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ESTABLISHMENT OF FOOD TESTING AND QUALITY CONTROL LABORATORY
IN THE YEMEN ARAB REPUBLIC

UC/YEM/79/201/11-01

THE YEMEN ARAB REPUBLIC

Technical report: Evaluation of the food testing and quality
control laboratory equipment and recommendations
for starting up the laboratory activities*

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

Based on the work of György Harsanyi,
Expert in food testing and quality control

Backstopping Officer: B. Galat, Agro-based Industries Branch

7/8

* This document has not been edited.

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1. ABSTRACT

Key words: food testing and quality control laboratory, Sana'a, food certificates, training, standardisation, food inspection, trouble shooting in food processes.

As a part of program UC/YEM/79/201/11-01/31.7.C requested by the Government of Yemen Arab Republic for the purpose to assist in the establishment and operation of the food testing and quality control laboratory, an expert in food testing and quality control was sent for mission to the General Department of Standardisation, Metrology & Quality Assurance in Sana'a where the laboratory exists, between 5th and 28th May 1990.

The expert found most of the laboratory equipment in working conditions, repaired two of the not working ones and proposed to buy spare parts for other four ones. The laboratory has been equipped as part of another project, DF/YEM/87/003, with additional equipment and tools, chemicals and glassware are under delivery. It was found that laboratory food tests had not been taken referring to missing equipment and chemicals, but a lot of food samples had been collected.

The working capability of the laboratory has been demonstrated by different food tests on more foodstuff samples organized by the expert and made by the counterpart laboratory staff. These laboratory determinations served as well as preliminary practical training for the personnel having no food testing experience earlier.

Under these circumstances it is proposed to evaluate the original project as implemented, after the delivery of the most urgent missing items for the small remained sum of the original project. It is proposed to the Director General of the General Department of Standardisation, Metrology & Quality Assurance to contact the Government for arranging a Government request to UNIDO to assist in the development of the existing food testing laboratory to a food standardisation control laboratory for the united Yemen Republic.

3. INTRODUCTION

At the end of seventies the Government of Yemen Arab Republic expressed an interest in having UNIDO's assistance for establishing a laboratory facility for the testing and quality control of food products. The project was selected from the portfolio of projects submitted. The purpose of the project is to assist in the establishment and operation of the food testing and quality control laboratory.

During an exploratory mission in May 1979, a UNIDO consultant made a general assessment of the basic requirements in food testing and quality control and determined the testing methods based on the Official Methods of Analysis of the Association of Official Analytical Chemists /AOAC/. The laboratory equipment, facilities and chemicals required for this purpose were determined, too. Basic food testing equipment and chemicals were delivered during the next two years. As the conditions has been arranged to begin basic food testing activities, the expert of food testing and quality control was sent in May 1990 by UNIDO for a month to assist at the very beginning of the basic food tests.

4. RECOMMENDATIONS

Taking into account that the food testing and quality control laboratory facilities are primarily intended for the tasks mentioned in Chapter 11. about the utilization of the laboratory, the recommendations for the further development of the food testing and quality control activities are as follows:

1. The laboratory should take practical food tests using the existing chemicals and tools at the beginning for training purposes based on AOAC or similar methods.
2. The laboratory will be applicable for a greater number of tests, examples for which are given in Annex No. 1., if the most urgent chemicals and missing equipment will be acquired.

2.1 The most urgent chemicals of Annexes No. 2. and No.7. are proposed to be acquired for the sum remained from the original project.

2.2 One part of the most important equipment of Annex No. 3. are proposed to acquire for the remained sum mentioned in Section 2.1, the other part which is over the remained sum should be acquired for the running project costs or as a part of a new project, like the needs in Annex No. 8.

2.3 The proposals for the development of the Instrumental Laboratory can be found in the report of the instrumental expert. The food and instrumental laboratories have to work in close cooperation, the food samples to be measured by the sophisticated instruments are to be prepared in the food lab in detailed processes, which are longer than the instrumental measurements.

3. Daily practical training is required for the food and microbiology laboratory personnel for arriving to a level where the laboratory staff of some local food factories can be found. The proposed training levels are as follows:

3.1 Tests which can be taken with the existing facilities using AOAC and similar methods.

3.2 Basic organoleptic training with wide range of food-stuffs.

3.3 After acquiring the tools for the remained sum of the original project, a systematic basic training is proposed, methods of which are listed in Annex No. 9. Important part of the training is the verification of the results, that is to avoid of outgiving wrong results.

3.4 Food microbiology training.

3.5 Systematic tests based on local or foreign standards.

3.6 To take and evaluate practical tests parallel with the best quality control laboratories of the local food industry.

All the training participants must be evaluated on the basis of results to be determined which are not known by them, but are well known to the training leader.

4. After finishing the training mentioned in Section 3.3, the laboratory can begin its consulting activity to help local producers and to give certificates of fodstoffs on demand of the local producers.

5. After successful finishing of all the proposed training courses, the laboratory can begin its activity as an authorized standardization control laboratory.

6. After acquiring the necessary tools mentioned under Section 2., the staff of the laboratory can be increased to 6 working persons if the best use of capabilities is required.

7. If the laboratory works with success, it can earn money for its costs from tests as follows:

- 7.1 Periodic tests for certificates of the local manufacturers' products for getting more confidence from buyers.
- 7.2 Advisory consulting tests helping the local manufacturers in trouble shooting of their food production process.
- 7.3 Obligatory periodic authority inspection of the local food manufacturers with quality control data obtained by the laboratory.
- 7.4 Obligatory tests for food labelling and contents of packings.
- 7.5 Obligatory tests for food import and export.
- 7.6 Tests for determining competitive characters of the local food products.

The testing fee is to be paid by the local manufacturer or commercial company.

8. Assistance of food testing and quality control expert can be proposed in launching the activities as follows:

- 8.1 Training courses mentioned in Sections 3.3, 3.4 and 3.5.
- 8.2 To prepare a manual and to advise laboratory procedures of non AOAC methods required for the laboratory. As example for fruit juices, see annex No. 6. for the items where AOAC methods are missing.
- 8.3 To prepare a manual and to advise laboratory procedures for simplified microbiology tests.
- 8.4 Launching of certificate and competitiveness tests proposed in sections 7.1 and 7.6.

- 8.5 Launching the practical advisory tests for trouble shooting in manufacturers' production processes as mentioned in Section 7.2.
- 8.6 Launching the laboratory tests for the practical control of standardisation activity.
- 8.7 Launching the obligatory tests in the foreign trade of foods, their semi-products or raw materials.

9. The food laboratory should take part in the preparation of the standardisation proposals of all standards relating food, as a practical inner control station for the applicability of the standard requirements.

10. It is proposed to the Director General of the General Department of Standardisation, Metrology & Quality Assurance to contact the Government for arranging a Government request to UNIDO

to assist in the development of the existing food testing laboratory into a central food standardisation and quality inspection laboratory for the united Yemen Republic

with basic aims to help the country to develop in the directions of

- reducing food import by developing the local food industry,
- giving healthy food to the population,
- reducing food losses by control,
- development of standardisation and quality assurance activities with services of
 - granting food certificates for the quality local products,
 - trouble shooting in food producing processes by quality control methods,
 - obligatory food inspection to help longer life of the people,
 - standardisation level development by laboratory control methods,
 - food labelling control and competitiveness tests.

By such kind of assistance it would be possible to satisfy the demands for enlarging activities and laboratory development mentioned in Section 2. and of the expert missions of Section 3.

5. FINDINGS OF THE EXPERT

The laboratory building has been built in good quality and basic facilities have been established in the General Department of Standardisation, Metrology & Quality Assurance, its Director General is Abdulkarim A. Al-Saidi. During the expert's mission the General Department mentioned above was reorganized direct to the Council of Ministers as a step taken in time for the unification of Yemen Arab Republic and Yemen Democratic Republic as Yemen Republic which was taken during the mission.

As a consequence of further projects, the original laboratory equipment has been enlarged by the instruments and equipment of the project No. DP/YEM/87/003. An Instrumental Laboratory with sophisticated instruments as UV-VIS recording spectrophotometer, atomic absorption spectrophotometer and gas-chromatograph. These instruments are computer-controlled. A high performance liquid chromatograph is under delivery.

A larger amount of glassware and analytical chemicals will be available after their arrival, which is expected in the near future as they had to be despatched by September 1989. Electricity is available in the laboratory together with water supply, the 3-phase electricity for the second floor, however, and the gas supply have to be arranged yet.

The expert found most of the laboratory equipment in working conditions, repaired two of the not working ones and proposed to buy spare parts for other two ones. It was found that laboratory food tests had not been taken referring to missing equipment and chemicals. By preparing a large list of food testing examples /Annex No. 1./ it was shown that the laboratory was applicable for some basic food tests, in its situation having during the mission. It was shown by the said list which were the most important chemicals and equipment to be urgently acquired because they were needed for different tests. The urgently needed chemicals and equipment were collected on that basis in Annexes of Nos. 2, 3 and 7. Other needs have been collected in Annex No. 8. The items under shipment for the laboratory and others which are listed in the requirements of the Instrumentation Laboratory does not exist in the annexes

mentioned above. It is proposed that the most urgent chemicals and a smaller part of the equipment and tools should be acquired against the small remained sum of the original project.

After getting more detailed training, based on the AOAC methodology book the new edition of which has been arrived, the laboratory will be able to serve the local food producers as a food quality controlling laboratory after arrival of the urgent items mentioned above. For some basic tests it is applicable in its existing form.

The expert thanks for the successful and kind cooperation of the CFA, Mr El-Dosoky, of the Director General, Mr A. Al-Saidi, of the volunteer, Mr Sousil, and of the laboratory staff, as well as to Mr Kutahhar in the UNDP Office and not least, but last to the experts, Mr Halmos and Mr Kulcsár.

6. SETTING UP OF THE LABORATORY

Most of the laboratory equipment are in good and working condition by the activities of the volunteer and the laboratory staff. The expert and the volunteer have set up the laboratory furnace and the vacuum pump with the vacuum oven, as well as the connection for vacuum filtration. The laboratory instruments and equipment in working conditions are as follows: electronic, analytical and micro balances, blender, centrifuge, vacuum drying oven, vacuum pump, muffle furnace, pH meter, polarimeter, refractometer, magnetic stirrer, small autoclaves, quick drying balance, hot plates, sieving machine, melting point meter, distiller rotator, forced air drying oven /3-phase is missing/, membrane filter, binocular microscopes, radioactivity rate meter, other instruments: cooling incubator /cooling gas to be filled/, refrigerator /transformer is needed/, universal chopper /motor burned/, colorimeter /photocells are weak/, butyrometer /measuring cells are missing/.

Taking into account that the basic equipment and chemicals arrived ten years ago, a few tests were taken /see Chapter 9./ to control their applicability. The tests have given good results. To control the missing tools for food analysis, the expert has prepared a control list based on basic food test examples to control which are the necessary equipment and chemicals for the most important tests /see Annex No. 1/. The items underlined in this list were missing during the time of mission, they are to be acquired urgently that the laboratory should work, other items in this list are available in the lab.

The most urgent chemicals needed for the food tests of Annex No. 1. to be acquired are mentioned in Annex No. 2. The chemicals to be arrived from BDH Ltd UK as part of the project DP/III/87/co3 has been taken into account and they are omitted from Annex No. 2.

The equipment which are urgently needed for the tests of Annex No. 1. are listed in Annex No. 3. Most of the chemicals and equipment mentioned in these annexes are necessary in many different food tests, so their absence does not allow the required functional activity of the laboratory. Their urgency can be characterized by that, the laboratory is equipped with expensive, highly sophisticated, computer controlled instruments and practical tests are not taken because of missing relatively cheap chemicals and equipment.

Other equipment and additional chemicals will be needed for getting a level of the standardisation control and obligatory food inspection activities, which are listed in Annex No. 3. Some special equipment will be needed for the testing of packaging materials.

7. ORGANIZATION OF THE FOOD TESTING AND QUALITY CONTROL LAB

The laboratory has been organized in four units as follows:

1. Food Testing Laboratory, taking all the chemical and physical tests, as well as all the preparatory work on food samples for the Instrumental Laboratory, because the food samples are not applicable as direct samples for putting them into the highly sophisticated instruments, which demand well prepared, clear sample solutions as their sample input for analysis.
2. Microbiology Laboratory, taking the basic sanitary tests on food samples and taking part in sanitary inspection of the food processors and traders.
3. Organoleptic Laboratory taking all the tests connected with human sensory evaluation of foods /appearance, odour, taste,.../, its activities have to be organized by special training.
4. Instrumental Laboratory which will be capable after preparatory steps in the Food Testing Laboratory for testing of preservatives, dyes, metal contaminations, pesticide residues among other ones.

For fire-protection safety reasons, one of the small rooms is proposed to arrange for activities with flammable liquids, e.g. ether. The flammable liquids are to be stored in a closed metal cabinet. Also for safety reasons the poisons are to be stored in a closed cabinet under the supervision of an authorized laboratory personnel educated about poison regulations.

9. PROCEDURES FOR FOOD TESTING

Important procedures of basic food tests are listed in the Annex No. 1. by reference numbers referring to the Official Methods of Analysis of the AOAC, twelfth edition, as accepted test procedures all over the world. The new edition of this book arrived to the laboratory at the end of the mission. This book contains several thousand and well reproducible tests for foods, drugs and cosmetics. In their character, these tests are similar to each other. Some other proposed test methods are given in Annex No. 4.

To take microbiological examinations based on this book, it is not easy at all, because the tests are very sophisticated as the demands at the highest level of USA. In a developing country for the starting years simplified methods are proposed at which some local materials can be used for broth purposes. The difference in the components needed by the two test levels can be well seen in Annex No. 1. where the 46.039 microbiology test is based on an AOAC method, other tests signed Mbiol and having much smaller number in components are proposed for the beginning years of the microbiology laboratory. Some single microbiological test methods are proposed in Annex No. 5.

For the laboratory background of the standardization activity and of the competitiveness tests of local products, there are a lot of more tests to be taken in the laboratory than they are found in the AOAC methodology book. The AOAC book contains first of all the basic chemical analysis methods. There are, however, other important product characteristics which help the competitiveness of products, such as product stability, separation of the components, appearance, turbidity, accelerated lifetime tests, off-flavours, bitterness, foreign matter present, ... In Annex No. 6. a comparison is shown between these two kinds of methods. To prepare a manual and to advise laboratory procedures can be the task of another mission.

9. PRACTICAL TESTS CARRIED OUT

There are missing important chemicals and equipment, however, the expert has demonstrated that the laboratory conditions was applicable for some basic food tests. During the mission the following tests were taken by the staff of the laboratory organized and supervised by the expert:

- Milk: total solids, specific gravity, acidity
- Milk powder: moisture, ash, radioactivity
- Condensed milk: total solids
- Cheese: moisture
- Rice: ash
- Cooking oil: index of refraction

Mineral water, drinking water, cooking water : alkalinity
Microbiology sanitary control: preparation of broth from
local materials, milk plate
count.

In the case of milk powder it has been shown that the main
part of its radioactivity is caused by the normal beta
ray radiation of its potassium content.

Based on the existing equipment and chemicals, a list of
tests was prepared by the expert and the volunteer to show,
which kind of tests could be taken on the request of a local
manufacturer regarding his fruit juice. The tests, for which
the laboratory can be applied in the time of the expert's
mission are shown in Annex No. 6. The tests were not taken
because the short time of the mission.

10. TRAINING OF THE COUNTERPART PERSONNEL

The personnel of the laboratory has been trained in instrument
usage, but had no experience in food testing and quality
control before the time of the mission. Their knowledge in
English helps them in studying the food testing literature
available in their library. The operating instructions found on
the walls were very helpful during the training.

The counterpart personnel taking part in the training, have
been Mr Jamal Rahman /at the beginning/, Mr Abdulhaqim Reza,
Mr Ahmed Abu Thalab and Miss Soad Mohammed Quaid.

They have been trained for the first steps of modern methods
in food testing, laboratory analysis and quality control as
follows:

- weighing on electronic, analytical and micro balances,
- vacuum technics for oven drying and quick filtering,
- specific gravity determination,
- moisture- and dry matter content determination,
- furnace technique up to 600 °C,
- refractive index measurement,
- microbiology broth preparation from local materials.

These methods have been applied by the counterpart staff of the laboratory for the food tests mentioned in Chapter 9. As a result of this preliminary training, the counterparts were able to prepare with some help their working steps for the simplest tests from the prescriptions of the AOAC methods Book, to collect the equipment and chemicals needed for the test and to perform the tests based on active consultations with the expert. Previously the expert controlled the availability of the equipment and chemicals and proposed such kind of tests for which the tools were available in the laboratory.

This short introductory training is not detailed enough for the successful future activity of the laboratory. A detailed systematic training /see Chapter 4. Section 3./ to get at such a level as some laboratories of the private companies work in the country. The practical knowledge of food quality inspectors can be not below the level of the controlled factories.

The laboratory practices collected during the training courses can give important help to the standardization work, too. And from the other side, the standards have their strength only if their application will be controlled by the laboratory staff, taking the necessary measurements.

A detailed training is also needed for organoleptic tests, because of the tasty characters which are very important for the consumers.

For training purposes are to be acquired the chemicals listed in Annex No. 7. These chemicals are proposed to order in separate bottles, for the larger amount of chemicals to be used for test purposes after the training period, should not be contaminated during the training exercises.

After successful finishing the training courses, at least a full year laboratory practice of the staff will be needed before they can take obligatory control over the producers.

A real measure of the well trained controller personnel is that they should be over the level of the personnel in the private factory laboratories.

11. UTILIZATION OF THE RESULTS

The food testing and quality control laboratory in its present form is applicable for continuous preliminary training of the personnel for

- some nutrient content tests,
- basic chemical determinations,
- organoleptic evaluation,
- basic sanitary control,
- control of the effects of packaging.

The full applicability for training purposes will be fulfilled if the chemicals and glassware ordered earlier, together with the equipment listed in Annex No. 3. and the chemicals listed in Annexes Nos. 2. and 7. will arrive. After this period the laboratory can act as a consulting laboratory

- 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 or because of shortage of qualified personnel and facilities. The services of the laboratory can include:
 - testing of
 - raw and ancillary materials,
 - finished and semifinished productsin respect of their
 - chemical composition,
 - physical and
 - nutritional properties,
 - microbiological conditions.
 - helping of the local manufacturers to organize their industrial quality control,
 - helping to develop preservation methods as means of extending food freshness,
 - helping the manufacturers in trouble shooting in their production processes or product spoilage for preparing flow sheets of food spoilage or microbiological contamination,

- helping to maintain over a long period of time the identity and acceptability of their products.

After one year successful practice, the laboratory can be used for:

- controlling food processors to meet their legal obligations,
- to serve the population of the country
 - by regular food control service,
 - by developing standards of food quality and healthiness and as means of classifying foods to various groups of conditions and characteristics that experience and research have shown to be wanted by consumers,
 - by upgrading food quality through food standards and controlling their application,
 - by providing expertise to develop food standards, regulate food additives and establish tolerances,
 - by controlling food acts regulations, and
 - by helping to avoid serious causes of food spoilage or microbiological contamination.

Main objectives of the proposed new project in Chapter 4., Section 10 are the utilization of the existing facilities of the food testing and quality control laboratory with sufficient efficiency after acquiring some additional facilities and know-how by expert services.

EXAMPLES FOR SOME BASIC FOOD TESTS,
FOR THEIR PROCEDURES and
FOR THE EQUIPMENT and CHEMICALS
available in the Laboratory or
are to be acquired.

- Remarks: 1. The reference numbers of the tests are the paragraph numbers in the Official Methods of Analysis of the Association of Official Analytical Chemists, Twelfth Edition, 1975, AOAC, Washington, USA.
2. The items underlined are to be acquired, the other items are available in the Laboratory.

MILK

- 16.019 Sample Collection
250 ml air tight bottles, refrigerator, heat isolating boxes.
- 16.020 Sample Preparation
Cooled water bath with refrigerator,
- 16.021 Specific Gravity
Pycnometer, or hydrometers, analytical balance, cooled water bath with refrigerator.
- 16.023 Acidity
Measuring cylinder, erlenmeyer flask, bunsen burner or hot plate, magnetic stirrer, oven, 0.15 mm sieve, anal. balance, pH meter, CO₂-protection tube, phenolphthalein /later phthln/, NaOH, KHphthalate.
- 16.032 Total Solids
Anal. balance, flat bottom dish, steam bath or hot plate, oven, drying tower, desiccator.
- 16.055 Fat, caution, see 51.011, 51.039, 51.054, 51.073.
Anal. balance, steam bath, fume hood, oven, fat extraction tube, NH₄OH, alcohol, ether, pet.ether.
- 16.084 Added Water
Refractometer, measuring cylinder, 200 ml beaker, watch glass, water bath, funnel, filter paper, cooled water bath with refrigerator, pipet, furnace, crucibles, acetic acid.

- 16.036 Protein, caution, see: 51.030, 51.065
Anal. balance, Hjeldahl digestion flasks, distiller,
meas. cylinder, fume hood, Hg, K_2SO_4 , H_2SO_4 , $Na_2S_2O_3$,
NaOH, methyl red indicator, bunsen burner or hot
plate, boiling chips, Zinc granules, S powder, 30%
 H_2O_2 .
- 16.052 Lactose
Polarimeter, volumetric flasks, funnel, filter paper,
 HNO_3 , H_g, phosphotungstenic acid.
- 26.084 Aflatoxin in milk, see at 26.084.
- 46.008 Sanitary control of milk, see at 46.008.

MILK, ICE CREAM, CHOCOLATE DRINK, MILK POWDER

- 16.037 Protein
Colorimeter or spectrophotometer, 3-5 ml syringe, anal.
balance, 50 ml pipet, water bath, thermometer, Acid
Orange 12 or equivalent, NH_2PO_4 , H_3PO_4 , acetic acid
/later HOAc/, propionic acid, oxalic acid.

CREAM

- 16.127 Sample Preparation
Shaking machine, water bath.
- 16.133 Total Solids, see 16.032.
- 16.138 Fat, see 16.055.

MILK POWDER

- 16-174 Moisture
Round flat bottom dishes with cover, vacuum oven,
anal. balance.
- 16.176 Protein, see 16.036.
- 16.182 Fat
Steam bath, and see at 16.055.

BUTTER

- 16.186 Sampling, Sample Preparation
Sample containers, water bath, shaking machine.
- 16.187 Moisture
Anal. balance, oven, flat bottom dishes with cover.

- 16.189 Fat
Extraction funnel, steam bath, anal. balance, erlenmeyer flask, ether, fire extinguisher.
- 16.195 Acid Value of Fat
Buret, anal. balance, oven, funnel, filter paper, erlenmeyer flask, alcohol, ether, phthln, KOH.
- 16.196 Refractive Index of Fat
Refractometer, water bath, oven, hot funnel, filter paper, precision water bath circulator,

BUTTER, ICE - CREAM

- 16.192 Vegetable Fats in Butterfat
- 28.073 Melting point apparatus, glass microfilter, beakers, watch glasses, hot plate, meas. cylinders, oven, buchner funnel, micro buchner funnel, refrigerator, separator funnel, microscope, KOH, alcohol, digitonin, ether, acetic anhydride.

CONDENSED MILK, Total Solids

- 16.165 Vacuum oven, anal. balance, pipet, flat bottom dish with cover, hot plate, thermometer.

CHEESE

- 16.216 Sample Preparation
Food chopper, blender, refrigerator.
- 16.217 Moisture
Flat bottom dish, hot plate, thermometer, vacuum oven, air drying column, desiccator, anal. balance.
- 16.224 Total Chlorides
Buret, erlenmeyer flask, pipet, hot plate, volumetric flask, AgNO₃, KMnO₄, KSCN, Fe alum, HNO₃.
- 16.230 Fat
Fat extraction flask, steam bath, beaker, watch glass, NH₄OH, HCl, alcohol, ether, petr. ether.

ICE CREAM and FROZEN DESSERTS

16.252 Total Solids

Flat bottom dish with cover, anal. balance, hot plate, thermometer, vacuum oven, desiccator.

16.255 Fat

Fat extraction flask, pipet, anal. balance, water bath, NH_4OH , and see 16.055.

WHEAT FLOUR

14.003 Moisture

Flat bottom dish with cover, vacuum oven, desiccator, anal. balance.

14.005 Extract Soluble in Cold Water

Anal. balance, erlenmeyer flask, refrigerator, shaking machine, funnel, filter paper, pipet, hot plate, thermometer, vacuum oven.

14.006 Ash

Furnace, crucibles, anal. balance, desiccator, CaO .

14.020 Crude Fiber

Digestion flask with condenser, anal. balance, oven, furnace, beaker, meas. cylinder, H_2SO_4 .

14.022 pH

pH meter, shaker, water bath, erlenmeyer flask.

14.019 Fat

See 14.101

44.162 Uric Acid in Flour

See 44.162

WHEAT, RICE, RYE, CORN, OATS, BARLEY and their PRODUCTS

14.058 Moisture, see 14.003

14.059 Ash, see 14.006

14.060 Crude Fiber, see 14.020

26.038 Aflatoxins in Corn, see 26.038

44.149 Animal Urine in Grain, see 44.149.

SOYBEANS

26.065 Aflatoxins in Soybean, see 26.065.

CGRE

Starch

Polarimeter, wash bottles, grinder, beakers, anal. balance, spatula, test tube, test tube brush, 10 ml graduated cylinder, aspirator connection, filter flask, funnel, vacuum pump with tubing, hot plate, kohlrausch flask /100 ml/, erlenmeyer flask.

BREAD

14.083 Total Solids, see 14.003

14.101 Fat

Fat extraction apparatus, beaker, 2, 10 ml pipets, water bath, meas. cylinder, distiller, centrifuge, filter paper, steam bath, funnel, oven, anal. balance, alcohol, ether, pet. ether.

14.103 Crude Fiber, see 14.020.

14.104 Sucrose /Sugar/

Polarimeter, vol. flasks, meas. cylinder, water bath, funnel, centrifuge, pipets, steam bath, funnel, filter paper, pH meter, beaker, atomic absorption spectrophotometer, hot plate, watch glasses, gooch filter, erlenmeyer flask, buret, alcohol, Pb/OAc/2, Na₂CO₃, HCl, CuSO₄, alk. tartrate, HNO₃, Br, NaOAc, KJ, Na₂S₂O₃, KSCN.

14.108 pH, see 14.022.

14.100 Protein, see 16.036.

Sporicidal test for bacteria of deterioration of loafs, see Microbiology 1.

BAKED PRODUCTS

14.113 Solids, see 14.003.

14.114 Ash, see 14.006.

14.115 Protein, see 14.036.

14.118 Crude Fiber, see 14.020.

14.119 Sugars, see 14.104.

14.116 Fat, see 14.101.

14.120 pH, see 14.022.

MACARONI

- 14.125 Total Solids & Moisture
Food grinder, sieve and as in 14.003.
- 14.127 Ash, see 14.006.
- 14.129 Chlorides
Buret, funnel, filter paper, hot plate, gooch filter, oven, desiccator, anal. balance, HNO_3 , AgNO_3 , and as at 14.006.
- 14.136 pH, see 14.022.
- 14.134 Protein, see 16.036.

BREAKFAST CEREALS

- 20.009 Antioxidants
Gas chromatograph, food grinder, sieve, prep. chromato. column, Florisil or equivalent, petr. ether, fine glass wool, anal balance, tamping rod, CS_2 , butylated hydroxyanisole, butylated hydroxytoluene, di-butylated hydroxyanisole, nitrogen,
- 44.059 Light Filth
Wildman trap flask, Kilborn separator, el. balance, 1.5 L beaker, hot plate, thermometer, sieve, HCl, isopropanol, hot plate magnetic stirrer, mineral oil, rubber policeman.
- Mbiol8 Sanitary control, see Microbiology 8.
- Mbiol9 Molds & Yeasts, see Microbiology 9.
- Mbiol10 Coliforms, see Microbiology 10.

COFFEE

- 15.011 Loss on Drying
Vacuum oven, desiccator, anal. balance, gas washing bottle, drying dish with lid.
- 15.012 Soluble Solids
Coffee grinder, 0.6 mm sieve, erlenmayer flask, glass stirring rod, meas. cylinder, hot plate, oven, funnel, filter paper,

15.031 Total Acidity
Grinder, 0.6 mm sieve, erlenmeyer flasks, funnel,
filter paper, pipet, buret, NaOH, phthln.

15.025 Caffein, see 15.049.

TEA

15.035 Moisture
Vacuum oven, analytical balance, covered Al dish,
desiccator.

15.036 Water extract
Oven, vol. flask, meas. cylinder, condensor tube,
evaporation vessel, hot plate, thermometer, anal.
balance.

15.049 Caffein
Spectrophotometer, gas chromatograph, blender, sieves,
anal. balance, beaker, hot plate, thermometer, vol.
flask, NH_4OH , caffein, CHCl_3 , pentobarbital.

NONALCOHOLIC BEVERAGES & CONCENTRATES

12.002 Specific gravity
Pycnometer, water bath, pycnometer funnel, anal.
balance.

12.004 Total Solids
0.425 and 0.25 mm sieves, forced draft drying oven,
furnace, drying dish with cover, desiccator, anal.
balance, hot plate, vacuum oven.

12.005 Sucrose /sugar/
Polarimeter, vol. flasks, funnel, filter paper, watch
glass, 50 ml pipet, water bath, refrigerator, Pb/OAc/_2 ,
 Na_2CO_3 , /anhyd./, NaCl, HCl. See 36.026 a and c.

12.016 Total Acidity
Buret, pipet, beaker, NaOH, phthln.

10.038 CO_2 Pressure in the Bottle
Piercing apparatus.

12.023 Esters
Steam distiller, reflux, buret, NaOH, phthln, H_2SO_4 .

9.002 Color

Colorimeter, $K_2Cr_2O_7$.

Carbohydrates

Spectrophotometer, water bath, pipet, distiller, phenol, H_2SO_4 .

Caffein in Cola

Solvent heavier extractor, Allihn condenser, stand, versatile clamp, hot plate, 250 ml rb flask 24/40 gs, rubber tubing, beakers, fritted glass filter funnel, vacuum test tube, filtering flask, wash bottles, pipets, meas. cylinders, policeman, berzelius beaker, el. balance, vol. flasks, pipet bulb, spectrophotometer.

12.003 Alcohol

Gas chromatograph, as at 19.125.

Mbiol6 Sanitary Control, see Microbiology 6.

Mbiol7 Molds & Yeasts, see Microbiology 7.

EGGS & EGG PRODUCTS

46.012 Microbiological Contamination, see 46.012.

46.008 Living Microorganisms, see 46.008.

46.009 Coliforms, see 46.009.

46.011 Contamination by Fungi see 46.011.

FISH & OTHER MARINE PRODUCTS

18.019 Total Solids

Oven, gooch funnel, asbestos, anal. balance, desiccator, flat bottom dish with cover.

18.022 Total Nitrogen /Protein/ see 16.036.

18.031 Salt

Buret, hot plate, meas. cylinder, $AgNO_3$, HNO_3 , NH_4 thiocyanate, $FeNH_4/3O_4/2$.

25.080 Lead

Atomic absorption spectrophotometer, crucibles, el. balance, oven, furnace, desiccator, hot plate, vol. flask, HNO_3 , HCl, magnetic stirrer, Buchner funnel, $Pb/HO_3/2$, gs reagent glasses, EDTA, NH_4OH , $HClO_4$, La_2O_3 , lit orange, 25 vol flask, pipets.

18.046 Volatile Fatty Acids

Gas chromatograph, steam distillation apparatus, pipets, vol. flasks, blender, meat chopper, sieve, erlenmeyer flasks, funnel, filter paper, phosphotungstic acid, H_2SO_4 , congo red paper, NaOH, phthaln, rotary evaporator, vacuum bottle, vacuum pump, air blower, steam bath, spatula, screw cap vial, acetone, dichloroacetic acid, methyl heptyl ketone, formic acid, HOAc, propionic acid, butyric acid.

18.083 Identification of Fish Species

Polyacrylamide gel electrophoresis equipment, acrylamide, N,N'-methylenebisacrylamide, 2-amino-2-hydroxymethyl-1,3-propanediol, N,N,N',N'-tetramethylethylenediamine, NH₄persulfate, riboflavin, glycine, aniline black, HCl, pH meter, refrigerator, HOAc, bromophenol blue, 20 ml syringe, dropper, blender, centrifuge, funnel, filter paper, brown reagent bottles.

Adulteration in Processed Fish

As at 18.083, and sucrose, coomassie blue, sulfosalicylic acid.

44.098c Mold in Tomato Sauce Packing Medium on Fish, see 44.098c.

DRIED FRUITS

22.013 Moisture

Food chopper, vacuum oven, metal dish with cover, anal. balance, desiccator.

mbiol6 Sanitary Control, see, Microbiology 6.

mbiol7 Molds & Yeasts, see Microbiology 7.

FRESH & CANNED FRUITS, JAMS, MARMALADES, & PRESERVES

22.018 Total Solids

Vacuum oven, anal. balance, desiccator, flat bottom dish with cover.

22.020 Water Insoluble Solids

Flat bottom Al dish with cover, funnel, filter paper, hot plate, oven, anal. balance, beakers.

- 22.024 Soluble Solids
Refractometer
- 26.016 Aflatoxins in Peanuts, see 20.016.

FRUIT JUICES, JELLIES & SIRUPS

- 22.019 Total Solids
Vacuum oven, gas drying column, drying agent, desiccator, drying dish, water bath, 2L beaker, 0.425 and 0.25 mm sieves, hot plate, furnace, quartz sand.
- 22.061 Titratable Acidity
Buret, pH meter, beakers, magnetic stirrer, NaOH.
- 22.096 Sucrose /Sugar/
Polarimeter, see 12.005.
- 22.095 Carbohydrates in Juices
Gas chromatograph, pipets, centrifuge, porcelain dish, steam bath, Pb/OAc/2, alcohol, Pyridine, glass wool, funnel, refrigerator, vials with teflon lined caps, silicagel, incubator, trimethylchlorosilane, hexamethyldisilazane.
- 22.101 Essential Oils
Oil separator trap, glass beads, 2L rb flask, gs, condenser,

Vitamin C in Fruit Juice
Buret, pH meter, erlenmeyer flasks, glacial HPO₃ pellets, shaker, mortar with pestle, HOAc, vol. flasks, funnel, filter paper, refrigerator, ascorbic acid, 2,6-dichloro-indophenol, sodium salt, desiccator, soda lime, NaHCO₃, amber glass reagent bottle.
- Mbiol6. Sanitary Control, see Microbiology 6.
- Mbiol7 Molds & Yeasts, see Microbiology 7.

MEATS, CANNED MEATS & SAUSAGES

- 24.002 Moisture
Vacuum oven, meat grinder, drying dishes, desiccator, anal. balance,

- 24.004 Added Water in Sausage, see at 24.024.
- 24.024 Nitrogen /Protein/, see at 16.036.
- 24.007 Salt
Buret, erlenmeyer flask, hot plate, el. balance,
AgNO₃, HNO₃, KMnO₄, ether, and as at 18.031.
- 24.038 Nitrits
Colorimeter, hot plate, funnel, filter paper, vacuum
oven, vol. flasks, blender, beakers, glass rod,
water bath, sulfanilic acid, HOAc, alpha-naphtylamine,
AgNO₃, NaCl, NaNO₂, HgCl₂.
- 24.044 Added Flour in Sausage or Chopped Meat
El. balance, hot plate, vol. flask, iod, KJ.
- 24.045 Soybean Flour in Sausage or Chopped Meat
El. balance, beaker, hot plate, meas. cylinder, centrifuge,
microscope, alcohol, KOH, HCl.
- Mbiol2 Sanitary Control, see Microbiology 2.
- Mbiol3 Sanitary Control of Chopped Meat, see Microbiology 3.
- Mbiol4 Living Microorganisms, see Microbiology 4.
- Mbiol5 Coliforms, see Microbiology 5.
- 44.098b Mold in Tomato Sauce in Canned Meat, see Microbiology
44.098b.

NATURAL POISONS

- 26.038 Aflatoxins in Corn
TLC equipment, grinder, 1.4 and 0.5 mm sieves, el.
balance, 500 ml gs erlenmeyer flask, shaker, filter
paper, funnel, UV spectrophotometer, CHCl₃, afla-
toxin B₁, B₂, G₁, G₂ standards, benzene, CH₃CN,
K₂Cr₂O₇, H₂SO₄, silica gel, acetone, anhyd. ether,
alcohol, anal. microbalance, oven, 10, 200 ul
syringes, Al foil, UV lamp, UV absorbing eye glass,
refrigerator.
- 26.016 Aflatoxins in Peanuts, see 26.038.
- 26.065 Aflatoxins in Soybeans, see 26.038.

26.084 Aflatorin in Milk
TLC equipment, blender, coarse fritted glass buchner funnel, vacuum flask, 1 L separator, 1 L rb flask, centrifuge, hot plate, vials, 10 ul syringes, MeOH, NaCl, hexane, CHCl₃, Na₂SO₄, isopropanol, acetone, aflatoxin M₁ standard and as at 26.038.

OILS & FATS

28.002 Moisture & Volatile Matter
Al moisture dish, vacuum oven, anal. balance, desiccator.

28.003 Specific Gravity
Pycnometer, hot plate, water bath, anal. balance, H₂SO₄, Na₂Cr₂O₇, alcohol, ether.

28.006 Index of Refraction
Refractometer, water bath.

28.009 Melting Point
Melting point meter.

28.018 Degree of Saturation
Buret, 2L beaker, hot plate, cl. balance, anal. balance, oven, 500 ml gs flask, pipets, iod, HOAc, K₂Cr₂O₇, H₂SO₄, bromine, Na₂S₂O₃, KJ, starch, CHCl₃.

28.022 Rancidity
Buret, 500 ml gs flask, 2 L beaker, hot plate, anal. balance, oven, mohr pipet, meas. cylinder, funnel, filter paper, HOAc, CHCl₃, Na₂S₂O₃, Na₂Cr₂O₇, H₂SO₄, K₂Cr₂O₇, starch.

28.025 Saponification Number
Buret, reflux distiller, thermometer, Al foil, gs bottles, refrigerator, mortar with pestles, funnel, filter paper, erlenmeyer flasks, pH meter, anal. balance, pipets, air condenser, alcohol, KOH, CaO, HCl, phthln, NaOH, KHC₈H₄O₄.

28.029 Free Fatty Acids in Crude & Refined Oils
Buret, erlenmeyer flasks, anal. balance, meas. cylinder, water bath, alcohol, phthln, NaOH.

28.065 Methyl Esters of Fatty Acids
Gas chromatograph, reference mixtures.

- 28.074 Vegetable Fats in Butterfat
Microscope, beakers, hot plate, 125 ml separator,
meas. cylinder, alcohol, KOH, ether.
- 28.086 Animal Fats in Vegetable Fats & Oils
TLC equipment kit, long wave UV light, anal. balance,
erlenmeyer flasks, meas. cylinder, hot plate, reflux
air condenser, 250 ml separators, beakers, vials,
steam bath, oven, 10 ml vol. flask, spatula, funnel,
filter paper, alcohol, KOH, ether, nct.ether, beta-
sitosterol std., HOAc, anhydr.ether.
- 28.105 Identification of Sesame Oil
Furfural, alcohol, HCl, meas.cylinder, test tube.
- 28.108 Mineral Oils in Fats
Reflux boiler, 1 ml pipet, meas.cylinder, erlenmeyer flask,
alcohol, KOH.
- 28.121 Synthetic Colors
500 ml separators, meas.cylinder, 2 L gs bottles, 2 L
beaker, filter paper, net.ether, HOAc, HCl, H₂SO₄,
alcohol.

SPICES & OTHER CONDIMENTS

- 30.005 Moisture
Moisture distillation apparatus, liebigs condenser,
250 ml rb gs flask, anal.balance, Na₂Cr₂O₇, H₂SO₄,
KOH, toluene, hot plate.
- 30.006 Ash
Furnace, spice grinder, 1 mm sieve, spoon, flat bottom
dish, desiccator, anal.balance, anhyd.Mg/ClO₄/2.
- 30.013 Alcohol Extract
Anal.balance, vol. flask, filter paper, pipet, hot
plate, thermometer, alcohol.
- 30.020 Volatile Oils
Lighter than water oil trap, heavier than water oil
trap, spice grinder, 0.35 mm sieve, 1 L rb gs flask,
heating magnetic stirrer, pipets, antifoam agent,
H₂SO₄, Na₂Cr₂O₇, acu.detergent, xylene, anhyd Na₂SO₄,
gs tube, refrigerator.

- 30.022 Specific Gravity of Volatile Oil
1 ml mod. Sarangel tube and as in 30.020 & 28.006.
Refractive Index of Volatile Oil
- 30.023 Refractometer and as in 30.020 & 28.006.
- 30.028 Microscopic Evaluation
Microscope, spice grinder, mortar with pestle, sieve set, slide glasses, cover glasses, iod, KJ, KOH, chloral hydrate, HCl, glycerol, $KClO_3$, HNO_3 , $ZnCl_2$, sudan IV, ether, pet.ether, alcohol, Hg, $FeCl_3$, HOAc,
- 44.115 Gross Contamination, see 44.115.

FOOD DRESSINGS

- 30.045 Total Solids
Plastic jar, vacuum oven, spatula, anal.balance, covered flat dish, desiccator, hot plate,
- 30.046 Reducing Sugars Before Inversion
Anal.balance, electronic balance, centrifuge, suction flask, water pump, ether remover, vol.flasks, porcelain gooch funnel, desiccator, oven, beakers, pipets, 100 ml gs flask, hot plate, watch glass, vacuum pump, gas dryer, pet.ether, HPO_3 , filter paper, NaOH, phthln, $CuSO_4$, KNatartate, asbestos, HCl, HNO_3 , alcohol, ether, sucrose.
- 30.047 Reducing Sugars After Inversion
As in 30.046
- 30.048 Sucrose /Sugar/, as at 30.047.
- 30.049 Total Acidity
Buret, elnic.balance, erlenmeyer flasks, NaOH, phthln.
- 30.052 Total Fat
Moionnier extractor, anal.balance, pipet, water bath, meas.cylinder, centrifuge, erlenmeyer flasks, oven, HCl, ether, pet.ether, fire extinguisher.
- 30.053 Identification of Oil /Vegetable, Animal, Butter/
As in 30.046 and 28.074 or 28.006.
- 44.141 Filth, see 44.141.

SUGARS & SUGAR PRODUCTS /Glasseccuits, molasses, sirups, etc./

31.005 Moisture

Vacuum oven, anal.balance, flat dish with cover, drying tower, desiccator, P_2O_5 .

31.011 Solids in Liquid Samples

Refractometer, sucrose.

31.020 Sucrose

Polarimeter, water bath, filter funnel, magnetic stirrer, 100 ml ww gs bottles, sucrose, dry 3PB/OAc/2, 2PbO, filter paper, alum, NH_4OH , BaCl₂.

HONEY

31.023 Sucrose

NH_4OH , Na_2CO_3 , and as at 31.020.

31.112 Moisture

Refractometer.

31.119 Reducing Sugars

CuSO₄, KNatartrate, alum, NH_4OH , BaCl₂, filter paper, $NaOH$, sucrose, HCl , $NaOH$, methylene blue, vol.flasks, erlenmeyer flasks, pipets, boiling chips, hot plate, buret.

31.121 Fructose

As at 31.023.

31.122 Glucose

As at 31.119 and 31.121.

31.144 Diastatic activity

Colorimeter, diastatic activity reactor, hot plate, vol. flasks, pH meter, iod, KJ , NaOAc, $HOAc$, $NaCl$, starch, erlenmeyer flasks, pipets, beakers, water bath.

CONFECTIONARY

31.091 Moisture, see 31.005.

31.092 Sucrose

Polarimeter, anal.balance, vol.flasks, 100 ml ww gs bottles, funnel, watch glass, water bath, alum, NH_4OH , litmus paper, BaCl₂, filter paper, Le red, invertase.

31.104 Ether Extract

Soxhlet fat extractor, anal. balance, funnel, filter paper, NH_4OH , alcohol, ether, pet. ether.

VEGETABLES

3.102 Chlorophyll

Colorimeter, mortar and pestle, wash bottles, blender, mill, CaCO_3 , quartz sand, acetone, funnel, filter paper, suction flask, vacuum reductor, vacuum pump, vol. flask, spectrophotometer, ether, Na_2SO_4 ,

CANNED VEGETABLE PRODUCTS

32.002 Drained Weight /Net Weight/

Electronic balance, 2.36 mm sieve.

32.004 Total Solids

Vacuum oven, flat bottom dish with cover, H_2SO_4 , air dryer, air drying column, boiling water bath, sand, forced draft drying oven, anal. balance, desiccator.

32.011 Specific Gravity of Comminuted Tomato Products

Pycnometer, pycnometer funnel, capillary tube, vol. flask, water bath, anal. balance, centrifuge, acetone.

32.030 Oxalic Acid

Atomic absorption spectrophotometer, electronic balance, blender, pipets, beakers, HCl, caprylic alcohol, hot plate, vol. flasks, funnel, filter paper, erlenmeyer flasks, Na_2WO_4 , H_3PO_4 , centrifuge, pH meter, HOAc, Ca oxalate, refrigerator, H_2SO_4 , La_2O_3 , HCl,

44.092 Molds, see 44.092.

44.094 Rot, see 44.094.

44.098a Mold in Tomato Soup, see 44.098a.

44.098b Mold in Tomato Sauce, see 44.098b.

44.099 Molds in Pureed Infant Food, see 44.099.

44.100 Light Filth in Pureed Infant Food, see 44.100.

44.103 Weevils in Peas and Beans, see 44.103.

44.108 Insects in Canned Greens, see 44.108.

DRIED VEGETABLES

- 32.040 Water
Karl Fisher titrimeter with reagents, anal. balance,
50 ml gs erlenmeyer flasks, pipet, water bath, beaker.
- 44.113 Filth
Electronic balance, trap flask, hot plate, heptane,
microscope, 2.36 mm sieve.
- Mbiol8 Sanitary control, see Microbiology 8.
- Mbiol9 Molds & Yeasts, see Microbiology 9.
- Mbiol10 Coliforms, see Microbiology 10.

MINERAL WATERS, DRINKING & COOKING WATERS

- 33.001 Specific Gravity
Pycnometer, pycnometer funnel, anal. balance,
- 33.006 pH
pH meter, CO₂ absorber, 1 L gs reagent bottle, thymol,
Kbitertrate, Kbiphthalate, KH₂PO₄, Na₂HPO₄, vol. flask,
oven, Na₂B₄O₇, NaHCO₃, Na₂CO₃,
- 33.009 Acidity
Buret, pH meter, soda lime protector, erlenmeyer
flasks, beakers, refrigerator, reagent bottles, hot
plate, mortar, 0.15 mm sieve, oven, CO₂ sweeping
device, desiccator, vol. flask, phthln, Kbiphthalate,
H₃BO₃, Na₂S₂O₃, H₂SO₄, Na₂Cr₂O₇ techn., NaOH, CaCl₂
techn., KCl.
- 33.014 Alkalinity
Buret, pH meter, soda lime protector, hot plate,
meas. cylinder, 1 L gs erlenmeyer flask, H₂SO₄,
Kbiphthalate.
- 33.066 Nitrate Nitrogen
Colorimeter, 45 um filter, pipet, refrigerator, beakers,
100 ml gs dark bottles, water bath, vol. flasks, HgCl₂,
HOAc, NaCl, H₂SO₄, brucin sulfate, sulfanilic acid,
KNO₃,
- 33.069 Chloride
Buret, pH meter, refrigerator, vol. flask, 150 ml gs
dark bottle, 3-diphenylcarbazone, HNO₃, xylylene cyanol
FF, alcohol, Hg/HO₃/2.

- 33.076 Carbonate & Bicarbonate
Buret, erlenmeyer flask, phthln, H_2SO_4 .
- 33.084 Hardness
Buret, porcelaine cassarole, vol.flasks, erlenmeyer flask, pH meter, pipet, mortar, 100 ml wms bottle, NH_4Cl , NH_4OH , $MgEDTA$, $NaCN$, eriochrome black T, $NaCl$, Na_2EDTA .
- 33.088 Potassium, Sodium, Calcium & Magnesium
Atomic absorption spectrophotometer, vol.flasks, beakers, pipets, $CaCl_2$, $EDTA$, $NaOH$, NaH_2PO_4 , La_2O_3 , HCl , $MgCl_2$, glass wool, HCl , $NaCl$.
- 33.118 Sulfate
Spectrophotometer or colorimeter in nephelometric conditions, glycerol, HCl , alcohol, $NaCl$, $BaCl_2$, H_2SO_4 , pipets, erlenmeyer flasks, magnetic stirrer,
- Mbiol11 Sanitary Control, see Microbiology 11.
Mbiol12 Coliforms, see Microbiology 12.

SALT

- 33.134 Moisture
0.85 mm sieve, mortar with pestle, erlenmeyer flask, oven, electronic balance.
- 33.135 Matters Insoluble in Water
Oven, beaker, anal.balance, gooch, meas.cylinder, asbestos, $AgNO_3$.
- 33.142 Iodine in Iodized Salt
Buret, anal.balance, erlenmeyer flask, pipet, hot plate, vol.flask, Me orange, H_2SO_4 , KJ , $Na_2S_2O_3$, Br , Na_2SO_3 , starch.

FLAVORS

- 19.002 Alcohol
Gas chromatograph as at 19.125.

LEMON & ORANGE OILS

- 19.078 Specific Gravity
Pycnometer, pycnometer funnel, water bath, anal.balance, acetone.

19.079 Refractive Index
Refractometer.

19.081 Spectrophotometric Absorbance
Spectrophotometer, gs weighing bottle, anal.balance,
vol.flask, alcohol.

LEMON, ORANGE & LIME EXTRACTS AND FLAVORS

19.053 Specific Gravity, see 19.078.

19.055 Alcohol, see 19.125.

19.065 Oils of Lemon and Orange in Extracts
Polarimeter, sucrose.

19.075 Total Solids
Oven, anal balance, steam bath, desiccator, pipet,
flat dish with cover.

19.077 Sucrose
Polarimeter, pH meter, hot plate, thermometer,
ether, and see 31.020.

METALS IN FOODS

25.030 Cadmium
Atomic absorption spectrophotometer, beakers, boiling
chips, watch glass, meas.cylinder, gas burner, funnel,
refrigerator with freezer, hot plate, 250 ml separators,
hot plate, HNO_3 , H_2SO_4 , citric acid, thymol blue,
 NH_4OH , dithizone, HCl , CH_3Cl .

25.146 Zinc
Atomic absorption spectrophotometer, kjeldahl flask,
anal.balance, hot plate, funnel, vol.flask, HNO_3 ,
 H_2SO_4 .

FOOD ADDITIVES

20.024 Benzoic Acid
TLC kit, spectrophotometer, steam distillator, forced
draft oven, erlenmeyer flasks, shaker, kjeldahl flask,
blender, anal.balance, 1 L separator, meas.cylinder,
beakers, steam bath, vol.flasks, centrifuge, MgSO_4 ,
 H_3PO_4 , NaOH , HCl , litmus paper, CHCl_3 , ether, hexane.

RADIOACTIVE CONTAMINATION

48.030 Emergency level
Count rate-meter.

PESTICIDE RESIDUES

29.009 Chlorinated and Phosphated Pesticides
Gas chromatograph, concentrator, steam bath, water bath, air streamer, grinder, blender, suction flask, separators, centrifuge, acetonitril, pet.ether, NaCl, Na₂SO₄, Naoxalate.

TOBACCO

3.110 Moisture
Forced draft oven, Al moisture dish with cover, anal. balance, 1 mm sieve, desiccator.

3.130 Total alkaloids
Steam distillator, anal.balance, vol.flask, hot plate, oven, beakers, crucibles, NaOH, NaCl, silicotungstic acid, HCl, paraffin, Me orange,

COSMETICS

35.006 Water & Ethyl Alcohol
Gas chromatograph, 125 ml gs flask, anal.balance, ethylene glycol monomethyl ether.

DEODORANTS

35.013 Aluminium and Zinc
Atomic absorption spectrophotometer, Al and Zn standards.

35.019 Boric Acid
HPLC liquid chromatograph

35.027 Hexachlorophene
Liquid chromatograph, spectrophotometer, hexachlorophene.

35.030 Phenolsulfonates
Spectrophotometer, Znphenolsulfonate.

TOILET PREPARATIONS

19.126 Essential Oils
Babcock bottle, mineral oil, kerozene, shaker, centrifuge.

- 19.125 Alcohol
Gas chromatograph, pipet, separators, shaker,
abs.alcohol, n-FrOH.
- 19.127 Essential Oils in Emulsion
Oil separator trap, 500 ml rb gs flask.

M I C R O B I O L O G Y

BASIC TECHNICS IN MICROBIOLOGY

- 46.012 Direct Microscopic Count, see at 46.012.
- 46.008 Plate Counts
Colony Counter, petri plates, autoclave, pH meter,
incubator, water bath, beaker, hot plate, peptone-
tryptone, yeast extract, or milk protein hydrolysate.
- 46.011 Tests for Fungi
Microscope, incubator, el.balance, hot plate, pH
meter, petri plates, malt extract, lactic acid,
gram stain.
- 44.092 Mold Count
Microscope, Howard /Bürker/ cell, ocular diaphragm,
refractometer.
- 46.009 Incidence of Coliform Group
Colony counter, autoclave, hot plate, pH meter, petri
plates, incubator, beaker, beef extract, peptone,
lactose, K₂HPO₄, Na₂S₂O₃, basic fuchsin, or eosin Y
methylene blue.
- Mb 13 Shape and Size of Microorganisms
Microscope, slides, cover plates, ocular micrometer,
objective micrometer, inoculator loops, vaseline or
glue, NaCl.
- Mb 14 Growth Rate of Microorganisms
Microscope, incubator, slides, cover plates, autoclave,
hot plate, el.balance, pH meter, saccharose, NaIO₃,
K₂HPO₄, AgSO₄, FeSO₄, KCl, agar, vaseline or glue.

TOMATO PRODUCTS

- 44.092 Molds, see at 44.092.
44.094 Rot
4.35 mm sieve and as at 44.092.

CANNED PRODUCTS CONTAINING TOMATO

- 44.098a Mold in Tomato Soup
Centrifuge, water bath, magnetic stirrer and as
in 44.092.
44.098b Mold in Tomato Sauce with Meat, beans or Spaghetti
3.35 mm sieve, centrifuge, pipet and as in 44.098a.
44.098c Mold in Tomato Sauce Packing Material on Fish
Centrifuge, hot plate, 3.35 mm sieve and as in 44.092.

PUREED INFANT FOOD

- 44.099 Molds
Magnetic stirrer, NaOH and as in 44.092.
44.100 Light Filth
Light paraffin oil, 1 L wildman trap flask.

PEAS & BEANS

- 44.103 Weevils
Wildman trap flask, hirsch funnel, 2.36 and 0.425 mm
sieve, beaker, filter paper, heptane.

CANNED GREENS

- 44.108 Insects
Wildman trap flask, microscope, beaker, hot plate,
filter paper, funnel, 2.36 mm sieve, heptane.

SPICES AND OTHER CONDIMENTS

- 44.115 Gross Contamination
Microscope, 0.85 mm sieve.

DRESSINGS FOR FOOD

- 44.141 Filth
H₂PO₄, 0.1 mm sieve, beaker, suction flask.

ANIMAL EXCRETIONS

44.149 Animal Urine in Grain

UV light, filter, watch glass, filter paper, 1 L
wm dark glass bottle, lg uranyl acetate, glycerol,
bromothymol blue, chromatographic sprayer.

44.162 Uric Acid in Flour

Spectrophotometer, centrifuge, incubator, water bath,
cellophane sheets, beakers, erlenmeyer flask, uric
acid, NaOAc, Naborate, glutathione, uricase.

EGGS & EGG PRODUCTS

46.012 Sanitary Control, see 46.012.

FROZEN, CHILLED, PRECOOKED or PREPARED FOODS & MEATS

46.038 Aerobic Plate Counts

Blender and as in 46.008.

FLOUR

Mbiol1 Sporidical Test for Bacteria of Deterioration of Loaf

200 ml wm reagent glass gs, 50 ml gs reagent glasses,
pipets, NaCl, el.balance, quartz sand, watch glasses,
snaker, test tubes, water bath, incubator, peptone,
lactose, pH meter, autoclave, beef.

MEATS & MEAT PRODUCTS

Mbiol2 Quick Sanitary Control

El.balance, meas.cylinder, blender, autoclave, heat
sterilizer, pipet, water bath, incubator, KH_2PO_4 ,
 Na_2HPO_4 , peptone, vol.flask, resazurine, 50 ml gs
amber reagent glass.

Mbiol3 Quick Sanitary Control of Chopped Meat

Autoclave, milk, el.balance, meas.cylinder, incubator,
alcohol, methyl blue.

Mbiol4 Aerob microorganisms

Colony counter, el.balance, blender, meas.cylinder,
autoclave, peptone, pH meter, triptone, glucose,
agar, hot plate, yeast, petri plates, inoculator
loops.

Mbiol5 Coliforms in Meat

Colony counter, bromothymol blue, trinaflavin, lactose, peptone, NaCl, agar, yeast, steam bath, NaOH, pH meter, alcohol, el. balance, blender, petri plates, inoculating loop, gas burner.

FRUITS & FRUIT PRODUCTS

Mbiol6 Plate Count

Colony counter, food chopper, blender, autoclave, heat sterilizer, el. balance, beaker, petri plates, inoculating loop, gas burner, pH meter, malt extract, refractometer, agar.

Mbiol7 Molds & Yeasts

Colony counter, food chopper, blender, autoclave, heat sterilizer, el. balance, beaker, petri plates, inoculating loop, gas burner, pH meter, sacharose, NaNO₃, K₂HPO₄, MgSO₄, FeSO₄, HCl, agar, lactic acid.

DRIED VEGETABLES, SOUP POWDERS, MACARONI & FROZEN PRODUCTS

Sample Preparation

Food chopper, blender, el. balance, beaker, autoclave, heat sterilizer, petri plates, gas burner, inoculating loop.

Mbiol8 Plate Count

Colony counter, tribtone, yeast, glucose, agar, hot plate, pH meter, steam bath, gs amber reagent glass.

Mbiol9 Molds & Yeasts

Colony counter, and as at Mbiol7.

Mbiol10 Coliforms also for Precooked & Prepared Foods

46.039 Trypticase or tryptose, NaCl, lactose, KH₂PO₄, K₂HPO₄, Na lauryl sulfate, test tubes with inverted fermentation tubes, pH meter, autoclave, incubator, inoculation loop, peptone, meas. cylinder, beakers, dehydrated oxgall or oxbile, brilliant green, alcohol, covered water bath, NaOH, cosyn Y, methylene blue, peptone-tryptone, yeast extract, glucose, amyl alcohol, n-dimethylaminobenzaldehyde, HCl, porcelaine spot plate, a-naphthol, KOH, creatine, Me red, tryptone, proteose peptone, Na₂H₂P₂O₇, MgSO₄, Na citrate, gram stain,

MINERAL WATERS, DRINKING & COOKING WATERS

Mbioll1 Plate Count

Colony counter, autoclave, petri plates, inoculating loop, gas burner, incubator, beef, water bath, glucose, agar.

Mbioll2 Coli titer

Peptone, NaCl, yeast, steam bath, 100 ml gs amber reagent glasses, water bath, pH meter, funnel, filter paper, lactose, phenol red, alcohol.

PROPOSAL

for acquiring the most urgent chemicals
for efficient utilization
of the food testing and quality control laboratory

4	L	Petroleum ether
200	g	Zinc granules
2	kg	Sulfur powder
50	g	Phosphotungstic acid
30	g	Acid Orange 12 /crocein orange G/
100	ml	Propionic acid 99%
4	g	Digitonin 50%
200	g	Potassium thiocyanate
200	g	Potassium ferricyanide 99%
500	g	Florisil, Mg silicate, 60 - 100 mesh
200	g	Carbon disulfide
200	g	Butylated hydroxy anisole
1	L	Mineral oil, light white
250	g	Ferric ammonium sulfate
200	g	EDTA 99%
200	g	Perchloric acid
20	g	Lanthanum oxide 99,9%
25	g	Methyl orange
25	g	Congo red
200	ml	Dichloroacetic acid
50	g	Methyl heptyl ketone
200	ml	Formic acid 99 %
100	g	n-Butyric acid 99%
200	g	Ammonium persulfate 98 %
5	g	Riboflavin
100	g	Glycine
50	g	Aniline black /naphtol blue black/
1	g	Bromphenol blue, sulfone form
2	g	Brilliant blue G 90 %
200	g	5-sulfosalicylic acid
200	ml	Pyridine 99 %
25	ml	Trimethyl chlorosilane
25	ml	Hexamethyldisilazane
20	g	Glass beads 16 - 25 mesh
10	g	Phosphoric acid glacial
25	g	Ascorbic acid
2	g	2,6-Dichlorophenol - indophenol sodium salt
200	g	Sulfanilic acid
50	g	alfa-Naphthylamine
2	mg	Aflatoxin B ₁
2	mg	Aflatoxin B ₂
2	mg	Aflatoxin G ₁
2	mg	Aflatoxin G ₂
100	ml	Anhydrous ether
1	L	Isopropanol

0.005	mg	Aflatoxin M ₁ 98 %
2	mg	beta-Sitosterol
50	ml	Furfural 99 %
300	g	Magnesium perchlorate, anhydrous
25	ml	Antifoam agent
1	L	Xylenes
100	g	Chloral hydrate
100	g	Zinc chloride
50	g	Sudan IV red
5	g	Basic lead acetate / Lead subacetate
100	g	Aluminium potassium sulfate 12 H ₂ O
25	g	Invertase grad V, practical
100	ml	Capryl alcohol
10	g	Calcium oxalate H ₂ O
25	g	Thymol
200	g	Potassium hydrogen tartrate 99 %
500	g	Sodium tetraborate 10 H ₂ O
10	g	Brucine sulfate
20	g	S-diphenylcarbazone
100	g	Na ₂ -EDTA
300	g	Eriochrome black T
100	g	Magnesium chloride 6 H ₂ O
250	g	Sodium sulfite
100	g	Citric acid 99 %
15	g	Thymol blue
40	g	Diphenylthiocarbazone
1	kg	Paraffin wax
1.5	L	Ethylene glycol monomethyl ether
15	g	Hexachlorophene 98 %
3.8	L	Kerosene, clear
500	ml	n-Propanol 99 %
250	g	Yeast extract
200	g	Malt extract
50	g	Beef extract powder
200	g	Peptone primatone
75	g	Basic Fuchsin
100	g	Vaseline
100	g	Glue
1	g	Bromothymol blue
100g	g	Dodecyl sulfate, sodium salt 70 %
75	g	Brilliant green
25	g	Eosin Y
25	ml	1-Pentanol
50	g	4-Dimethylaminobenzaldehyde 98 %
200	g	1-Naphthol 99 %
50	g	Creatine H ₂ O 99 %
500	g	Sodium ammonium hydrogen phosphate 99 %
200	g	Citric acid, trisodium salt 2 H ₂ O
50	g	Crystal violet
10	g	Safranin O

PROPOSAL

for acquiring the most urgent equipment
for efficient utilization
of the food testing and quality control laboratory

1. 1 pc Heat isolating box for sample transfer, 8 L
2. 2 pcs Pycnometer, 25 or 50 ml
3. 2 pcs CO₂ protection tube, glass, U-shaped, total 18 cm
4. 100 pcs Flat bottom metal dish with cover, Ø 5 - 7 cm
5. 1 pc Steam bath, 2 L
6. 2 pcs Gas drying tower, 25 cm
7. 2 pcs Fat extraction tube, Mojonnier, DIN 10280
8. 10 pcs Kjeldahl digestion flasks, 500 ml
9. 1 pc Steam distillation apparatus, 500 ml
10. 0.5 kg Boiling chips, 3 - 4 mm
11. 2 pcs Record syringes, 5 ml
12. 2 pcs Laboratory thermometer 100 °C
13. 4 pcs Sample container plastic jar, 200 g
14. 1 pc Hot funnel steam heater
15. 2 pcs Glass microfilter funnel 1-2 ml
16. 2 pcs Buchner funnel porcelaine, dia 55 cm
17. 2 pcs Buchner microfunnel, porcelaine, dia 25 mm
18. 1 pc Food chopper for semi-hard foods
19. 1 pc Crude fiber digestion apparatus
20. 1 pc Aspirator vacuum connection with vacuum reductor
21. 1 pc Solvent distiller, 500 ml
22. 12 pcs Gooch filter crucible 30 ml with fritted glass filter, 40 - 60 µm
23. 1 pc Preparative liquid chromatography column, glass, dia 22 mm x 30 cm
24. 100 pcs Glass wool filter disc, 5 cm
25. 10 pcs Rubber policeman tamping rod, 25 cm
26. 1 pc Wildman trap apparatus, 1 L
27. 1 pc Hilborn separator equipment, 1 L
28. 1 pc Grinder for hard foods
29. 1 pc Water reflux condenser, 30 cm
30. 250 pcs Pycnometer capillary funnel, 200 mm
31. 1 pc Solvent heavier extractor, 200 ml
32. 2 pcs Liquid condenser, 500 ml
33. 2 pcs Versatile clamps

34. 2 pcs Vacuum test tubes, 18 cm
35. 5 pcs Wash bottles 500 ml
36. 1 kg Asbestos
37. 6 pcs Grounded stopper glass bottles, amber, 1000 ml
38. 6 pcs Grounded stopper glass bottles, amber, 1000 ml
wide mouth
39. 1 pc Food chopper with shear knives for tender foods
40. 2 pcs Hot air streamer, 600 - 1000W
41. 100 pcs Screw cap vials, 2 - 5 ml
42. 100 pcs Caps for the screw cap vials
43. 1 pc Oil separator trap
44. 0.5 kg Glass beads
45. 2 pcs Round bottom, grounded stopper flask, 2 L
46. 2 pcs - " - 1 L
47. 2 pcs - " - 500 ml
48. 2 pcs - " - 250 ml
49. 1 pc Syringe 10 ul
50. 1 pc Syringe 250 ul
51. 2 pcs Round bottom flask, 1 L
52. 2 pcs Erlenmeyer ground stopper flask with stopper 1 L
53. 2 pcs - " - 500 ml
54. 2 pcs - " - 50 ml
55. 1 pc Aluminium foil
56. 2 pcs Air condensers, reflux, 50 cm
57. 1 pc Reflux boiler, 1 L
58. 1 pc Moisture distiller apparatus, 500 ml
59. 1 pc Spice grinder
60. 1 pc Lighter than water oil trap, 250 ml
61. 96 pcs Glass culture tubes with cap
62. 2 pcs Mod. Sprengel tube, 1 ml
63. 1 pc Diastatic activity reactor, 18 cm
64. 1 kg Glass wool
65. 2 pcs Babcock bottles, 50 ml
66. 1 pc Concentrator
67. 1 pc Micro concentrator
68. 1 pc Sterilizer for broths, 100 °C
69. 100 pcs Culture tubes with inverted fermentation tubes
70. 1 pc Culture hood, 125 L

Repair parts

71. 1 pc Single phase step down transformer 220/110 V
400 W, for the refrigerator
72. 1 pc Single phase motor 370 W, 220 V 2900 rev/min
IME 02 710 - 2E or equivalent, for the chopper
73. 1 set Butyrometer tubes for the butyrometer water
bath
74. 1 pc Safety funnel for the Hipp generator
75. 1 pc Ground stopper tubing with stopcock
76. 2 pcs Photocells for the colorimeter

EXAMPLE

for test method, not given in AOAC methods

Determining Starch in Corn

1. Grind 25-50 g of corn.
2. Place about 2 g sample in a 10 mm test tube, add 10 ml mercuric chlorid solvent in alcohol /dissolve 1 g $HgCl_2$ in 900 ml water and add 100 ml 95 % alcohol/, shake it for 2 min.
3. Place a 60° funnel for vacuum filtering and filter the sample. Use ethanol to make a quantitative transfer.
4. Remove the paper with contents and transfer it to a 250 ml beaker.
5. Add 10 ml of water and with a stirring rod wash the corn away from paper.
6. Add 60 ml of $CaCl_2$ solution /dissolve 550 g $CaCl_2 \cdot 2H_2O$ in 760 ml water, adjust pH to 2.0 with glacial acetic acid/ place it on hot plate for boiling 30 min, keep the liquid level.
7. Use the polarimeter, determine a blank by measuring the rotation of a tube filled with water.
8. Fill the tube with potassium tartrate solution /30g in 70 ml of water/, determine the polarimetry reading for this solution, calculate the specific rotation.
9. Cool the starch solution in a small ice bath to room temperature.
10. Add 10 ml uranyl acetate solution to a flat bottom flask.
11. Transfer your gelatinized starch to this flask. Dilute it with the calcium chloride solution to 100 ml. Shake the contents thoroughly and let it set 5 min.
12. Filter your solution into an erlenmeyer flask.
13. Fill the polarimeter tube with the blank solution / 97.5 % $CaCl_2$ solution + 2.5 % uranyl acetate solution/dissolve 10 g $UO_2/C_2H_3O_2/2 \cdot 2H_2O$ in 20 ml water and 20 ml glacial acetic acid, add 100 ml of the $CaCl_2$ solution//. Determine the blank.
14. Rinse the polarimeter tube with your filtrate and fill it with the filtrate. Determine the rotation of the sample and calculate the starch content of the sample.

EXAMPLE

for simplified microbiology test method

Plate count agar for sanitary control of milk

Preparation of meat extract:

1. 500 g beef is cleaned by a knife from fat and other non-meat constituents, cut and grind it in a meat grinder.
2. Measure the weight of the ground meat, add twice the amount of H_2O , mix it and put it into water bath of $37^{\circ}C$ for an hour.
3. Filter it by vacuum.
4. Cook it at $121^{\circ}C$ 1-2 min, and sterilize it in steam at $100^{\circ}C$ 30 min each day during 3 days following each other.

Preparation of the agar broth:

5. Take H_2O on 20 g agar in amount that the agar should be covered with H_2O , let stand overnight to be saturated.
6. Place ca. 500 ml meat extract into a 1000 ml vol. flask, add 3 g NaCl, add 2 g $Na_2HPO_4 \cdot 12H_2O$, add 10 g peptone and add the water saturated agar /see 5./.
7. Dissolve them by heating in water bath. Final pH 7.5 \pm 0.1. Filter it hot into 30 ml test tubes or 300 ml flasks and heat it in the autoclave until the pressure will be 2 bars /130 $^{\circ}C$ / then switch off the autoclave.

Preparation of low-fat milk:

8. Centrifuge 150 ml milk, discard the upper ca. 40 ml, fill 100 ml into flask and sterilize it in steam at $100^{\circ}C$ 30 min each day, during 3 days following each other.

Preparation of the plate count agar:

9. Melt agar broth in water bath and cool it to $45^{\circ}C$.
10. Heat the sterile low fat milk to $45^{\circ}C$.
11. Add 25 ml low-fat milk to 75 ml molten agar broth.
12. Add 1 ml from one of the sample dilutions into a petri plate and add the warm, mixed broth and mix them by circular movement. After cooling, when the broth is semi-solid take it into an incubator, the bottom part should be on top position.

COMPARISON

among tests required by AOAC, by Saudi standards
and the capability of the laboratory

Example: Fruit juices

No	Tests	AOAC	Saudi standard	Laboratory capability
1.	Net content	+		+
2.	Pulp in juice	+	+	+
3.	Specific gravity			+
4.	Ash	+	+	+
5.	Total solids	+	+	+
6.	Soluble ash	+	+	+
7.	Insoluble ash	+	+	+
8.	Alkalinity of sol. ash	+	+	+
9.	Alkalinity of insol. ash	+	+	+
10.	Water soluble solids	+	+	+
11.	Refractive index			+
12.	Water insoluble solids	+	+	+
13.	Vitamin C	+	+	-
14.	Organoleptic tests		+	+
15.	pH			+
16.	Titratable acidity	+	+	+
17.	Citric acid	+		-
18.	Volatile acidity		+	-
19.	Foreign organic acids	+		-
20.	Monochloroacetic acid	+		-
21.	Quaternary ammonium c-s	+		-
22.	Sugar	+		-
23.	Reducing sugars	+		-
24.	Carbohydrates	+		-
25.	Starch	+		-
26.	Saccharin	+		-
27.	Dulcine		+	-
28.	Cyclamates		+	-
29.	Color spectrum			+
30.	Consistency	+		-
31.	Stranous matter	+	+	-
32.	Escherichia coli	+	+	-
33.	Yeast and mold counts	+	+	-
34.	Benzoic acid	+	+	-
35.	Total SO ₂ content	+	+	-
36.	Sorbic acid	+	+	-
37.	Stability test			+
38.	Degree of gelation			+
39.	Self separation			+
40.	Alcohol	r		-

PROPOSAL

to acquire chemicals for training purposes

1.	25	g	Aniline black /naphthol blue black/
2.	1	g	Bromphenol blue, sulfone form
3.	5	g	Brilliant blue G 90 % or Coomassie blue
4.	100	g	5-Sulfosalicylic acid
5.	100	ml	Pyridine 99 %
6.	25	ml	Trimethyl chlorosilane
7.	25	ml	Hexamethyldisilazane
8.	10	g	Glassbeads
9.	5	g	Phosphoric acid, glacial
10.	1	g	2,6-Dichlorophenol-indophenol sodium salt
11.	25	g	Ascorbic acid
12.	100	g	Sulfanilic acid
13.	25	g	alfa-Naphthylamine, 98 %
14.	1	mg	Aflatoxin B ₁
15.	1	mg	Aflatoxin B ₂
16.	1	mg	Aflatoxin G ₁
17.	1	mg	Aflatoxin G ₂
18.	0.005	mg	Aflatoxin M ₁ 98 %
19.	100	ml	Anhydrous ether
20.	1	L	Isopropanol
21.	1	mg	beta-Sitosterol
22.	25	ml	Furfural
23.	100	g	Magnesium perchlorate, anhydrous
24.	1	L	Xylenes
25.	100	g	Chloral hydrate
26.	100	g	Zinc chloride
27.	25	g	Sudan IV red
28.	5	g	Basic lead acetate / Lead subacetate
29.	100	g	Aluminium potassium sulfate 12H ₂ O
30.	25	g	Invertase grad V, practical
31.	100	ml	Caprylic alcohol
32.	5	g	Calcium oxalate.H ₂ O
33.	25	g	Thymol
34.	100	g	Potassium hydrogen tartrate
35.	500	g	Sodium tetraborate
36.	10	g	Brucine sulfate
37.	10	g	S-diphenylcarbazone
38.	100	g	Zinc granules
39.	25	g	Phosphotungstic acid
40.	10	g	Acid orange 12
41.	100	ml	Isononic acid 99 %
42.	1	g	Digitonin
43.	100	g	Potassium thiocyanate
44.	100	g	Potassium ferricyanide
45.	250	g	Florisil

46.	100 ml	Carbon disulfide
47.	100 g	Butylated hydroxy anisole
48.	250 g	Ferric ammonium sulfate
49.	100 g	EDTA 99 %
50.	100 g	Perchloric acid
51.	10 g	Lanthanum oxide 99,9 %
52.	25 g	Methyl orange
53.	25 g	Congo red
54.	100 ml	Dichloroacetic acid
55.	25 g	Methyl heptyl ketone
56.	100 ml	Formic acid 99 %
57.	100 g	n-Butyric acid 99 %
58.	100 g	Ammonium persulfate
59.	5 g	Riboflavin
60.	100 g	Glycine
61.	100 g	Na ₂ EDTA.2H ₂ O
62.	100 g	Eriochrome ² black T
63.	100 g	Magnesium chloride.6H ₂ O
64.	250 g	Sodium sulfite
65.	100 g	Citric acid
66.	5 g	Thymol blue
67.	10 g	Diphenylthiocarbazone
68.	500 ml	Ethylene glycol monomethyl ether
69.	5 g	Hexachlorophene 98 %
70.	100 g	Malt extract
71.	100 g	Peptone primatone
72.	25 g	Basic fuchsin
73.	5 g	Bromothymol blue
74.	100 g	Dodecyl sulfate, sodium salt
75.	25 g	Dile, bovine, dried
76.	25 g	Brilliant green
77.	25 g	Eosin Y
78.	25 ml	1-Pentanol
79.	100 g	1-Naphthol
80.	25 g	Creatine.H ₂ O
81.	100 g	Citric acid, trisodium salt.2H ₂ O
82.	25 g	Crystal violet
83.	5 g	Safranin O

PROPOSAL

for additional equipment and chemicals
needed for sufficient utilization
of the food testing and quality control lab.

1. 1 pc Refrigerated water bath, -20°C to 100°C , $\pm 0.1^{\circ}\text{C}$, volume min 3 L, flow through 10 L/min
2. 1 pc Shaking machine, 50-250 strokes/min, stroke 0-40 mm, capacity 12x250 ml flasks
3. 1 pc Precision water bath circulator, 5° above ambient to 80°C , control accuracy $\pm 0.1^{\circ}\text{C}$, min 10 L/min flow through
4. 1 pc Polyacrilamide gel electrophoresis equipment for 14 pcs of gels in rod form of dia 6 mm
5. 1 pc Power supply for item 4. 0-450 V, max 450 mA, 100 VA
6. 1 set Power leads for item 4.
7. 1 set Chemicals for item 4.:
 - 500 g Acrylamide
 - 500 g TRIS Tris/hydroxymethyl/amino methane
 - 100 ml TEMED N,N,N',N'-tetramethyl ethylene-diamine
 - 200 g BIS N,N'-Methylene-bis-acrylamide
 - 200 g Riboflavin
 - 25 g Brilliant blue G
 - 100 g 5-Sulfosalicylic acid dihydrate 98 %
 - 500 g Glycine
 - 500 g Ammonium persulfate
8. 2 pcs Record syringe, 20 ml with needles
9. 1 pc Hot air sterilizer, max 200°C , workspace 30x18x19 cm
10. Equipment to be specified at start of the project, needed for AOAC and international food standard tests in a total value of 150,000 USD
11. Chemicals to be specified at the start of the new project, needed for food standard tests and for AOAC methods in a total value of 50,000 USD
12. Equipment, tools and chemicals to be specified by the Instrumental Laboratory expert for the utilization of the Instrumental Laboratory
13. 1 pc Portable spectrophotometer with nephelometer attachment, 400-800 nm ± 3 nm, 1% T readability

PROPOSAL

for test methods of a detailed training course for the
laboratory personnel

1. Atomic absorption spectroscopy - Determination of calcium and magnesium in cooking water
2. Milk conductivity, adulteration and household disinfectants
3. PAG electrophoresis - detecting adulteration in processed fish
4. Ion exchange chromatography - chloride and bromide in brine waters
5. Gas chromatography - determination of antioxidants, BHA and BHT, in breakfast cereals
6. Continuous extraction - solvent heavier than water - determination of caffeine in Cola beverages
7. Dialysis - the determination of phosphatase in milk
8. Flotation - insect filth in foods
9. Molecular distillation - the determination of Vitamin E in margarine and in oils
10. Polarimetry - determining starch in corn
11. Karl Fischer titration - determination of moisture in dried vegetables
12. Rapid ash determination in flours
13. Measurement of unsaturation of fats and oils
14. To distinguish butter fat from other oils
15. Rapid protein determination in milk
16. Nitrate determination in cured meats and baby foods
17. Determination of Vitamin C in fruit juices
18. Thin layer chromatography - aflatoxin in corn and soybeans