applicants for Standards Mark;

b./ testing and forming the opinion of the products for which processing license is requested;

c./ to make control in the factories,on markets and supermarkets and other distributing centres taking samples for testing whether they are corresponding with the requirements of the standards or not;

d./ to prove the testing methods fixed in the standards,whether they are suitable to carry out the testing and to qualify the concerning food commodities;

e./ to collect all the data received during the above mentioned activities,store those and make use of them for the determination of the average quality,furthermore utilize those for the preparation of standards.

It seems to be necessary to underline the importance of the legal steps taken in the case,if any offence of the prescriptions of the Food Act No.10,1978 would be detected.The food is influencing directly the human health and fitness and from the point of view both of hygiene and nutritional value may be considered as a risk factor of health and life hazard.Therefore it is justified to announce all the food standards as compulsory specifications.According to the Standards Act No.3,1975 /Part IV.16./8/ and 17./7/ /,if a commodity would not respond to the compulsory standard,the person who contravenes of this, is guilty on an offence.None the less in the case ,if any person who resists,hinders,or obstructs an inspector /of TBS/ acting according to the law,should be convicted of an offence under the Act /Part V.23./

This short introduction has the intention to underline the responsibility of the whole staff of the food laboratory being it very clear,that all the data produced by the staff members might have serious consequences and may serve for the conviction of persons who might be suspected as guilties. Therefore, the food laboratory has to have a high level organization and each staff

member has to be aware of his responsibility.

The main directions of the organization of food laboratory's work following below,do not regard only the present situation,but have the intention to give some perspectives for the near future, when the staff will be completed.

1./ Since the food commodities may have a very wide spectra, although the actual situation is not like this,the specialization of the staff members is indispensable.The replacement of the single specialists by the others is important,but it is necessary to form groups according to the branches of food industries.The proposal is as follows :

1.1 Testing and control of commodities of animal origin,like meat,milk,dairy products,poultry,egg,fats,oils /although these are not of animal origin/;

1.2 testing and control of foods of vegetal origin : canned fruits,vegetables,legumes,juices,marmelades,jams etc;

1.3 testing and control of cereals,seeds,bread,bakery products;

1.4 Tea,coffee,spices.

1.5 Microbiology.

The number of the staff of the single groups depends on the preliminated number of the samples.Every group has its responsible leader,directed by the Head of Food Laboratory /HFL/.

2./The HFL distributes the samples received from HIT and gives all the instructions necessary to carry out the testing wanted. Being a special case,he has to give special instructions and advices concerning the adequate method,the instruments to be used,the chemicals etc.The HFL is in charge to control the process of analysis.His duty is to evaluate the data of the testing and to sign the report and to pass it to the HIT.

3./The HFL has to prepare a Work Plan taken in consideration the directives of HIT.The Work Plan has to include the number of samples detailed according to the different branches,and the number of control processes,executed in factories and on markets.15 - 25 % of the capacity is recommended to let free for unexpected tasks.

4./ The Laboratory Manual should be compiled taking in consideration the following main ideas :

4.1 The working hours,i.e.the time table;

4.2 the description of the duties of the staff members,including everybody,i.e.the Job Descriptions must be prepared and signed by the HFL and the employee himself;

4.3 the system of the distribution of the samples,/prepared already and has to be attached to the Manual!/;

4.4 the system of the storage of chemicals and glassware,including the code-system used at the storage;

4.5 the denomination of the responsible of the store,including the duties for the continuous supply of the means;

4.6 the system of the provision of the staff members with these means,including the time-table,when stores are working in providing the specialists;

4.7 the break diary of glass ware must be placed into the laboratory and each break must be noticed.The use of broken or hurted glassware is strictly forbidden;

4.8 the obligation of keeping and using labour-diaries with numbered pages,where every measurement,observation must be noticed and loose leaves should not be used for any notice.Even the failed measurings and the errors are to be noticed in the labour-books;

4.9 the establishment of instrument-diaries,where should be noted the period the instrument was used,the time-point as well,the specification of the sample,the parameters determined and the signature of the user.Such instrument diaries are recommended only for those of high value.It has to be considered,whether in a later time-point would not be useful to design one single person for the handling of the instruments,who was trained for a longer time in this field.By all means,the responsible for each instrument has to be appointed and anybody is going on to use the concerning instrument,he has to contact with the responsible;

4.10 the regulations of fire protection and safety already elaborated have to be attached too.Every new employee must get the training in this field and has to sign the statement,that he got the instructions.

5./ The analysis should be carried out in duplicate in every case.Having a deviation between the two results over the limit permitted,the analysis must be repeated.The normality of the solutions has to be controlled from time to time.Those standard solutions

are not used frequently,should be prepared only when will be used.

6./ The form of the reports and their content has to be regulated.The report has to contain all the information received at the control and the analysis,and are useful either for the producer or/and for the higher organizations,e.g.Ministry of Industries, National Food Control Commission etc.At the same time it must be assured,that all the data received should be stored in a system,which is suitable to make use of them at any time and for various purposes:- for the preparation of standards,for the evaluation of average food quality according to the single foods or/and according to the factories,producing the same commodity.The storage of data could be carried out on punch cards,one sample of which is attached to the present Outlines.These punch cards may be collected in different files either grouping those according to the factories,or to the commodities.

7./ The evaluation of the data using mathematical-statistical apparatus is indispensable,drawing off the consequences,concerning the quality of the different foods and the work of the different factories.The changes of the quality of food should be reported at elast once a year,on the basis of the mathematical-statistical evaluation of the data.But this must not limit the reporting of changes of food quality of shorter periods,supposed a satisfying amount of data.

8./ The food laboratory is the experimental base for standardization.

8.1 It seems to be reasonable to prove every testing method in the laboratory before standardizing it.It is advisable, that the laboratory staff member interested in the concerning standard should participate on the committee's session where the method will be discussed.On the other hand the laboratory should make proposals to the SD for standardization of proved,up-to-date,exact testing methods.

8.2 Just the same idea emerges for the preparation of commodity standards.The data received by the analytical work of the food laboratory should promote the preparation of specifications,not simply accepting the present quality of food products,but making proposals for pushing the producers to improve the quality,either that of raw material,or that of processed food.

Anyway, the cooperation between food laboratory and SD must be very close.

9./ There is a great need to extend the training within TBS. Apart from the training carried out by experts /SIS, UNIDO etc./, a type of self-training would be very useful. The experts of TBS, of any department could give lectures using the newest results of food analysis, taken from reviews, or presenting their own results in laboratory work. Even experts of various Tanzanian organizations might be invited according to a planned training course programme, e.g. from the University of Dar-es-Salaam etc. Anyhow, the systematic training should be established performing lectures and discussions weekly, or in every fortnight.

Dar-es-Salaam, 17 March 1982.

Item	Property and Unit	Extent req.	Extent obs.	Extent obs.	Ref. to lab. report book	Sign of observer	Date	Remarks
1	CORRECT LABLE	+						includes also item 28
2	Description of material	+						
3	Internal-External use	+						
4	Color	+						
5	Name of manufacturer	+						
6	Trade mark	+						
7	Volume(1)	+						
8	Production date	+						
9	Batch number	+						
10	Reference to standard	+						
11	MICROORGANISMS	–						
12	Swolen container	–						
13	Smell for bacteria	–						
14	Fibers of microorganisms	–						
15	Normal consistency	+						
16	SEPARATED PHASES	–						
17	RUST OR DAMAGE OF CAN	–						
18	FOREIGN MATERIALS	–						
19	SURFACE LAYER	–						
20	CHALKING	–						
21	LIGHT INFLUANCE	–						
22	WEATHER RESISTANTE	+						
23	FINNESS OF GRIND(μm),max.	25						
24	HIDING POWER(%)min.	80						
25	WASHABLE	+						
*26	WET HIDING POWER							
*27	CHALKING (TAPE METHOD)							
28	Label in Arabic language							

Notes for test: "+" stands for yes; "–" stands for no ; *Not included at present in JS 31

Accepted:	yes	no	Sign :	Date :

Ministry of Industry & Trade	A B C D E F	Directorate of Standards — ITQCL

Code number ..... *Extension on:* B C D E F

Description of sample : .....

.....

Source of sample : .....

Manufacturar: ..... *Trade mark (Brand) :* .....

Quantity of unit sample : ..... *Reason of test :* .....

Lot size : ..... *Sample size :* .....

Requirements acc. to standard(s) : .....

Test acc. to standard(s) : .....

Information about the sample :

Final report : *(on sample unit)* *(on sample / for the lot /)*

ANNEX 7

LIST OF RECOMMENDED BOOKS AND PERIODICALS

1. Meyer, L.C.: Food Chemistry, Reinhold, New-York.
2. Stewart, G.F. Amerine, M.A.: Introduction to Food Science and Technology, Academic Press, London, New-York.
3. Borgstrom, G.: Principles of Food Science, 1-11., MacMillan, New-York.
4. Karlson, P.: Introduction to Modern Biochemistry, Academic Press, New-York, London.
5. Fox, B.A., Cameron, A.G.: Food Science, A Chemical Approach, Crane Russak Co., New-York.
6. Charm, S.E.: Fundamentals of Food Engineering, AVI, Westport, Connecticut
7. Desrosier, N.W.: Technology of Food Preservation, AVI, Westport, Connecticut
8. Gould, R.F.: Radiation Preservation of Foods, American Chemical Society, Washington, D.C.
9. Minifie, B.W. Ffst, F.: The Science and Technology of Chocolate, Cocoa and Confectionary, Churchil, Livingstone, London.
10. Williams, K.A.: Oils, Fats and Fatty Foods, Churchil, Livingstone, London.
11. Copley, M.J. Van Arsdel, W.B.: Food Dehydration, AVI, Publ. Co., Westport, Connecticut,
12. Hough, J.S., Briggs, D.E., Stevens, R.: Malting and Brewing Science, Chapman and Hall, Associated Book Publishers Ltd.
13. Amos, A.G. et al.: Food Industries Manual, Leonard Hill, London.
14. Reed, G.: Enzymes in Food Processing, Academic Press, New-York, London.
15. Kramlich, W.E. et al.: Processed Meats, AVI Publishing, Westport, Connecticuty.
16. Prescott, S.C., Dunn, C.G.: Industrial Microbiology, McGraw Hill, Book Co. Inc., New-York.
17. Harris, R., Von Loesecke, H.: Nutritional Evaluation of Food Processing, AVI Publ. Co., Westport, Connecticut.
18. Fox, A.: Hygiene and Food Production, Churchil Livingstone, London.
19. Schultz, H.S.: Food Enzymes, AVI Publ. Co., Westport, Connecticut
20. Altschul, A.M.: New Protein Foods, Academic Press, New-York, San Francisco, London

LIST OF RECOMMENDED BOOKS AND PERIODICALS Contd..../...

21. Food Chemicals Codex, Food Protection, National Acas. Print and Publ. Washington.

22. Pederson, C.S.: Microbiology of Food Fermentation, AVI Publ. Co., Westport, Connecticut.

23. Joslyn, Maynard, A.: Methods in Food Analysis, Academic, Press, New York, London.

24. Pomeranz, V., Meloan, C.E.: Food Analysis, Theory and Practice, AVI Publ. Co. Westport, Connecticut.

25. Hart, L.F.: Modern Food Analysis, New-York.

26. Jacons, M.B.: The Chemical Analysis of Foods and Food Products, Von Nostrand, Princeton, New Jersey.

27. Winton, A.L., Winton, K.B.: The Analysis of Foods, Wiley, New York.

28. Pearson, D.: Chemical Analysis of Foods, Churchil Livingstone, London.

29. Stahl, E.: Thin Layer Chromatography, Springer Verlag, Berlin, New York.

30. Macleod, A.J.: Instrumental Methods of Food Analysis, Halsted Press New York,

31. Pearson, D.: Laboratory Techniques in Food Analysis, Halsted Press New York.

32. Microbiological Methods, Butterworth, London.

33. Jay, J.M.: Modern Food Microbiology, New York, Van Nostrand Reinhold Co.

34. Speck, M.L.: Compendium of Methods for the Microbiological Examination of Foods, American Public Health Association, Weshington.

35. Frazier, W.C. Food Microbiology, McGraw Hill, New York.

36. Amarine, M.A., Pangborn, R.M., Roessler, E.B.: Principles of Sensory Evaluation, Academic Press, New-York, London.

37. ASTM, STP-434: Manual on Sensory Testing Methods, American Society for Testing and Materials, Philadelphia.

38. Kramer, A. Twigg, G.A.: Fundamentals of Quality Control for the Food Industry, AVI Publ. Co., Westport, Connecticut.

39. Herschdoerfer, S.M.et al: Quality Control in the Food Industry Vol. I.-III., Academic Press, London, New York.

40. Goodwin, R.W.L.: Chemical Additives in Foods, Churchil Livingstone, London

LIST OF RECOMMENDED BOOKS AND PERIODICALS Contd..../....

41. Ayres, J.C.: The Safety of Foods, AVI Publ. Westport Connecticut.

42. Ayres, J.C. et al: Chemical and Biological Hazards in Food, Hafner Press, McMillan Publ. Co., New York.

43. Ockerman, H.W. Source Book for Food Scientists, AVI Publ. Co. Westport Connecticut

44. Food Technology, Ed. John B. Klis, Institute of Food Technologists, 221 N. LaSalle Str., Chicago

45. Food Manufacture, Ed. Anthony Woollen, Morgan-Grampian Ltd., 30 Calderwood Str. Woolwich, London

46. British Food Journal, Ed. C.R.A. Martin, Peterson Publ. Co. Birmingham, U.K.

47. Association of Official Analytical Chemists, Journal, Ed. H. Reynolds, Washington, USA.

48. Food Science and Technological Abstracts, Ed. E.J. Mann, Farnham Royal. Bucks, U.K.

49. Canning and Packaging, Ed. P.J. Newman, Tim Publ. Ltd. 7 High Road, London, W42NE, U.K.

50. Cereal Chemistry, Publ. Association of Cereal Chemists, St. Paul, Minnesota, USA.

51. Food Processing and Packaging Publ. Tothil Press Ltd., London, UK

52. Food Preservation Quarterly, Commonwealth Scientific and Research Organization, Australia.

53. Journal of Dairy Science, American Dairy Science Association, White Plans, New York.

54. Soft Drinks, Ed. P. Mullins, Keller Publ. Corp., 10 Cutter Mill Road, Great Neck NY 11021

55. Microbiological Abstracts, Section A., Ed. E.S. Krudy, Information Retrieval Ltd., 1 Falconberg Court, London WIV TFG, U.K.