CSIR-FRI/RE/G-AM/2009/019

REPORT ON PRELIMINARY INVESTIGATION ON THE SHELF LIFE STABILITY OF MORINGA OLEIFERA LEAF POWDER

Mary Glover-Amengor

REPORT ON PRELIMINARY INVESTIGATION ON SHELF LIFE STABILITY OF MORINGA OLEIFERA LEAF POWDER

BY

MRS. MARY GLOVER-AMENGOR

March 2009

Report on preliminary investigation of shelf-life stability of *Moringa oleifera* leaf powder

1.0 Introduction

Moringa oleifera also referred to as "The Miracle Tree", horseradish-tree and drumstick- tree, is one of about thirteen plants in the *Moringaceae* family. It is a leafy vegetable with high contents of protein, vitamins A, B, C and minerals. *M. oleifera* leaves are reported to contain 3 times the Potassium in bananas; 4 times the Calcium in Cow's milk; 2 times the protein of yoghurt; 4 times the vitamin A of carrots and 7 times the vitamin C of oranges Fuglie, 1999, Babu, 2000). It is therefore not surprising that ancient medicine claims that *M. oleifera* leaves prevent 300 diseases and cure 67 Fahey, 2005), because good nutrition promotes good health. Nutrients are also concentrated in the pods of the plant. *M. oleifera* leaves are also high in iron content but low in phosphorus (Jongrungruangchok *et al*, 2010).

In Senegal and Haiti, health workers treat malnutrition in young children with *M. oleifera* powder; they also give the powder to pregnant women and nursing mothers. One rounded tablespoonful (8g) of *M. oleifera* leaf powder will satisfy about 14% of the protein, 40% of the calcium, 23% of the iron, and almost all the daily vitamin A needs of a child 1-3 years old (Saint Saveur (de), and Broin, (eds)., 2010). In the Phillipines, *M. oleifera* is prescribed for anaemia (Fuglie, 1999). *M. oleifera* is therefore becoming a plant of high economic value, and one of the organizations that promote the use of *M. oleifera* is the MORINGANEWS.

Dr Armelle de Saint Sauveur, consultant to MORINGANEWS made a mission visit to Ghana from November 21st to November 26th, 2007 with a general objective to help standardize and legalize the trade of *M. oleifera* leaf powder in Ghana.

The specific objectives of the mission visit were:

1. Erase the obstacles that hinder the certification of the product by the FDB
2. Identify the needs of the Moringa Association of Ghana (MAG) to carry out its role as a professional organization

She met representatives of the stakeholders in the food industry notably, Food and Drugs Board, Ghana Standards Board, Food Research Institute, Centre for Scientific Research into Plant Medicine, School of Business, University of Cape Coast as well as representatives of MAG and its entire membership.

During the meeting with CSIR-FRI, it was identified that the missing data for the Product Standardisation can be found if the Food Research Institute conducted a few tests.

Consequently, MAG engaged the CSIR-FRI to offer services leading to the establishment of optimal drying temperature and packaging material to maximise *M. oleifera* le af powder shelf-life.

The overall objective was: To establish the optimal drying temperature and packaging material to maximise *M. oleifera* leaf powder shelf-life.

Specifically,

a. To determine the optical conditions (method, temperature and humidity) for drying *M. oleifera* leaves and conserving the maximum nutrient
b. To investigate the best packaging material to conserve nutrients during storage
c. To investigate the shelf-life stability of *M. oleifera* leaf powder according to drying method and packaging.

2.0 Methodology

M. oleifera leaves were harvested from an acre field in the Accra metropolis, Ghana. The leaves were harvested at 2- week intervals from the one-acre field. The field was divided into three segments. Each segment was randomly sampled during a visit.

- Harvesting was done early in the morning before 7 am. The harvested leaves were transported in an ice-chest and quickly transported to CSIR-FRI to prevent moisture loss.

- At each harvest, leaves were divided into four parts; Three out of four parts were treated with 1% saline for 3 min, after initial washing to remove dust. Leaves were rinsed with water to remove residual salt.

One part each of the leaves was dried at room temperature (28-31°C), in a solar dryer (35-55°C) or in a mechanical dryer (50°C and 55°C). The fourth part was used for fresh leaf analysis. The parameters that were determined were:

Moisture
Proteins
Vit A
Vit C
Vit E
Vit B1 and B6
Colour
pH
Water activity
Mould and yeast
Mycotoxins

After the initial analysis of the dried products and fresh leaves, and based on the nutrient outcome, solar drying using a constructed dryer was selected for the shelf-life study. This is because the solar dryer is cheaper to run and it also offered convenient storage conditions as the mechanical dryer (FDGS 998, FDGS 999).

The solar dryer is a GIZ constructed one that was constructed with opaque polythene material to exclude UV penetration. The project started in the last week of March 2009 and run into May. The humidity range during that period was 75-85% in the coastal belt.

Three packaging materials were selected. These were high density and low density polythene material, and aluminium foil. Leaf powder was weighed into these materials and sealed off.

These were then put into a paper bag that was glued at its mouth. The bags were left in a shelf at room temperature (28-31°C). After the initial analysis, samples were withdrawn at 2-month intervals for nutrient analysis.

3.0 Result and Discussion

The results of the study are shown in table 1

Shelf-life	(solar drying)									
		Aluminium foil			**LD PET**			**HD PET**		
Time	0	2 months	4 months	6 months	2 months	4 months	6 months	2 months	4 months	6 months
water content (%)	7.40	13.6	13.7	14.1	9.5	10	13.3	12	12.5	13.9
proteins (%)	25.00	25	25	25	25	25	25	25	25	25
vitamin C (mg/100gDW)	14.0	7.8			7.3			10.5		
beta-carotene (mg/100gDW)	56.0	57	53	25	39	35	35	34	26	38
alhpa-tocopherol (mg/100gDW)	200.	215	175	175	147	102	106	118	100	91
pH	5.27	5.23	5.33	5.40	5.13	5.34	5.39	5.16	5.41	5.48
mould and yeasts	$2.3x10^3$	250	320	315	$1.2x10^3$	743	740	743	300	351
Aflatoxin	0	0	0	0	0	0	0	0	0	0

The moisture content increased regardless of the packaging material used, and was almost double that of the initial value after six months.

The protein content did not vary with time at least after six months of storage

The vitamin C content decreased quickly upon storage and could be halved after only two months of storage

The level of lipid-soluble vitamins (beta carotene and alpha-tocopherol) could be reduced by half after six months.

4.0 Conclusion and Recommendations

Moringa leaf powder could be produced and stored for up to six months without any changes in the protein content of the leaf powder, whilst the lipid-soluble vitamins could be reduced by half. Vitamin C levels could reduce rapidly and could be lost after two months. For better preservation of lipid-soluble vitamins, it is recommended that a packaging material that is water-proof, air-

proof and light-proof is used. The study should be extended to cover one year. If favourable, this could provide the opportunity to processors to make use of the abundant sunlight during the dry season (Dec-Mar) to produce the powder for a year- long storage.

5.0 References

Babu Suresh Chamba. Rural nutrition intervention with indigenous plant foods – a case study of vitamin A deficiency in Malawi.Biotechnol.Agron. Soc. Environ 4(3), 2000 169-179.

Fahey J.W. *Moringa oleifera*: A review of the Medical Evidence for Its Nutritional, Therapeutic and Prophylactic Properties, 2005. Part 1. Trees for Life Journal. www.TFJournal.org

Fuglie LJ (1999). The Miracle Tree: *Moringa oleifera*: Natural Nutrition for the Tropics. Church World Service, Dakar. 68 pp.; revised in 2001 and published as The Miracle Tree: The Multiple Attributes of Moringa, 172 pp. http://www.echotech.org/

Ghana Standard..Medicinal Plants – Specifications for *Moringa* Leaf Products. FDGS 998

Ghana Standard..Medicinal Plants – Code of Practice for the production *Moringa* leaf products FDGS 999

Jongrungruangchok S, Bunrathep S and Songsak T. Nutrients and Minerals Content of Eleven Different Samples of *Moringa oleifera* Cultivated in Thailand.J Health Res 24(3) 2010, pp 125.

Khalafalla MM, Abdellatef E, Dafalla HM, Nassrallah AA, Aboul-Enein KM, Lightfoot DA, El-Deeb FE and El-Shemy HA. Active principle from *Moringa oleifera* L am leaves effective against two leukemias and a hepatocarcinoma. African Journal of Biotechnology Vol 9(49) 2010, pp 8467.

Saint Saveur, Armelle (de), Broin, Melanie (eds). MORINGA Growing and processing moringa leaves. Moringanews/ Moringa Association of Ghana. 2010, 15-29.

EDITORIAL COMMITTEE OF CSIR-FOOD RESEARCH INSTITUTE