RISK ASSESSMENT FOR DRYING METHODS OF CHAMOMILE AND MARIGOLD

By

OSAMA AHMED MOHAMED EL-SAYED
B.Sc. Agric. Sci. (Food Science), Fac. Agric., Cairo Univ., 2000

THESIS
Submitted in Partial Fulfillment of the Requirements for the Degree of

MASTER OF SCIENCE

In

Agricultural Science
(Food Science)

Department of Food Science
Faculty of Agriculture
Cairo University
EGYPT

2013

APPROVAL SHEET

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ABSTRACT

Food safety practices implementation in post-harvest processing of medicinal and aromatic plants is a very important aspect to produce safe products. Gap analysis of drying methods showed that oven drying was the best method conforming with food safety regulation. The lowest total aerobic as well as mold and yeast counts were detected in oven dryer contact surfaces, followed by solar drying. Besides, no pathogenic bacteria; *i.e.* coliform group, *Staphylococcus aureus* and *Salmonella sp.* were detected in both two drying methods. High microbial counts were found in sun drying method. Oven drying workers were more hygienic than two other drying methods. Moreover, oven dried plants showed a lowest total aerobic and mold and yeast counts followed by solar and sun dried plants. Pathogenic bacteria *i.e.* coliform group, *Staphylococcus aureus* and *Salmonella sp.* were not detected in both oven and solar dried Chamomile and Marigold, but coliform group and *Salmonella sp.* were detected in sun dried Chamomile and Marigold. Two pesticide residues were identified from fresh and dried Chamomile, and four residues were detected in fresh and dried Marigold. Lead and cadmium were found in dried Chamomile and Marigold by different levels depending on dehydration method used. The obtained results showed that all dried samples were found to be free from aflatoxins except sun dried marigold in which contained G_1. The obtained results also showed that sun dried plants contained higher physical hazards than those detected in solar and oven dried Chamomile and Marigold.

Keywords: Chamomile, marigold, hazards, risk assessment, pathogenic bacteria, pesticide residues, heavy metals, aflatoxins.

DEDICATION

I dedicate this work to whom my heartfelt thanks to soul of my mother and soul of my father in law. I specially dedicate my father Ahmed, my wife Hadil and my brother sherif for all of their lovelly support they offered along the period of my post-graduation. I lovely dedicate this work to my young daughters Hala and Habiba.

ACKNOWLEDGEMENT

Deep thanks and many prayers to Allah for helping me to achieve this work.

I would like to express my deep gratitude and sincere appreciation to Dr. Yahia Ibrahim Sallam, Professor of Food Science and Technology, Faculty of Agriculture, Cairo University for his supervision, guidance through the course of study, practical part and revision the manuscript of this thesis. Sincere thanks to Dr. Mahmoud Ali Ahmed Bekheet Professor of Food Science and Technology, Faculty of Agriculture, Cairo University for his great help and kindness throughout this study.

I wish to express my sincere gratitude and great help provided for solving the problems, in supervising the research and for continuous help during the experimental part of the thesis to Dr. Amal Hsanien Mahmoud Head of Research of Special Food and Nutrition Depatment, FTRI, Agricultural Research center.

Grateful appreciation is also extended to all staff members of Special Food Department, for their great help during the experimental part of this thesis.

Finally, sincere appreciation´s are extended to my family, especially my father and my wife for their love, encouragement, support and kind help through the course of this study.

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INTRODUCTION

Egypt flora consists of about 2000 species of plants distributed in its different localities that are vary in type of soil and prevailing climatic and other environmental condition that hence encourage the growth of wide range of plant species. In addition many medicinal plants have been successfully introduced and acclimatized in Egypt. The modern pharmaceutical industry also requires a large quantity of medicinal plants for manufacturing drugs. Cultivation of medicinal plants in Egypt is taking place mainly for feeding the drug industries and for exportation. It had been cultivated in Delta and Nile vally, especialy, in upper Egypt (Omer, 2009).

Medicinal and aromatic plants in Egypt represent a significant source of national income. The area cultivated with such plants reached about 63500 acres in 2006. In 2008, it was about 75000 acres, about 80% of these concentrated in EL-Fayom, Beni Suweif, El-Menia and Assiut Governorates. The total exported quantity attained about 35000 tons of dry herb and spices in 2006 and it reached 40000 tons in 2008. As well as, Egyptian exports take the 11^{th} place among the biggest medicinal and herbal plants exporting countries. In 2001, Egypt´s exports reached a value of 17.7 million US Dollar and 2.32% of all exports worldwide. The number of markets to which Egypt is exporting medicinal plants was 25 in the year 2001. The value of Egyptian exports of medicinal plants reached LE 45.28 million in 1995, and in 2001, it reached LE 205 million, whereas the imports decreased from LE 10.01 million in 1995 to LE 4.85 million in 1999 (Safwat, 2009).

The same author discussed the problems facing the production, processing, and marketing of medicinal plants and herbs in Egypt. Production's promblems summarized as lack of clear data on the areas of cultivation and the various crops cultivated which leads to the incapability of planning or finding alternatives, lack of knowledge of modern agricultural methods, quality and properties of the end product, and the intense use of chemical pesticides and fertilizers leads to a high rate of residues in the products which is not accepted in international markets. Regarding to processing problems, it could be summarized as traditional methods of collecting, drying and packing which lead to the incapability of developing production, packing materials and methods are not up to international standards, the general trend is to export medicinal herbs as raw material without additions which would lead to fully processed products like medicinal, dried and oil products. This leads to a decrease in economic revenues which could be much higher through processing, and environmental pollution lead to high microbial contamination with *E. coli*, *Salmonella spp.*, and yeasts after post-harvest operation like sun drying which could be lead to the decrease of egyptian herbs and spices exportation. Regarding to the marketing problems, it could be caused by the monopoly of local traders and the limited number of exporters which lead to the refusal of many farmers to cultivate medicinal plants because of their low revenues. In addition, lack of stable amounts of plants for export because of the annual fluctuation of the cultivated areas and the fluctuation in prices, as well as the absence of marketing information on the needs of foreign markets, competitive countries, and prices.

El-Eshmawy and Ali (2010) found that the most important problems facing production of medicinal and aromatic plants in Egypt included fluctuations in incident cultivated areas and low quality produced from these areas due to law awareness of the producers with no commitment of agriculture and farmers of the dates of collection and storage needs of the occasion. It is also most important marketing problims are the low price of the crop and control traders in the price and the absence of an association of producers of medicinal and aromatic plants.

Risk analysis is a process of three components: risk assessment, risk management, and risk communication. Its overall objective is to ensure public health protection. Risk assessment is a key element in ensuring that sound science is used to establish standards, guidelines and other recommendations for food safety to enhance consumer protection and facilitate international trade. The risk assessment process should include quantitative information to the greatest extent possible in the estimation of hazard. Pathogens can be transferred from handlers, contact surfaces or air. Surfaces, utensils, equipment, fixtures and fittings should be thoroughly cleaned and, where necessary, disinfected after raw food, has been handled or processed (FAO and WHO, 2009).

Food safety is still an important issue both to citizens and to agribusiness and food industry. Increased consumer awareness and new legislative demands on food production systems have resulted in significant efforts in control measures and assurance systems in different food sectors all over the world. Moreover, new challenges in

reducing incidence of food safety hazards due to typical changes in food supply chains, health and demographic situations, social situations, and environmental conditions (*e.g.* increased pollution), underpin the need for effective food safety management systems (FSMS). On the other hand, new and modified safety control measures and techniques are now being developed to effectively combat microbial hazards. Examples are more rapid and accurate microbial methods, more effective cleaning and disinfection methods, new processing techniques, and more effective food safety training programs. These developments offer opportunities for the improvement of current FSMS (Luning *et al.*, 2008).

The implementation of international standards on the market represents a necessary element in the process of improving a company's competitiveness. Customer care, healthy and safe food, and ecological standards represent only some of the conditions that modern business requires from producers of food products. The implementation of the HACCP system, that is standard ISO 22000:2005 – Food safety management systems – Requirements for any organization in the food chain, represents one of many requirements directed towards companies in the function of customer health care. Its implementation is becoming compulsory for all companies whose aim is exporting products to European Union countries (EU) and the World Trade Organization (WTO) (Djordjevic *et al.,* 2011).

Post-harvest process such as collection of medicinal and aromatic plants in the field, transport to the farm and drying are often suspected to increase microbial contamination of medicinal plants.

When the bulk of harvested material is not ventilated, auto-heating due to respiration activity provides favorable conditions for micro-organism growth, in terms of temperature and humidity (Muller and Heindl, 2006). So, the HACCP pre-requisite program aspects should be taken in account during drying process and/or post-harvest procedure to avoid increasing of microbial hazard.

Aim of Investigation

This study was aimed to:

1. Identify different risks *i.e.* biological, chemical and physical .
2. Risk assessment of three drying methods *i.e.* sun, solar and oven of chamomile and marigold.
3. Implement a control measures during post-harvest process of chamomile and marigold.
4. Reducing biological hazards using a good hygienic practices.
5. Identifiy the most safer dried product produced using sun, solar and oven dryers.
6. Reducing the energy costs used for sterilizing the contaminated dried medicinal and aromatic plants by reducing microbial load that achieved by good practices during handling and drying processes.