

MANUAL FOR INTERNAL MONITORING OF WHEAT FLOUR (Quality Assurance and Quality Control, QA/QC)

Introduction

Wheat flour producers and importers need to ensure that their flour meets the standards for wheat flour fortification in the Solomon Islands, as detailed in the Pure Food (Food Control) Regulations.

Wheat flour fortification requires the implementation of Quality Assurance and Quality Control (QA/QC) activities at a mill to ensure flour meets the Solomon Islands' national standards. Simple processes for fortification can be added to a mill's existing QA/QC activities.

Wheat flour fortification requires the support and commitment of general management to provide the human and financial resources necessary to implement and maintain the QA/QC activities. Corrective or preventive actions need to be implemented if problems are identified in the QA/QC system.

Overview

This manual describes the steps to assure the quality of wheat flour fortified in the Solomon Islands. It covers the receipt and inspection of the premix, the wheat flour fortification process, and quality control of the fortified wheat flour. It includes a spot test method to determine if iron was added to the wheat flour (a timely verification for a mill that micronutrient premix is being incorporated into its flour). It also outlines a composite sampling method.

This manual recommends that mills in the Solomon Islands undertake daily iron spot tests. It recommends that composite samples be sent to a reliable external laboratory once a quarter to analyse iron and folic acid.

National health authorities from the Ministry of Health and Medical Services will visit wheat flour mills in the Solomon Islands at least once a year to carry out technical audits and inspection of the fortification process and product. Their activities will focus mainly on checking mill records and documentation. Therefore, it is important for mills to keep in mind that "what has not been recorded has not been done".

The following sections are included in this manual:

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Acknowledgement

This manual draws on the manual developed by the East, Central and Southern African Health Community Secretariat in 2007.

A. QUALITY ASSURANCE OF PREMIX RECEIPT, STORAGE AND DELIVERY

I. Objectives and Accountability

The objectives of the quality assurance of premix receipt, storage and delivery are to ensure that:

- The factory always has enough supply of premix in properly labelled bags to maintain production.
- Vitamin and mineral premix contain the micronutrient levels declared in the label as verified in the Certificate of Analysis.
- The premix is stored under suitable conditions and is used on the “first-in, first-out” (FIFO) basis.

Persons directly responsible for this activity are the *Warehouse Manager* and the *Head of the Quality Control Department*, who should inform the *Plant Manager* periodically, upon reception of premix or whenever internal checks of storage conditions are done.

II. Procedure

a. Reception and Storage (warehouse)

1. Every time a new shipment of premix is received, check that it is in accordance with the quantity and type indicated in the purchase order. Check that the boxes are not damaged and they are properly labelled (i.e. the following information is included: name of manufacturer and address, lot number, best use by date, list of ingredients using the chemical names, micronutrient content and net weight).
2. Check that the results of the Certificate of Analysis correspond to the lot number of the premix delivered to the factory. The Certificate should report results for every micronutrient in the premix. Results for moisture, granulometry and other parameters may also be included in the Certificate by the manufacturer.
3. In addition to the Certificate of Analysis, a Specifications or Fact Sheet should be included with each shipment. This sheet should contain the following information: Name and address of manufacturer, contact information, lot number, recommended mixing rate of the premix to flour, levels of micronutrients added at the recommended mixing rate, handling instructions and safety precautions.
4. **Table A-1** presents a form to record inspection of the incoming premix. If the lot meets the specifications, accept it and record the quantity of premix received. When a box is damaged and this might harm the integrity of the premix, contact the supplier to return and replace it.
5. Store the premix on top of palettes made of a suitable material, in a cool dry place, separated from potential contaminants. Arrange the stacks to deliver premix on a “first-in, first-out” basis.

b. Delivery (warehouse)

6. When premix is dispatched for flour fortification, record the date of dispatch and name of the person who is receiving the order, as shown in **Table A-2**. Keep the inventory records up to date.
7. Send a copy of the log form quarterly to the *Quality Control Department* and the *Production Manager*.

c. Bag Receipt (warehouse)

8. When the order of new bags is received check that the label is adequate and complies with the specification. Record amount, and keep daily track of the balance.

B. QUALITY ASSURANCE OF THE WHEAT FLOUR FORTIFICATION PROCESS

I. Objectives and Accountability

The purpose of the quality assurance of the wheat flour fortification process is to ensure that:

- Premix is continuously and properly added to the unfortified wheat flour.
- The feeder is working consistently and the amount of premix discharged is in accordance with the flow of wheat flour.
- The ratio of wheat flour produced/premix used is close to the theoretical ratio calculated.

Persons directly responsible for this activity are the *Production Personnel* assigned to the area where fortification is taking place, with supervision by the *Quality Assurance Department*, and daily or weekly reporting to the *Production Manager*.

II. Procedures

a. Beginning of the shift

1. Check that there is enough premix to use during the shift and that the premix container is properly closed.
2. When a new box is opened, check that the premix is free of lumps, is not physically contaminated and that the colour is not different from other batches. If a problem is found, contact the *Production Manager*.
3. If the feeder does not automatically adjust when flour flow changes, prepare a table with the amount of premix the feeder has to discharge at different flour flows. This table should be available for the operators in charge of checking the feeder.
4. Feeder verification: Check the feeder at least once every shift or as needed during the day. Collect the amount of premix the feeder discharges in one minute. Repeat this step three times when the feeder is checked, so three portions of premix are collected.
5. Weigh the three portions of premix and calculate the average.
6. Compare the amount of premix discharged by the feeder expressed in (g/min) to the theoretical amount that should be added according to the current flour flow in the mill.
7. If the amount discharged does not coincide with the theoretical one, adjust the feeder and repeat steps 4 to 6 again to verify the adjustment.
8. Record results in **Table B-1**. Keep the records up to date and be ready to show them to the *Quality Control Department* when required.

b. During the shift

9. Check that the feeder is loaded with enough premix and it is working properly. It is recommended to install electrical interlocking systems to stop the feeder automatically when the flour flow stops, in order to avoid premix waste and over fortification.
10. Take a 250g sample of flour once a day for the iron-spot test (see **Section D**), to check that the micronutrient premix is being delivered.
11. Report any abnormality to the *Production Manager*.

c. End of the shift

12. Record in **Table B-2** the amount of flour produced and the quantity of premix used during the shift.
13. Calculate the ratio of flour produced/premix used. Record the ratio in **Table B-2**. Data should always be ready to show to the *Quality Assurance Department* when requested.
14. Once a week, collect a 500g flour sample. Label it with the date and store in an air-tight and opaque container in the sample store room.

III. Records and Reporting

The *Production Manager* should update and file the records of feeder verification, amounts of flour produced and amounts of premix used, and description of actions taken during production to keep the fortification process performing as expected. The *Quality Assurance Department* verifies the amount of flour produced and amount of premix used from the production records. A copy of these should be kept along with the quality control ones.

C. QUALITY CONTROL OF FORTIFIED WHEAT FLOUR

I. Objectives and Accountability

The purpose of the quality control of the fortified wheat flour is to ensure that:

- Wheat flour samples are collected and tested to verify product is fortified as per the national standards.

The *Quality Control Department* has direct responsibility of this component, and should send daily reports to the *Production Manager*.

II. Procedures

a. Supervision and sampling (By personnel from Quality Control Department)

1. Make unannounced visits to the fortification place for checking that the feeder has been calibrated, it contains a proper level of premix and it is working properly. Sign the **Table B-1** and **B-2** to record completion of this supervision.
2. Ensure that personnel in the packaging site are taking 250g samples of the fortified flour once a day for the iron spot test, to confirm that the premix is being blended with the flour.
3. Ensure that personnel in the packaging site are taking 500g samples of the fortified flour every week, to be used for preparing monthly composite samples.
4. Once a month, mix four weekly 500g samples to create a monthly composite sample. Retain 1kg of this monthly composite sample. Label it with the date and store in an air-tight and opaque container in the sample store room.
5. Once a quarter, mix three monthly composite samples to create a quarterly composite sample. This will create a sample of 3kg. Label it with the date and store in an air-tight and opaque container in the sample store room. Retain the quarterly sample until a new, more recent quarterly sample can replace it. 500g of the quarterly sample should be used for laboratory testing (see **III Records & Reporting**), and 1kg should be provided to the Ministry of Health and Medical Services in the event of an inspection visit. At least 500g of the remaining flour should be retained by the mill for its own records.

b. Iron spot test

6. Once a day, carry out the iron spot test using the 250g daily sample of fortified flour (See **Section D** for the method). Record results in **Table C-1**.

c. Corrective actions

7. If abnormalities are found, discuss immediately with the *Production Supervisor* the measures to be implemented to correct them.

III. Records and Reporting

1. Review **Table B-2** and **Table C-1** and report any areas of concern.
2. Once every quarter, send a composite quarterly sample to an external reference laboratory for the quantitative determination of iron and folic acid.
3. Review and file the external laboratory's findings.
4. Send reports to the *General Manager* that include the overall performance of the fortification process, results from the external laboratory, problems found and corrective or preventive actions taken.

D. SPOT TEST FOR IRON IN FLOUR

AACC Method 40-40

IRON-QUALITATIVE METHOD

Scope

Applicable to iron fortified wheat flour.

Reagent

1. 2N HCL
 - Can also create 2N HCL from concentrated HCL 37%:
 - 100 mL distilled water + 17 mL HCL + 83 mL distilled water = 200 mL HCL 2N
 - **Warning – always add acid to water, not vice versa.**
2. Thiocyanate reagent. Dissolve 10 g KSCN in 100 ml distilled water. Mix with equal volume of 2N HCL just prior to use.
3. Hydrogen peroxide 3%.
 - Can also create 3% from concentrated hydrogen peroxide 30%:
 - Mix 15mL in 500 mL distilled water

Procedure

Make a flat surface of the fortified flour by pressing down with a flour slick, spoon, the bottom of a small beaker or any suitable smooth surface. Drop a few mls of the freshly mixed thiocyanate reagent onto the surface followed by a few mls of the hydrogen peroxide sufficient to wet an area approximately 1 inch in diameter. Let stand at least 10 minutes under observation.

If added iron compounds are present they will show up as red spots on the surface. Reduced iron shows up as small dots that take time to appear. Ferrous sulfate shows up as larger spots that appear more quickly. The density of the spots provides an estimate of how much iron was added, which is best done by comparison to flours having known levels of added iron.

Reagent preparation and storage

The two solutions for the thiocyanate reagent can be prepared in advance and stored in separate bottles as stock solutions. These can be kept for a month.

The solutions should be freshly mixed each day to create the thiocyanate reagent. It can be stored for 24 hours.

Ideally all reagents should be kept in an air conditioned room.

Reference

Schlesinger, H. I., and Van Valkenburgh, H. B. 1931. The structure of ferric thiocyanate and the thiocyanate test for iron. J. Am. Chem. Soc. 53:1212.

Table A-1: Inspection form for incoming vitamins and mineral premix

Product: Vitamins and mineral premix	Purchase order #:
Manufacturer:	
Inspected by:	Date:
Specifications	Observations
Quantity:	
Integrity of boxes: Y / N (please circle)	
Lot number: Y / N	
Production date: Y / N	
Micronutrient levels in label: Y / N	
Certificate of analysis: Y / N (results for every micronutrient)	
Other	
Accepted or Rejected (please circle)	
Reasons for Rejection/Actions taken	
Reviewed by:	Date

Table A-2: Vitamins and mineral premix inventory control log

Page No. _____

Date	Time	Received			Dispatched		Balance (C)	Observations/QA Review (name and signature)
		Quantity (kg) (A)	Lot ID	Expiry date	Quantity (kg) (B)	Lot ID	(C)=(A)-(B)	

Date of reporting: _____
 Signatures: _____

Table B-1: Feeder flow control for fortified wheat flour

Feeder Location:	Page No:
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Date	Shift (time)	Production rate (MT/hour)	Theoretical feeder flow (g/min)	Feeder flow (g/min)*				Adjusted (Yes or No)	Responsible	Observations/QA Review (name and signature)
				1	2	3	Average			

NB: This table should be kept near to the feeder site. Once a sheet is full, it should be sent to the Quality Assurance Department.

*Feeder flow (g/min) =MT/hour x 100/6

Table B-2: Production log of fortified wheat flour

Production line:	Page No:
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Shift (time)	Flour produced		Premix used (kg) (B)	Flour/premix ratio (A/B)	Responsible	Observations/QA Review (name and signature)
	MT (A)	Lot ID				

Table C-1: Quality control log for fortified wheat flour

This table can be incorporated into existing QC sheets that the mill may already use for measuring quality parameters such as protein, ash and moisture

Date	Shift	Iron spot test results (please tick)*		Responsible	Comments
		Adequate	Inadequate		

*An adequate result is when the test indicates the presence of iron