

BUSITEMA UNIVERSITY
FACULTY OF ENGINEERING
DEPARTMENT OF AGROPROCESSING
ENGINEERING

DESIGN AND CONSTRUCTION OF SILVER FISH SOLAR DRYER

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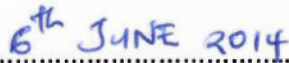


**SUBMITTED IN PARTIAL FULFILLMENT OF AN AWARD OF A
BACHELOR OF SCIENCE IN AGROPROCESSING ENGINEERING**

DECLARATION

I, *Nakintu Miriam Grace* hereby declare that this is an original copy of the research I conducted in reference to my project for design and construction of a low cost silver fish solar dryer and is submitted in partial fulfillment of an award of a Bachelor of Science in Agro Processing Engineering.





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DEDICATION

I dedicate this report to my dear Sponsor Hon. Gerald Wilson Mukasa and my brother Dr. Ssinabulya Isaac, you are the reason I've come this far

ACKNOWLEDGEMENT

Numerous individuals have been such a shoulder to lean on during the preparation and development of this report.

I wish to express my sincere gratitude to my supervisors Mr. Kilama George and Mr. Kavuma Chris, who generously shared their professional knowledge and guided me on the expected output and yet with a lot of patience. God bless you abundantly

I owe special thanks and gratitude to my family especially my sisters Phoebe and Catherine, and friends for the support rendered towards me. The project would not have been the way it was, but because of you, it was successful. You have made my life a lot easier and you gave me a reason to work hard. I will forever be grateful and may the Good LORD bless you abundantly.

Above all, I thank the Almighty God whose sufficient grace and love led me through the research, for the good health, provision and daily protection. I cannot thank Him enough.

APPROVAL

This report is an original copy of the research for the design and construction of a low cost silver fish solar dryer carried out under my supervision and is submitted in partial fulfillment of a Bachelor of Science in Agro Processing Engineering.



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Date

ABSTRACT

This is the general over view of this research proposal carried out with the aim of designing and construction of a low cost silver fish solar dryer.

Chapter one covers the introduction of the proposal which includes the background of the research talking about Silver fish and how it has been handled in the various years. The introduction also contains the problem statement and the objectives together with the justification and scope of the proposal.

Chapter two contains the literature review showing the ways how silver fish has been handled and the methods of drying which include open air drying which wasn't so efficient since it exposed the silver fish to contaminants and had a long duration of drying thus lowering the quality of silver fish.

Chapter three shows the methodology which encompasses the design and construction steps of the solar dryer and the materials to be used in construction and the mechanism of drying.

Chapter four talks about the data analysis, results and discussions from the design and construction of the solar dryer and the comparison made between solar drying and traditional sun drying.

Chapter five contains the conclusions and recommendations that is the conclusions on the use of the solar dryer as compared to traditional drying. It also contains the recommendations for use of solar dryers given the benefit-cost ratio of 1.12, payback period of 9 months.

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ACRONYMS

MC Moisture content

FAO Food and Agriculture Organisation

BOU Bank of Uganda

MAAIF Ministry of Agriculture, Animal Industry and Fisheries

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CHAPTER ONE

1.0 INTRODUCTION

Silver fish also known as Silver cyprinid and mukene in Uganda, Omena in Kenya and Daga in Tanzania is eaten in dried form mainly by poor and middle-income groups throughout East Africa. Sun dried Mukene is the most widespread fish harvested from Uganda's lakes. Significant quantities of the fish are exported to markets in the Democratic Republic of Congo and Sudan. Dried Mukene has a comparatively long shelf-life and can be easily be divided into small portions at point of sale, meaning that it can be had at prices affordable for many who otherwise could not afford fish as in the recent years been considered a poor man's diet (Vision, 2010)

The fisheries department under the Ministry of Agriculture, Animal Industry and Fisheries (MAAIF) has embarked on a move intended to ensure that silver fish (Mukene) gains prominence on the menu in most homes and hotels as well as earn more income for the fishing community. This can be achieved by making silver fish more appetizing by handling it properly through proper drying. Proper drying can be through use of solar dryers whereby contamination is reduced thus attracting a wider market for the mukene.

Edward Rukuunya, the principal Fisheries Officer in the Fisheries Department, says that for long silver fish popularly called Mukene or Omena has been considered to be a dish for the poor that could only be found in low scale markets or for use as animal feed.

He, however, says that as part of the new initiative, they have developed many products of the fish with added values. The new products include chips-mukene, sweet mukene, simsim mukene and powdered mukene. Unlike the whole fish Mukene that was previously found only mostly in low scale markets, the new products have quickly found their way to supermarket shelves within and outside Uganda.

Rukuunya explained that they made the initiative after realizing that while most of the fish stock was declining, Mukene and other small fish species such as Muziri and Rugoogi were

REFERENCES

- Kabahenda, M. O. (2009). *Post-harvest handling of low-value fish products and threats to nutritional quality*. Kampala: MK Publishers.
- FAO/UN, *Fish and fuel, food and forests: Perspectives on post-harvest losses in Uganda*, Fishing Project: P O Box 521, Kampala, Uganda.
- Muhlbauer, (1986). Design of a biomass burner for thermal backup of a solar dryer. *Journal of applied sciences* , 1926-1936.
- Bala, 1. &. (1997). *Solar drying of fruits, vegetables spices and fish*. Bangladesh: Bala and janjai.
- Trim, 1. (1985). *A Manual*. Ireland: Norton and company.
- Bradbury et al. (1988). *Global Bio diversity*. Ankas: Catalogue of Life.
- Youcef-Ali et al., (. (2001). *Design, Construction and Performance of a solar dryer*. Cairo: Elamin Akoy.
- Duffie and Beckman, 1. (1974). *Thermal theory and modelling of solar collectors*. New York: Wiley, 1974.
- Sodha et al., 1. (1987). Design and measured performance of solar chimney for Natural Circulation Solar energy dryers. *Solar energy Engineering* , 69-71.
- Sukhatme, 1. (1996). *Principles of thermal collection and storage*. New Dehli: Mc Graw Hill.
- Brooker et al., 1. (1992). *Preserving quality during drying*. New York: Mc Graw Hill.
- Hernandez et al, 2. (2000). Journal of Biological sciences. *Biological sciences* , 510-513.
- Earl, 1. (1986). *Solar angle of Tilt*. New York: Mc Graw Hill.
- Werner, et al. (2000). *Intensification of air flow*. Ohio: Mc Graw Hill.
- Greensmith, M. (. (1998). *Practical Dehydration*. Ohio: Woodhead Publication Ltd.
- New Vision, . (2010, August 8th). Why Silver fish beats red meat. *Diet*. Kampala, Central, Uganda: Vision Group.
- Uganda, B. o. (2014, April 2nd). *Bank of Uganda Rates*. Retrieved April 14, 2014, from www.bou.or.ug: www.bou.ug/bou/rates