TRAINING OF TRAINERS IN USE AND MAINTENANCE OF WYD IODINE CHECKERS

A CONSULTANCY REPORT

by Andrews Quashie, GAIN Consultant

May 2012

EXECUTIVE SUMMARY

The consultant was contracted design a training course and then travel to Ethiopia from the 9th of May 2012 to the 13th of May 2012 to train officers of the Ethiopian Food, Medicines and Health Care Administration and Control Authority (EFMHACA) and of the Ethiopian Health & Nutrition Research Institute (EHNRI) on the use and maintenance of WYD Iodine Checkers.

The training course was designed to cover the theoretical scientific basis, the technical operation and specification, the maintenance and simple troubleshooting of WYD Iodine Checker. It also included the preparation of the various solutions used in operating the WYD Iodine Checker.

Participants were also trained in the preparation of the various solutions and use of the iodometric titration method to check the level of iodine in edible salt.

Participants for the training course were drawn from both the Head Office and the branch offices of the EFMHACA. In all, there were fourteen (14) participants; two (2) participants from each branch office and four (4) from the Head Office.

The venues for the training were the lecture theatres and microbiology laboratories of the EHNRI.

The course was made up of theoretical lectures and practical sessions in the laboratory.

The results from participants when the WYD Iodine Checker was used on the various samples of salt were comparable; the minor variations can be attributed to errors which occurred when the solutions were been prepared.

Overall, five participants assessed the Course as excellent, seven assessed it as good and two thought the course was average.

The course was useful in that it exposed the participants to two more reliable methods of checking the level of iodine in salt.

The various challenges in preparing the solutions also gave the participants the chance to experience the problems which may come up as they use the methods in their laboratories.

Since the results of salt test by these participants will be of great importance, it is suggested that the participants be exposed to the salt industry, especially the salt iodization processes being used in Ethiopia so they can better appreciate their test results and give realistic interpretations.

Table of Contents

List of Tables

INTRODUCTION

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The purposes of this consultancy include

- Design a training course on the use and maintenance of WYD Iodine Checkers
- Travel to Ethiopia and deliver the designed training and account for the following:
- Use of the WYD iodine testing device for iodine content determination in salt;
- Preparation of reagents for use with the WYD iodine content testing device;
- Maintenance guidelines and troubleshooting issues of the WYD iodine content testing device
- Carry out an evaluation of the training effectiveness; and
- Advocate for GAIN QA/QC work with the ICCIDD and INTERTEK through focusing on complementariness of different partners.

DESIGN OF TRAINING COURSE

The training course was designed under the following sections:

- Theoretical scientific basis for WYD Iodine Checker
- Technical operation and specification of WYD Iodine Checker
- Maintenance of WYD Iodine Checker
- Simple Troubleshooting of WYD Iodine Checker
- List of Equipment needed for preparation of operational chemicals of WYD Iodine Checker
- List of Chemicals needed to prepare operational chemicals of WYD Iodine Checker
- Calculation of equivalent quantities of chemicals used during preparation
- Methods of preparation of operational chemicals

TRAINING OF TRAINERS/PARTICIPANTS

Participants for the training course were drawn from both the Head Office and the branch offices of the EFMHACA. In all, there were fourteen (14) participants; two (2) participants from each branch office and four (4) from the Head Office. The branch offices were:

- Mekelle
- Hawassa
- Jimma
- Dire Dawa
- Bahir Dar

Appendix 1 lists the participants and their offices.

FACILITATORS

The facilitators for the training programme were the GAIN Ethiopia Officers namely Mr. Alem Hedara and Mr. Tena Yigeza, and the staff of EFMHACA: namely Mr. Bikila Bayssa, the Director of the Quality Assessment Directorate, the Case Team Coordinator, Heran Gerba, the analysts Kinfe Wondimu and Lantider Kassaye. These were ably supported by the office staff of the Directorate.

VENUE AND FACILITIES FOR TRAINING

The venues for the training were the lecture theatres and microbiology laboratories of the EHNRI. The training used PowerPoint presentation for the theoretical aspect and then a hands-on session for the preparation of the chemicals. The LCD projector was provided by the EFMHACA and the chemicals were from the stores of EFMHACA.

THE TRAINING COURSE

OPENING

The course was started with Introductory Remarks by the Director of the Quality Assessment Directorate. The course was then opened by Mr. Dawit Dikaso, Deputy Director General of EFMHACA, Regulation and Enforcement.

A Welcome Address was given by Mr. Alem Hadera, the Country Manager of GAIN, Ethiopia who gave a background to the course.

Mr. Teshome, from the Federal Ministry of Health/UNICEF, gave a presentation on the Status of Salt Iodization in Ethiopia.

The Deputy Director of EFMHACA, Regulation and Enforcement, Mr. Dawit Dikaso then gave a presentation on the Status of Enforcement of the Salt Legislation in Ethiopia.

See Appendix 2 for the Programme of the Training Course.

TECHNICAL SESSIONS

The first technical session which was a lecture on the WYD Iodine Checker was given by Andrews Quashie, GAIN Consultant. He touched on the various aspects of the WYD Iodine Checker including the scientific principles which govern its operation, how it operates, its specifications and how to calibrate the device. There was also a discussion on how to maintain the device and trouble-shoot problems which may occur in its use.

The second technical session dealt with the preparation of the various solutions which the WYD Iodine Checker uses to determine the iodine content in salt. This session was in the microbiology laboratory. Participants were shown the various chemicals and taught how to prepare the Iodine Working Solution, Solution A and Solution B. Two teams were formed, Team A and Team B, from the participants; each team was made up of six members. With the support of and under the supervision of the Consultant and Kinfe Wondimu, one of the facilitators from EFMHACA, the teams prepared their solutions. After the preparation of the various working solutions, participants were asked to use their solutions and a WYD Iodine Checker to checker the level of iodine in three different types of salt available.

To make participants more comfortable with the device use and the preparation of the various solutions, some time was devoted to calculations of the various quantities of chemicals used and the reasons why those quantities were used.

The third technical session was on the use of the Titration Method to determine Iodine Level in Salt. This started with a presentation by Mr. Lantider Kassaye of the EFMHACA. He started with some information on IDDs worldwide and Ethiopia in particular. He touched on the sources of iodine and how and why salt is iodized. He gave the scientific background to the method which is based on Iodometric Titration. He touched on the preparation of the various solutions which are used in the procedure including the laboratory equipment, materials and chemicals needed.

The fourth technical session was also in the microbiology laboratory. Participants were taken through hands-on training in the preparation of the various solutions. Afterwards, participants were allowed to use the Titration Method to determine the iodine level in the same samples of salt used in the second technical session (using the WYD Iodine Checker).

Appendix 3 gives the two technical presentations which were made.

OBSERVATIONS

The results from both teams when the WYD Iodine Checker was used on the various samples of salt were comparable; the minor variations can be attributed to errors which occurred when the solutions were been prepared.

The laboratory used was small and had only one set of equipment to be used to prepare the solutions; thus not every participant had the chance to prepare his or her own solutions.

Due to an error in the preparation of one of the key solutions needed for the titration method, the determination of iodine using the titration method was not possible. Therefore the initial intention to compare the two methods of finding the level of iodine in salt was not realized.

Participants were interested in understanding the theoretical calculations which specified the amount of each chemical to be used in preparing the solutions.

Course materials, mainly print-out of the presentations, were provided to the participants after the lectures; this ensured that participants took their own notes and concentrated on the presenters.

EVALUATION

An evaluation of the two sets of training, WYD Iodine Checker and Titration Method, was done by the participants. The results are compiled in Table 1 below.

Table 1: Summary of Course Evaluation

S.N.	Evaluation items	Rate				
		Strongly Agree	Agree	Neutral	Disagree	Strongly disagree
1	Training met my expectations	3	10	1		
2	I will be able to apply the knowledge learned	5	9			
3	The training objectives for each topic were identified and followed	5	9			
4	The content was organized and easy to follow	5	5	4		
5	The materials distributed were pertinent and useful	6	3	2	1	2
6	The trainer was knowledgeable	7	6	1		
7	The quality of instruction was good	7	7			
8	The trainer met the training objectives	6	7	1		
9	Class participation and interaction were encouraged	7	3	3	1	
10	Adequate time was provided for questions and discussions	6	4	3	1	
	Total	57	63	15	3	2

** Table prepared by Tena Yigeza, GAIN Associate, Ethiopia.*

Overall, five participants assessed the Course as excellent, seven assessed it as good and two thought the course was average.

Comments from the participants included:

- Materials were not prepared ahead of time
- Training duration was not adequate
- Reagents should be prepared for the training by the trainer
- The lab room was too small

CONCLUSIONS AND REMARKS

The course was useful in that it exposed the participants to two more reliable methods of checking the level of iodine in salt.

The various challenges in preparing the solutions also gave the participants the chance to experience the problems which may come up as they use the methods in their laboratories.

Though there were time and space constraints which made it impossible for individuals to try their hands, the participation of officers from the head office of EFMHACA in the training gives the trainees the necessary backup they may need from their head office. In that vein, it may be prudent to give one WYD Iodine Checker to the head office staff to practice with and be in a better position to support the regional branches.

Since the results of salt test by these participants will be of great importance, it is suggested that the participants be exposed to the salt industry, especially the salt iodization processes being used in Ethiopia so they can better appreciate their test results and give realistic interpretations.

The head office staff may have to prepare the solutions which may be used as standard solutions to be given with the WYD Iodine Checkers for initial use.

Appendix 1: List of Participants

S.N.	Name	Office	Tel. number
1	Mubarek	Hawassa	0913 25 59 83
2	Fekadu	Hawassa	0913 57 59 25
3	Hiaw H/Selassie	Mekelle	0914 72 38 69
4	Ewnet Temesgen	Mekelle	0911 81 87 44
5	Yared Ketema	Dire Dawa	0911 91 21 25
6	Deginet Bekele	Dire Dawa	0922 63 71 75
7	Bekalu Arega	Jimma	0913 11 01 53
8	Meseret Getachew	Jimma	0917 01 53 97
9	Getaneh Bayeleyegn	Bahir Dar	0918 01 10 24
10	Melese Engidayehu	Bahir Dar	0918 71 51 81
11	Yonatan Samuel	Central	0911 42 48 52
12	Kinfe Wondimu	Central	0913 00 08 54
13	Lantider Kassaye	Central	0911 48 34 10
14	Tamiru Tadesse	Central	0921 34 75 03
15	Tena Yigezu	GAIN Ethiopia	0913 11 00 67

Appendix 2: Programme for Training Course

Schedule for WYD & Titration Training

Organized Jointly by FMHACA, GAIN & UNICEF

Venue: FMHACA Lab

Date	Time	Activity	Responsible
Friday, 11/05/12	8:30-9:00	Registration	Facilitators
	9:00-9:10	Welcome Address	Ato Alem, GAIN CM
	9:10-9:20	Opening Remark	Ato Dawit Dikaso, Deputy Director General, FMHACA
	9:20-9:45	Status of Salt Iodization in Ethiopia	Ato Teshome, FMoh/UNICEF
	9:45-10:00	Status of Enforcement of Salt Legislation	Ato Dawit Dikaso, Deputy Director General, FMHACA
	10:00-10:30	Tea Break	Facilitators
	10:30-12:30	WYD Training Theory Presentation Demonstration/Testing using WYD	Andrews Quashie, GAIN Consultant
	12:30-2:00	Lunch	Facilitators
	2:00-3:30	WYD training continued Preparation of reagents Testing using prepared reagents	Andrews Quashie
	3:30-4:00	Tea Break	Facilitators
	4:00-5:00	WYD Training continued	Andrews Quashie
Saturday, 12/05/12	9:00-10:30	Titration theoretical training	Ato Lantider Kassaye, EFMHACA
	10:30-11:00	Tea Break	Facilitators
	11:00-12:30	Titration Practical Training	Ato Lantider Kassaye, EFMHACA
	12:30-2:00	Lunch	Facilitators
	2:00-3:30	Titration Practical Training continued	Ato Lantider Kassaye, EFMHACA
	3:30-4:00	Tea Break	Facilitators
	4:00-5:00	Titration Practical Training continued	Ato Lantider Kassaye, EFMHACA

Appendix 3: Presentation on WYD Iodine Checker

WYD Iodine Checker

by Andy Quashie
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Addis Ababa, May 2012

Introduction

- The WYD Iodine Checker was developed by the Salt Research Institute of the China National Salt Industry Corporation as a rapid tool to measure quantitative levels of iodine in salt.
- It is a small portable instrument and comes in a compact kit that includes a portable photometer, two 50 ml glass tubes, a set of plastic pipettes, empty plastic 'cells' and a power cord.

The WYD Iodine Checker

- The WYD Iodine Checker is a single wavelength photometer with an LCD readout that displays the iodine level in salt.
- The fundamental principle of the WYD Iodine Checker is based on 'luminosity', where a small amount of iodized salt is dissolved in distilled water, two solutions are added to cause an iodine-starch compound to form leading to a colour change.
- This liquid is then placed in a small plastic vial and inserted in a well on top of the machine, with a cap screwed on so that the colour can be read by the photometer at a wavelength of 585 nm.
- The photometer is used to measure the shade of the blue colour which is converted to an iodine concentration, with the intensity reflecting the concentration of iodine in the salt. The range for the test is between 10 and 90 ppm (mg/kg).

- The WYD Checker requires the use of two reagents: a starch-based solution (Solution A); and a sulfuric acid solution (Solution B).
- When a kit is purchased, there are 100 ml bottles of each solution, which can test about 45 to 48 samples. Thereafter more reagent can be purchased from the suppliers of the WYD checker or prepared locally

Specifications

Calibration

One of the most critical steps in preparing the WYD Checker for operation is calibration.

- The first step is to place distilled water into the clear plastic vial provided which is then inserted in the well in order to establish a 'zero-point' calibration.
- Second, using a 'standard' solution, the machine is adjusted using keys on the LED display to read 50 ppm.
- Following this, a grey glass is placed in the well to determine the wavelength identified and this value is used as an external control to verify the validity of the calibration of the machine.
- *It is important for the machines to be re-calibrated at least once a month, especially if conditions in which the machine is operating change as the calibration of the kit will be affected by any change in temperature of ±5°C or if there is a change in the type and quality of water used.*

Calibration Solution

Machine Calibration

Salt Sample preparation

Trouble-Shooting

General Use and Maintenance

- To prevent contamination problems and to ensure proper functioning of the instrument and other necessary equipment (e.g. analytical balance), the WYD Checker should remain in a central field location for salt sample testing. It is important that the machine is placed in a well-ventilated area on level surface. After each use, all dust, salt and liquid should be wiped off the machine. Avoid spilling liquids on the machine as much as possible.

Local Preparation of Solutions

- To ensure uninterrupted use of the WYD Iodine Checker here, the main reagents needed, Standard Solution, Solution A and Solution B should always be available.
- The second part of the training will focus on how to prepare these solutions in our various laboratories.

List of Chemicals needed

Name	Symbol

Equipment needed

- An analytical Balance reading to four decimal places
- Pipettes (10 mls, 5 mls, 2 mls, 1 ml)
- Spatula
- Beakers (100 mls, 200 mls, 500 mls)
- Hot plate (with magnetic stirrer)
- Reagent bottles (for storage)
- Conical Flasks
- Volumetric Flasks (500 mls)
- Measuring cylinders (250 mls)
- Stop clock
- Oven (50 °C – 200 °C)
- Refrigerator

Standard Solution

KIO_3 (potassium Iodate) Standard (1000 µg/ml)

- Take 5 g KIO_3 (Potassium Iodate)
- *Dry at 100 – 110 degree Celsius (°C) for 3 hours*
- Weigh 0.8432 g dried KIO_3 (Potassium Iodate)
- Dissolve in 500 ml distilled water.

Iodine Working Solution

Iodine Working Solution (10 µg/ml)

- Take 5.0 ml KIO_3 (Potassium Iodate) Standard Solution
- add 180 g refined Sodium Chloride (NaCl)
- add 0.5 g Na_2CO_3 (Sodium Carbonate).
- add distilled water to make 500 mL
- Shake the solution thoroughly.
- *This solution can be used within 6 months.*
- *5.0 ml of solution equals the content of 50 mg/kg (or 50 ppm) in the iodized salt sample.*

Solution A

KI (Potassium Iodide) – Starch soluble (Solution A)

Make solution A in a sterilized container

- Boil about 250 ml of distilled water.
- Into 200 ml of boiling distilled water, add 2.0 g of soluble starch and stir thoroughly.
- *Do not add starch into distilled water until it is boiling vigorously.*
- Maintain boiling for two minutes (heat to above 100 °C).

After cooling,

- Add 1.0 g KI (Potassium Iodide).
- Add 20.0 g $K_2HPO_4.3H_2O$ (di-potassium hydrogen orthophosphate trihydrate)
- Add 1.0 g $Na_2B_4O_7.10H_2O$ (di-sodium tetraborate)
- Mix thoroughly.

Notes for Solution A

- This solution can be stored in a bottle for 6 months.
- If possible, store under refrigeration or in a temperature range of 4 – 20 °C.
- In warm weather, store in the fridge.
- Solution A is the primary reagent used, and proper storage and quality is essential for accurate results.

Solution B

H_2SO_4 (Sulfuric Acid) 1 mol/L) (Solution B):

- Add/mix 11 ml H_2SO_4 (Sulfuric Acid)
- To/with 150 ml distilled water evenly.
- *Please note that when preparing the sulfuric acid solution, it is critical that the acid be added to the water slowly.*

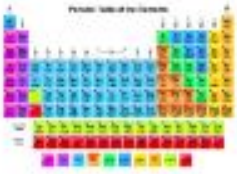
Notes for Solution B

- As sulfuric acid is a hazardous material, handling and proper disposal is necessary of this chemical plus any leftover reagents, standard solution and sample specimens.

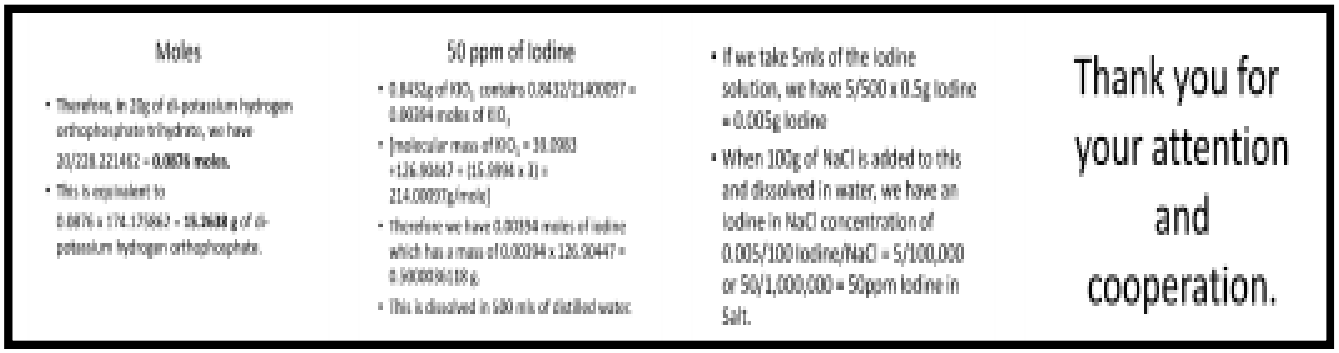
Calculations

Assuming you have the anhydrous form of a particular chemical, for eg. di-potassium hydrogen orthophosphate, how can you calculate the amount to use?

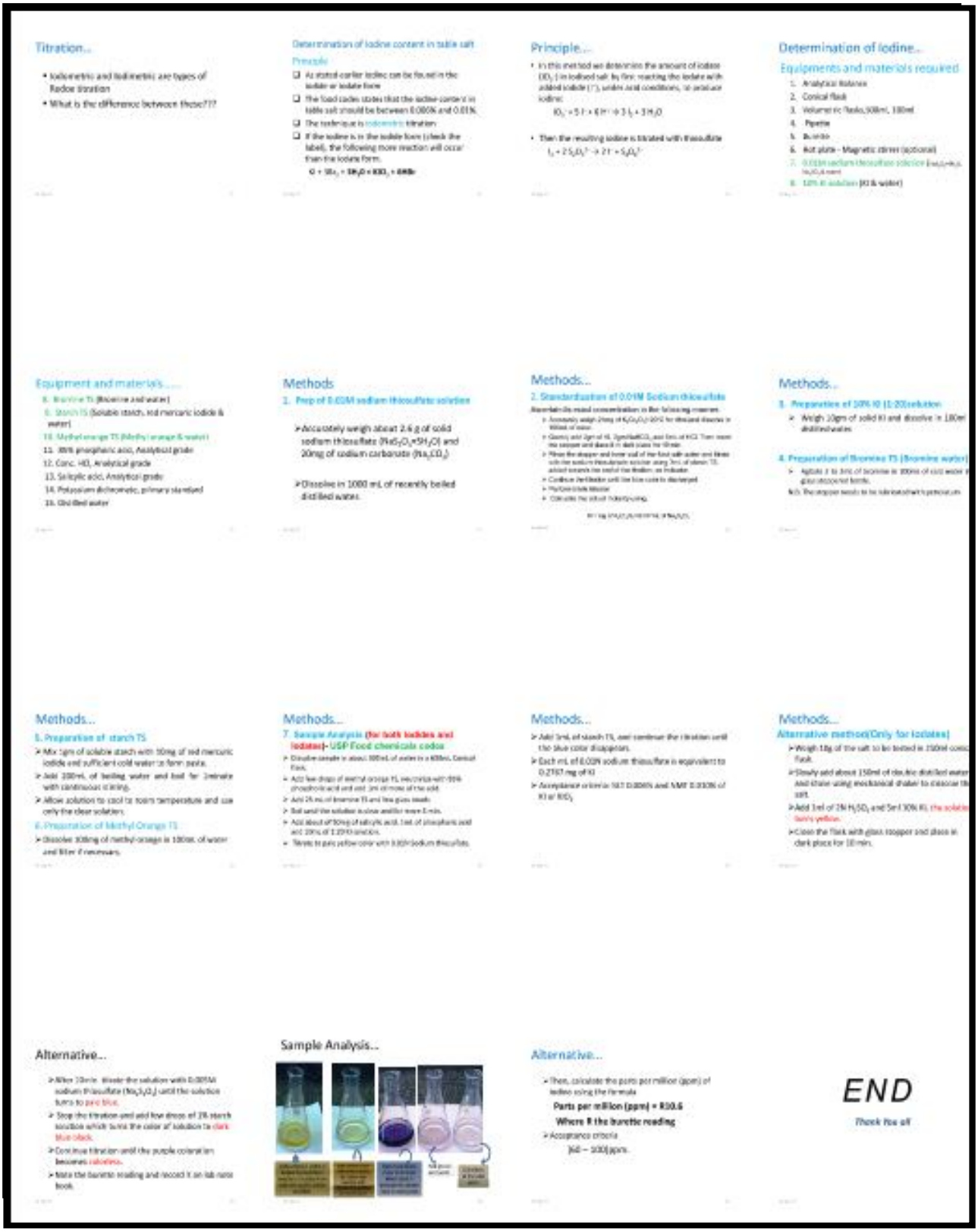
The Periodic Table



Molecular masses


Moles
• Therefore, in 10g of di-potassium hydrogen orthophosphate trihydrate, we have 10/228.221482 = 0.0876 moles.
• This is equivalent to 0.0876 x 174.175667 = 15.2648 g of di-potassium hydrogen orthophosphate.
50 ppm of Iodine
• 0.8452g of KIO_3 contains 0.8452/214.00997 = 0.00394 moles of KIO_3
• [molecular mass of KIO_3 = 39.0983 +126.90847 + (15.9994 x 3) = 214.00997g/mole]
• therefore we have 0.00394 moles of iodine which has a mass of 0.00394 x 126.90447 = 0.5000196108 g.
• This is dissolved in 500 mls of distilled water.
• If we take 5mls of the iodine solution, we have 5/500 x 0.5g Iodine = 0.005g Iodine
• When 100g of NaCl is added to this and dissolved in water, we have an Iodine in NaCl concentration of 0.005/100 Iodine/NaCl = 5/100,000 or 50/1,000,000 = 50ppm Iodine in Salt.
Thank you for your attention and cooperation.

Appendix 4: Presentation on Titration Method



Appendix 5: Training in Pictures

Mr. Bikila Bayssa, Dir. Quality Assessment Directorate, EFMHACA giving his Introductory Remarks

Mr. Alem Hadara, GAIN Country Director, Ethiopia giving his speech.

Mr Dawit Dikaso, Deputy Director General, Regulation and Enforcement, EFMHACA, delivering his Welcome Address.

Mr Teshome, FMoH/UNICEF giving his presentation

Mr. Tena Yigeza, GAIN Associate, Ethiopia listening with rapt attention to the presentations

Section of participants listening to presentations

Andrews Quashie, GAIN Consultant explaining a point to some participants during practical session.

Participants preparing solution under instruction.

Participant seeking clarification of a point.

Analysts Kinfe and Lantider of EFMHACA facilitating the practical sessions

Participants listening to instructions before preparing solutions

Heran Gerba, Case Team leader, EFMHACA, observing the practical session.