INDUSTRIAL TRAINING REPORT GHANA STANDARDS AUTHORITY (GSA)



PRESENTED TO THE DEPARTMENT OF LABORATORY TECHNOLOGY SCHOOL OF PHYSICAL SCIENCE

COLLEGE OF AGRICULTURE AND NATURAL SCIENCES

UNIVERSITY OF CAPE COAST, CAPE COAST

By

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FROM

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NAME OF SUPERVISOR………………………………………………………………………………………………..

SIGNATURE OF SUPERVISOR……………………………………………………………………………………………..

**ACKNOWLEDGEMENT**

I would like to first of all express my sincere gratitude to God Almighty for His love, strength, care, mercy and protection throughout my industrial attachment training.

I owe a considerable thanks to the institution Ghana standards Authority and the management for their positive response to my attachment letter and giving me the opportunity and the best industrial training at their firm with regards to my program of study, (BSc. Laboratory technology).

Special thanks to my supervisor Mrs. Rebecca Adjei Mensah (Metallic Contaminants Lab) for her excellent supervision and devotion. I thank all the heads of the various departments, Mr. Maxwell Kogbe (Head of metallic Lab), Mr. Derry Dontoh and Mr. Armah for their untiring assistance, direction, encouragement, comments, suggestions, continuous guidance, support, ideas and constructive criticism throughout my industrial attachment training process.

Again, my heartfelt gratitude goes to all the lecturers of the department of laboratory technology of the University of Cape Coast most especially to Mr. Rex Okoto for without his supervision, corrections and guidance this whole work would not have been fruitful.

Finally, I express my indebtedness to my parents, siblings, and friends and loved ones especially Mr. Alex Awuah, Mrs. Dora Awuah Martin Acheampong, and Mr. Alex Kissi Boateng for their love, prayers and support. And I thank my course mates and seniors for sharing their experiences, time and commitment especially during and completing this attachment training Program.

**ABSTACT**

In other to enhance laboratory skills, industrial laboratory training is an essential component of

the BSc. Laboratory Technology program for students of the department in the University of

Cape Coast.This report covers my practical attachment training at Ghana standards authority at Legon, Accra in the Greater Accra Region of Ghana from 24th June, 2018 to 16th August,2019.

The attachment began with an introduction to the food and agriculture department.

Food and Agriculture undertakes chemical, physical and organoleptic analysis on various food and agricultural products and produce including drinks (Beverages) to ascertain quality and level of compliance with applicable standards. There are five (5) laboratories under the department which perform various analyses under which I was assigned to the metallic contaminants’ lab.

This is the devision where analysts perform analysis to ascertain level of contaminants as well as essential and other elements in various products/produce.The methods employed in this analysis are the wet digestion(microvave digestion) and dry digestion(mineralization) methods from which metallic contaminants such as lead,arsenic, Mercury, cadmium,cupper and zinc contents of samples are being detected.The metallic lab consist of three sub-labs;the sample receipt room,sample preparation room,analysis room and the instrumentation room.

Quantification of these metals is by the use of the Atomic absorption spectrometer (AAS).

The laboratory is accredited to ISO/IEC 17025 in the area of heavy metals in Fish and Fishery products.

The second part of the training was at the material science department.

The department undertakes physical and chemical tests and analyses on various products including general chemical-based materials, water, textiles, paper, petroleum, precious metals and rubber products.

There are six (6) laboratories under the department which perform various functions under which I was assigned to the textile lab.

Textiles and Leather laboratory which undertakes physical and chemical tests on textiles, leather and related products.

In the textiles lab samples such as tissue papers,

jute bags and fabrics are analyzed by both physical and chemical methods. instruments used in this lab includes the tensile machine, grey scale, wascator.

CHAPTER ONE

INTRODUCTION

The industrial attachment is an essential component of the laboratory technology program in the University of Cape Coast. It is a course mounted by the department of laboratory technology of the school of Physical Science in the university as part of the requirement for a degree program.

Students of the department are expected to undergo practical and industrial training under competent supervision to enhance their competence for a period of 8 weeks in a preferred organization of choice. Lecturers from the department visit students at the site of attachment to enquire about the seriousness of students and also assess students based on the exhibition of basic laboratory skills and principles pertaining to the machines used at the work site.

Students of the department are also required to enter the description of the work done each particular day in the log book given to them by the department. This report is the outcome of the 8 weeks practical training at Ghana Standards Authority.

* 1. OBJECTIVES OF INDUSTRIAL ATTACHMENT

The objectives of this industrial attachment are to make students;

❖ Get hands on practical experience to the theories learnt in class.

❖ To also ascertain if students can exhibit proper laboratory skills.

❖ To see if students can observe simple health and safety rules.

❖ To observe how students are self-motivated to work and their independent approach to work as well.

❖ To introduce the student to the worksite for future employment.

❖ It also exposes students to other work procedures which are not taught in the university.

**BRIEF HISTORY**

Ghana Standards Authority is an Agency of Government responsible for developing, publishing and promoting standards in the country.

It does this through standardisation, metrology and conformity assessment activities. Some of these activities are testing, inspection and certification. These activities ensure that products or goods and services produced in Ghana, whether for local consumption or for export are safe, reliable and are of good quality.

The Ghana Standards Authority was known as National Standards Board in August, 1967, when it was couched out of the Institute of Industrial Research (IIR), one of the leading 13 Research Institutes of Ghana’s Council for Scientific and Industrial Research (CSIR), the main Science and Technology Research and Development institution of Ghana. The Organisation was separated from IIR and located in a pre-fabricated structure at the beach, near the current Management Development Productivity Institute (MDPI) in Accra.

After a few years, the Standards Body was re-located to the third floor of the State House in Accra. From the State House, the Organisation was again re-located to a new place off Tetteh Quarshie Interchange – Legon – Madina Road, near Gulf House, Okponglo where its Head Office is currently situated. Through hard work and a desire to bring standardisation to the door steps of all people throughout the country, the GSA now has branches in all the regions, apart from the Upper West Region for which reason the Regional Office in Tamale has been empowered to superintend over the Upper West.

**Vision**

“To become a customer-focused world-class standards organization.”

**Mission**

“To contribute towards the growth of industry, protect consumers and facilitate trade through standardization, metrology and conformity assessment”.

**Core Values**

Excellence

Customer-focus

Integrity

Team work

**3.0.SAMPLE RECEIPT ROOM**

This is where all samples from the reception are broght for record keeping and sample identation based on the requizerement.the samples are labelled based on the FA(food and agriculture) number where FA1 is for product certification and FA2 for quality evaluation.the lab numbers are then recorded into a sample record note book labelled MC1 and MC2 respectively.the samples are labelled accordind to the reqirements and the format in an “MC/YEAR/LAB number.” Format.

**3.1.sample preparation and sampling**

There are four major steps involved in the analysis of foods for the metal contents,

(a) Obtaining a representative sample from the bulk received for testing.

(b) Destruction of organic matter.

(c) Separation and concentration of the element of interest and (d) Determination

**Sampling:**

The object of this step is to obtain a small and representative portion from the large sample in such a way that any subsequent test on the sample will give a reproducible value. For fresh foods, the homogenization process is like macerating in a blender whereas dry products are normally ground mechanically and then mixed and the powder is sieved before analysis. Contamination during this step can be avoided with the use of stainless steel equipment. Hard foods, such as, chocolates are sampled by grating/chopping finely by grinding in a mortar.

Meat and meat products are thoroughly minced and then ground in a mortar and in this case, too small quantities should not be taken for analysis. Fats are melted before analysis. Wet foods such as pickles, etc are homogenized in high-speed blender. Liquids are normally sampled after they have been thoroughly mixed by repeated slow inversion of container. After the sample is properly homogenized and reduced to usable form, it should be stored in an air tight container. If the sample received for analysis is too large, it has to be reduced to a more convenient size (for homogenization purpose) by repeated quartering in which the sample is arranged in a flat heap, opposite two quarters are rejected and remaining two quarters are mixed and again subjected to quartering. This process is continued till a convenient quantity of sample remains for homogenization by grinding etc. The edible portion of the sample of food has to be taken for preparation of sample for analysis. E.g. fish, etc.

**Equipment used at the sample preparation Room**

Kitchen knives,cutlass,chopping Board,blender,grindomix machine,mortar and pestle,beakers,spatula,markers,basin

**3.2 Weighing**

Prepared samples are weighed according to the sample constituent. For fish samples 1g of sample is weighed,0.5g for salt sample and 3g for any other sample.

The analytical balance is first tared and the sample is weighed and recorded.

3.3**. Chemical analysis**

Destruction of Organic Matter:

The commonly used methods of destruction of organic matter can be broadly grouped into Dry Ashing and Microwave Digestion.

**Dry ashing**

This procedure is also used for destruction of organic matter. Precautions are to be taken to avoid losses by volatilization of elements, retention of element on the surface of vessel used or incomplete extraction of ash. These problems can be avoided by using controlled muffle furnace, by adding ash aid wherever necessary (Magnesium nitrate, sodium carbonate sulphuric acid etc) to the food before ashing and by using a suitable acid for extraction. Silica or platinum vessels are to be preferred.

**Procedure:**

Weigh accurately a suitable quantity of the well mixed sample in a tared silica or platinum dish. Heat first by means of a soft flame to volatilise as much organic matter as possible, then transfer the basin to a temperature controlled muffle furnace. Keep the muffle at about 300ºC. Once the material is dry and charred, the temperature is allowed to rise to 450ºC and ash at this temperature till no carbon remains. If it is suspected that all carbon has not been removed, cool the ash, add about 1 to 2 ml of conc. nitric acid, evaporate to dryness and again heat in muffle furnace. After ashing is complete, remove the dish from muffle furnace, cool, cover the dish with watch glass.2ml of conc nitic acid is pipetted into the sample containing a reasonable amount of deionized waterand Filtered into a 100 ml volumetric flask using Whatman No. 44 filter paper. Wash the residue and basin twice using deionised water. Make up to the mark. For food stuffs of low ash or high chloride content and where the loss of heavy metals by volatilization is suspected, 1g of thesalt is weighed and the microwave digestion for highly volatile samples.The commonly used ashing aids are nitric acid, dilute sulphuric acid, magnesium nitrate, magnesium acetate, sodium carbonate, etc.

**Reagents:**

It is necessary to use reagents and distilled water of suitably low metal content taking into consideration that the concentrated mineral acids are generally used in amounts several times more than the sample. Even when these reagents are used, reagent blank determination shall be All chemicals that are used in these procedures should be of highest purity. The chemicals should not be transferred to other bottles if any chemical to be used has any kind of impurity, then it should be purified. necessary. Blanks must be prepared with the same quantities of the reagents as are used in the test.

**Microwave Digestion:**

The method provides for the acid digestion of the samples in a closed vessel device using temperature control microwave heating for the metal determination by spectroscopic methods. Induction of Microwave digestion method will do the best digestion with loss of target metal concentration. The Microwave digestion temperature needs to change according to food matrix. Advantage of the method is to avoid loss of volatile metal like Sn, As, Hg, Lead as well as less sample quantity. The lab can validate digestion method according to food matrix.

Sample amount: 1 g

Microwave digester

Reagents;

3ml conc HNO3

5ml conc H2O2

Procedure:

1. the Teflon vessel (TFM) is placed on the balance plate, tared and the mass of the sample weighed.

2. The TFM vessel is introduced into the HTC safety shield.

3. 3ml of H2O2 is added to the sample followed by 5ml conc HNO3, if part of the sample stays on the inner wall of the TFM vessel, wet it by adding acids drop by drop, then gently swirl the solution to homogenize the sample with the acids.

. 4. The vessel is closed and introduced into the rotor segment, then tightened by using the torque wrench.

5. the segment is inserted into the microwave cavity and the temperature sensor connected.

6 the microwave program is run to completion.

7. The rotor is cooled by air or by water until the solution reaches room temperature.

8. the vessel is opened and the solution is transferred into a centrifuge tube and topped up to the 25ml mark.

Microwave program:

|  |  |  |  |
| --- | --- | --- | --- |
| step | time | temperature | Microwave power |
| 1 | 10 minutes | 200C | Up to 1000W |
| 2 | 20 minutes | 200C | Up to 1000W |

2.0 DETERMINATION OF LEAD, CADMIUM, COPPER, IRON AND ZINC IN FOODS BY ATOMIC ABSORPTION SPECTROPHOTOMETER

Principle: Test portions are dried and then ashed at 450°C under a gradual increase (about 50°C/hr) in temperature, 6 N HCl (1+1) is added and the solution is evaporated to dryness. The residue is dissolved in 0.1N HNO3 and the analytes are determined by flame and graphite procedures.

Apparatus:

(a) Atomic absorption Spectrophotometer – with an air – acetylene burner or nitrous oxide- acetylene burner for flame and a graphite furnace for electro-thermal determinations with appropriate background (non atomic correction). Instrument parameters are usually given by the manufacturer in the manual provided with the instrument

(b) Hollow cathode or electrode less discharge lamps for all elements.

(c) Furnace – Programmable or muffle furnace with thermostat maintaining 450 ±25°C

(d) Hot plate – with heating control to heat upto 300°C

(e) Quartz or platinum dishes (f) Polystyrene bottles – with leak proof closures – 100 ml Carefully clean and rinse all glassware and plastic ware with HNO3 or HCL to avoid metal contamination – First wash with water and detergent, rinse with tap water, followed by distilled water, then with dilute acid ( 1 + 9 ) and finally 3-4 times with distilled water. NOTE: Microwave Digestion can be done since there is a chance of loss of target metals i.e. Lead, during ashing.

Reagents: (a) Water – redistilled or deionised

(b) Hydrochloric acid A.R (6N) – Dilute 500 ml HCl to 1 litre with water

(c) Nitric Acid A.R 0.1M – dilute 7 ml conc. acid to 1 litre.

(d) Nitric acid concentrated (Sp. Grade 1.40)

(e) Standard solutions of cadmium, copper, lead and zinc prepared as Follows:

(It is suggested to use NIST Tractable all solution of 1000mg/l. Prepare stock & working solution from this. For the better result, working solution should be prepared in the digestion solution).

(1) Lead Standard solution– 1mg / ml. Dissolve 1.000 gm Pb in 7 ml conc HNO3 in 1 litre volumetric flask. Dilute to volume with water. Commercially available standard solutions for AAS may be used for all metal standards. (2) Cadmium Standard solution – 1 mg / ml . Dissolve 1. 000 gm in 14 ml water and 7 ml conc HNO3 in 1 litre flask. Dilute to volume with water. (3) Zinc Standard solution – 1mg / ml. Dissolve 1.000 gm Zinc in14 ml water + 7 ml conc HNO3 in 1 litre volumetric flask and dilute to volume with water. (4) Copper Standard solution – 1mg / ml. Dissolve 1.000 gm Copper in 7 ml HNO3 in 1 litre flask. Dilute to volume with water. (5) Iron Standard solution – 1mg / ml. Dissolve1 .000 gm Iron in 14 ml water and 7 ml conc. HNO3 in 1 litre volumetric flask. Dilute to volume with water. (e) Working Standard solution – For graphite furnace analysis dilute standard solutions with 0.1 M HNO3 to a range of standards that cover the linear range of the elements to be determined. For Flame analysis dilute standard solutions with 0. 1 M HNO 3 to a range of standards that covers the concentration of the elements to be determined.

NOTE: Apart from the NIST tractable metal standard, internal standard may be used for accuracy of test result.

Preparation of Sample: Digestion by Microwave Method. Weigh accurately about 25 g of well homogenised sample into a clean silica dish. Add 25 ml of 20% sulphuric acid (b). Mix thoroughly with a glass stirring rod ensuring all sample material is wetted by the acid. Rinse stirring rod with water into silica dish. Dry the contents of the dish thoroughly on a steam bath or in an oven around 110ºC. When the sample is thoroughly dry, heat the contents of the dish with a soft flame (such as that of a Bunsen burner) until all volatile or readily combustible matter has been removed. Transfer the dish to a furnace set at 250ºC. Slowly raise temperature to 500 ºC. Ash at this temperature for about 6 to 8 hours. Remove the dish and cool. Ash should now be white or brownish red and essentially be carbon free. If ash contains carbon particles, wash down sides of dish with water and add 2 ml of HNO3 and mix well. Dry thoroughly on hot plate. Return dish to furnace at 500ºC and ash for 30 minutes. Repeat nitric acid treatment using 1 ml increments of HNO3 until white/brownish red, carbon free ash is obtained. When clean ash is obtained, remove the dish from furnace, cool and add 1ml HNO3 and 10 ml of water. Heat on hot plate till sample ash is dissolved. Quantitatively transfer the contents of the dish to a 50 ml volumetric flask, heat the dish with 10 ml of HCl (1+1) and transfer the solution again to the same volumetric flask to volume with water. Prepare sample blank solution by following the same procedure as described for sample. Use same quantities of reagents including water for both sample and blank. Subject both sample and sample blank to identical treatment (even the length of time kept in furnace etc.)

NOTE: 1. Do not ash HNO3 in furnace. Always dry HNO3 (in the dish) on steam bath or hot plate and then ash in furnace.

2. Do not allow sample to ignite during any stage of ashing.

3. If the calcium content of the sample is high, then avoid the use of sulphuric acid (Ash aid) and ash at temperatures not exceeding 470ºC.

Determination: Atomic absorption Spectrophotometry: - Lead and Cadmium in foods generally require graphite furnace AAS (GFAAS) for determination Zinc , Copper and Iron can be determined by flame AAS

(1) Set the instrument as per the previously established optimum conditions /as per the guide lines given in the Instruction Manual (provided along with the instrument). The standard conditions for Atomic absorption spectrophotometer are given below.

(2) Determine absorbance of sample solution(s) and blank.

(3) Calculate the heavy metal content from standard curve.

NOTE: calibrate AAS with copper solution (NIST tractable) before use, for absorption value (pre-defined).

Preparation of Standard Curve:

Read the absorbance of a series of standard metal solutions in the Atomic Absorption Spectrophotometer after setting the instrument as per optimum conditions. Plot absorbance against μg of metal/ml solution.

Standard Conditions for Atomic absorption Spectrophotometer

Element Wavelength Flame-Gases

Copper 324.8 Air – acetylene

Lead 217.0 Air – acetylene

Zinc 213.9 Air – acetylene

Cadmium 228.8 Air – acetylene

Iron 248.3 Air – acetylene

Aluminium 309.3 Air – acetylene / Nitrous oxide – Ac

Nickel 232.0 Air – acetylene.

NOTE: 1. Prepare spike standard in the same kind of sample.

2. Use of QC NIST tractable standard in the different kind of food matrix after interval of 20 sample. If any deviation observed, then equipment should be calibrated again

3. Always monitor Current density of AAS lamp. Old lamp (after expiry of pre defined age of lamp), normally users increase lamp current, which creates a noise and chance of false positive result

4. Use Spike method and analyze recovery of metals

**Calculation: (mg/L) =**

Concentration (mg) X Volume ( V) X Dilution Factor (DF)

Weight of sample

Textile testing is the term for a whole series of tests that examine the physical, mechanical and chemical properties of textiles. These tests are sometimes done before a textile goes into widespread use, or they're done on textiles arriving from other countries for sale in US markets. Countries like Ghana have established standards for what should and should not be in textile products. Tests can show whether companies making textiles are in compliance or not.

Why do such tests?

They can ensure that a given textile is what a manufacturer or importer says it is. Sometimes, testing is done while textiles are being manufactured, to identify problems or faults in the machinery making them, and to double-check that materials being used for a specific textile are appropriate.

Methods of Textile Testing

There are many textile tests. Some of them are physical tests, in which a sample of textile material is examined closely for feel and appearance. Such tests are done on individual fibers or strands of material and on yarns, threads made of several fibers twisted together. Textiles are also subjected to light and other elements to see how they react. Some of these tests are done in a weather-ometer, a machine that tests for weathering and lightfastness of textiles. It's basically an enclosed box. Textiles are placed inside and subjected to conditions replicated from the natural environment.

Mechanical tests are those in which textiles are subjected to different pressure and stressors, usually in specialized testing machines. These include tests to measure breaking strength, the force needed to break a fabric under tension. Such tests can ensure fabrics are strong enough to maintain integrity even when under great stress. Other tests gauge tearing strength, or the strength required to make an already existing rip or tear worse. And abrasion tests determine how quickly a textile wears out when it's rubbed against another surface. Such tests make sure that fabrics used in products like parachutes and car seat belts won't break when needed most to keep the user safe.

Still other tests are chemical tests, in which a textile is analyzed through chemical means to determine what it contains. These tests are often done in laboratories, and they're important to determine whether textiles might have harmful substances in them like lead or other heavy metals, banned chemical dyes or pesticides that could possibly endanger the consumer.

Specialized textile testing is also done to test for flammability, or how quickly a given textile burns. Various methods of performance testing are done on textiles that must possess special qualities, like be effectively bulletproof or provide a layer of filtering on construction projects. In short, there are as many ways to test textiles as there are uses for textile products in our world.

Importance of Textile Testing

The most obvious reason is that it allows companies, consumer groups and the government to make sure textiles are safe, of good quality, and that the customer is getting what they are paying for. Textile products are made around the world, and sent to markets around the world. Testing ensures that something harmful or illegal isn't slipping through the regulatory cracks.

**PHYSICAL TESTS**

Colour fastness to washing

A specimen of the textile, in contact with one or two specified adjacent fabrics, is mechanically agitated under described conditions of time and temperature in a soap solution, then rinsed and dried. The change in color of the specimen and the staining of the adjacent fabric are assessed with the grey scales.

**equipments**

Rotawash

Stainless Still Ball,

Multi-fiber fabric,

Grey scale,

Sewing machine,

Thermometer,

Color matching cabinet

Sample Preparation:

Working Procedure:

A 10cm×4cm of both test fabric and the multi fibre fabric are measured and cut

Collecting the sample from bulk and then conditioning for 04.30 to 06 hours

↓

Making a specimen of 04 cm\*10 cm in size.

↓

Sewing the specimen with multi-fibre fabric of same size at one corner.

↓

Making the solution of 4gm/litre ECE detergent & 1 gm/litre sodium perborate, (If required SKFL use 0.15 gm/litre TAED).

↓

Putting the specimen with multi-fibre fabric into the solution in Rotawash m/c

Prog.: C2S Temp.: 60OC/ 40OC Time: 30 min Still ball: 25 pcs

↓

Rinsing with hot water respectively.

↓

Squeezing with cold water of the sample is done (Hand Wash).

↓

Then drying is done at a temperature in the air not exceeding 60OC

↓

The stitching is then broken out except on one of the shorter end.

↓

Measuring the staining and color change by grey scale & make a test report.

Equipment used:

Rotawash

Stainless Still Ball,

Multi-fiber fabric,

Grey scale,

Sewing machine,

Thermometer,

Color matching cabinet

1. Sample preparation for ISO method:

A 10x4 sample size is taken and stitched with a 10x4 multifibre from all sides.

Multifibre consists of six fibres i.e., acetate, cotton, nylon, polyester, acrylic and wool.

Procedure for ISO method:

25 silver balls were taken, along with the sample and put into the stainless steel container of Rotawash which is rotated for 30 min at 50°c.

After 30 min sample is dried in 45°c-60°c.

Assessment of color fastness to washing:

The assessment of colour fastness is carried out by assigning ratings for

a) Change in colour (of the test specimen):

Grey scale is used for checking the change in colour of the specimen.

This scale consists of nine parts (from 5-1).

The differences in colour between the chips of each pair are given a rating

b) Staining(of adjacent fabric):

This scale consists of pairs of normally white and grey colour chips, each representing a difference in colour or contrast corresponding to a numerical rating for staining.

Here too the ratings are from 5-1.

**Dimensional changes due to washing.**

This procedure describes the process for determination of dimensional changes of fabrics when subjected to home laundering process.

Definitions:

· Dimensional Change: Percentage change in length and width of fabric specimen when subjected to specified conditions.

· Growth: Dimensional change result in increase in length and width of specimen.

· Shrinkage: Dimensional change result in decrease length and width of specimen

· Laundering: A process intended to remove soils and/or stains by washing with detergents or soap solutions and normally includes rinsing, extraction and drying.

Test Principle

Fabrics with specified dimension are handled in water of a certain temperature in a certain time; then measure the length change in the warp and weft direction after fabrics are dried and evaluate shrinkage of fabrics. Mechanical Shrinkage Method usually adopts shrinkage tester to complete the test, and it is divided into two types: cylinder washing machine adding materials from the front door, stirring washing machine adding materials from the top.

c) Test Method

Sample preparation.

Choose smooth sample with no obvious crease, and its size should no less than 500mm\*500mm; if width is less than 500mm, complete sample can be used, whose length is at least 500mm. Sample is made 3 pairs of marks along the warp and weft direction. The space of marks should be not less than 350mm; marks from the edge of cloth should be not less than 50mm. When necessary, sample of 250mm\*250mm can be used, and 3 pairs of marks are made on the sample in the length and width direction, each pair of whose space is 200mm.

Washing accompany preparation.

2. Washing temperature, water level, and washing time are set. Prepared sample and washing accompany are put in detergent, handled as chosen washing program.

3. After fabrics are washed, you can choose one of the following 6 drying methods to dry it:

Hanging dry — after dehydration, fabric is perpendicular to the ground in the length direction, hanging on a string or smooth pole and drying in room temperature and stationary air.

Drip dry — Sample without dehydration is perpendicular to the ground in the length direction, hanging on a string or smooth pole and drying in room temperature and stationary air.

Flattened dry — sample is flattened on the drying rack with horizontal screen, removed wrinkles to make it flat but not to let it deform or extend, dried in the room temperature.

Flat pressing — sample is put on the flat pressing machine, removed bigger wrinkles by hands. As request of drying sample, putting down the pressing head, sample is hot pressed in a or more short periods until it is dried. Choose apposite temperature and record temperature and pressure used.

Tumbling drying — sample and washing accompany is put in tumbling dryer (Figure 6), and choose the drying stall. As for fibers which are sensitive to hot, a lower temperature is better.

Oven drying — sample is mounted flat on filter screen in oven, noticing not to make it deform or extend. The temperature of oven is set in 60℃ ± 5℃, and drying it.

Soaking, sample is flattened horizontally on table at a state of no tension. Under the condition that no any tension is applied to it, shrinkage rate is measured directly by shrinkage scale; or scale is used to measure the length (accurate to 1mm) between 3 pairs of marks in warp and weft direction of fabric, then take averages respectively and replace the data to the following formula to calculate fabric shrinkage rate:

Calculation

Grammage Test

Grammage may be measured by determining the mass of a test piece or test pieces of tissue paper or tissue products cut to specified dimensions, or by determining the mass and area of a specified number of units of finished tissue products.