



**BUSITEMA  
UNIVERSITY**  
*Pursuing Excellence*

**FACULTY OF ENGINEERING**

**DEPARTMENT OF CHEMICAL AND PROCESS ENGINEERING**

**FINAL YEAR PROJECT**



**EXTRACTION OF SUNFLOWER OIL USING LIQUID CARBON DIOXIDE**

**BY**

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*A final year project report submitted to the Department of Chemical and Processing Engineering as a partial fulfillment of the requirements for the award of a Bachelor of Science degree in Agro-Processing Engineering.*

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## **ABSTRACT**

This study highlights generally the process of extraction of sunflower oil using liquid carbon dioxide. The available methods of sunflower oil extraction are associated with some problems; the mechanical pressing method involves a lot of drudgery and gives low oil recovery rates and the solvent method is associated with residual problem in the extracted oil and also leads to loss of some nutrients like free fatty acids, phospholipids, polyphenols and phytosterols, flavor and color (resulting in a pale-yellow). The supercritical carbon dioxide method gives moderate oil recovery rates, has less residence time and gives oil free from the solvent as carbon dioxide can be removed by just release of pressure. The oil was extracted from well-conditioned milled sunflower seed powder using a semi continuous extraction column at condition of 343K and pressure 10MPa. The extraction method had an oil recovery rate of 43.4%. The results of my study will encourage the oil extracting industries to take up this new technology to replace the existing methods of oil extraction.

## DECLARATION

I **GYEZAHO RONALD** hereby declare that, this report is a true work of my hands and has never been presented by any person or institution for an academic award.

Signature: .....  .....

Date: ..... 23/05/18 .....



## APPROVAL

This final year research project proposal for the programme of Agro-Processing Engineering has been submitted to the Department of Chemical and Process Engineering for examination with approval from the following supervisors:

**MR. SSERUMAGA PAUL**

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Date: ..... 23/05/2012

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Date: .....

## **DEDICATION**

I dedicate this report to my mother Ms. Nyebaza Enid, my father Mr.Kagumire Stephen, my brothers and lastly my beloved sister. I love you so much.

## **ACKNOWLEDGEMENT**

First and foremost, I am thankful to the Almighty God who has supported me up to this far in my academics and finances

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# CHAPTER 1

## 1.0 Introduction

### 1.1 Background

Sunflower (*Helianthus annuus*) is a crop which, compared to other crops, performs well under drought conditions. Sunflower is adapted to a range of soil conditions, but grows best on well-drained, high water-holding capacity soils with a near neutral pH (6.5-7.5). Sunflowers are tall annuals and modern planted varieties of sunflower reach a plant height of between 1.5 and 2.5 m at flowering and have strong taproots, from which deeply-penetrating lateral roots develop. The flower head typically has a maximum diameter of 15-30 cm which consists of mostly yellow and ray flowers and the fertile disc or tube flowers. The flowers tend to be cross-pollinating and the best temperature range for the production of seed is 20-25°C. Seed and oil yield are reduced under stress conditions. Oilseed producing varieties have a 1000 seed weight of 40 to 60g and non-oilseed varieties have a 1000 seed weight of over 100g(UK Sunflower Association, 2003).

The sunflower originated from America (Strategy, 2008) and in Uganda, sunflower was introduced in the 1920s and 1930s by missionaries. It is generally cultivated in the semi-arid central and northern part of Uganda due to its tolerance of dry conditions in areas like Otuke district, Lira, Apac, Oyam, Dokolo and Soroti. It is also grown in Kiryandongo district Uganda. The main grown varieties are Sunfola and (PAN 7351) (Chain and For, 2016). Sunflowers are usually attacked by wildlife like birds, squirrels, field mice and deer. It is important to know when to harvest sunflowers because when you do it before the proper time, heads may have plenty of seed coats with little meat and when too delayed, the sunflowers will be attacked by birds and also the tender seeds will be too dry to roast. Sunflowers are harvested when their petals become dry and begin to fall and even when the green base of the head turns yellow and eventually brown. Sunflower seeds are completely dried prior to storing them.

The sunflowers are majorly grown for oil extraction, a sunflower seed contains 32-53% oil and this oil can be used as an edible oil, can be used for cosmetics and pharmaceutical products and for use in the varnish industry. The common methods of oil extraction in Uganda are Mechanical pressing of sunflower seeds and the use of organic solvents like hexane. (Bhupesh C. Roy, 2006)

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