RELATIONSHIP BETWEEN COSMETICS (CONDITIONING CREAM) QUALITY AND MICROBIAL ACTIVITIES DURING STORAGE

By

Eman Sayed Abdallah El sayed
B. Sc. Agric. Sci., (Food Science), Fac. Agric., Cairo Univ., 2008

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

MASTER OF SCIENCE

In

Agricultural Sciences
(Agricultural Microbiology)

Department of Agricultural Microbiology Faculty of Agriculture Cairo University

EGYPT

2018

APPROVAL SHEET

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APPROVAL COMMITTEE

Dr. EL SHAHATT MOHAMMED RAMADAN.....
Professor of Agricultural Microbiology, Fac. Agric., Ein Shams University

Dr. OLFAT SAYED MOHMOUD BARAKAT……
Professor of Agricultural Microbiology, Fac. Agric., Cairo University

Dr. MONA HUSSEIN BADAWI……..
Associate Professor of Agricultural Microbiology, Fac. Agric., Cairo University

Dr. MOHAMMED ZAKARIA SEDIK……
Professor of Agricultural Microbiology, Fac. Agric., Cairo University

Date: 8/7/ 2018

SUPERVISION SHEET

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ACKNOWLEDGEMENT

*Praise and thanks be to **ALLAH**, for assisting and directing me to the right way.*

*I wish to express my sincere thanks, deepest gratitude and appreciation to **Dr. Mohammed Zakazria Sedik**, Professor of Agricultural Microbiology, Fac. Agric., Cairo University, **Dr. Mona Hussein Badawi**, Associate Professor of Agricultural Microbiology, Fac. Agric., Cairo University and **Dr. Sonia al Gendi**, Head of Research and Development at Yasmina Cosmetics and Perfumes Company, for suggesting the problems, supervision, continued assistance and their guidance through the course of study and revising the manuscript.*

Grateful appreciation is also extended to all staff members and colleagues in the Department of Agricultural Microbiology, Faculty of Agriculture, Cairo University.

Special deep appreciation is given to all my colleagues in yasmina Cosmetics and Perfumes Company head for all their support to finish this work.

Deep appreciation is given to all to finish this work.

DEDICATION

I dedicate this work to whom my heartfelt thanks; to my parents, my brother and my sisters for their patience & help and for all the support they lovely offered during my post graduate studies.

Name of Candidate: Eman Sayed Abdallah **Degree:** M. Sc.
Title of Thesis: Relationship Between Cosmetics (Conditioning Cream) Quality and Microbial Activities During Storage
Supervisors: Dr. Mohammed Zakaria Sedik
Dr. Mona Hussein Badawi
Department: Agricultural Microbiology. **Approval: 8/7/2018**

ABSTRACT

Microbial contamination of cosmetic products is a matter of a great importance to the industry and it can become a major cause of both product and economic losses. Microorganisms can grow on almost every substances existing in nature and often able to attack or even decompose them. Cosmetic ingredients are rich in nutrients that provide organic substrates in the form of sugar, starch, protein, amino acids, organic acids, alcohols, lipids and etc. for microbial growth. Addition to that, water is a fundamental requirements for any microorganisms likely to contaminate the cosmetics products. Thus untreated or non sterile water can support microbial growth leading to contamination of cosmetics products.

For this problem, the aim of this study is to evaluate the microbial content of the hair conditioner, study the effect of the storage conditions at refrigerator, room temperature, high temperature, isolated of lipolytic bacteria, follow the physical changes for the cream and determination of fatty acids pattern.

For that, 18 of hair conditioning cream products were tested. The products were purchased from pharmacies in Cairo and Giza Governorates., 12 samples as local manufacturers and 6 samples were imported. Package sizes ranged from 200 to 1000 gm.

Total bacterial count (TBC), total spore forming count (TSC), total lipolytic bacteria count (TLBC), Total fungal count (TFC) , also, detection of pathogenic bacteria such as *Pseudomonas aeruginosa*, *E.coli*, *Salmonella* spp. and *Staphylococcus aureus*, Moreover, chemical and physical quality (pH , viscosity , separation , odor, color and fatty acids pattern) were determination. Total bacterial counts results revealed that, nine brands of jar hair conditioning cream are laying under the limits of united state pharmacopeia (2009) $\leq$ 100 cfu/g. While, the other nine brands of jar hair conditioning cream are over the limits of European directives >100 cfu/g ranged from 110 to 560 cfu/g . In addition, all brands were free from indicator bacteria (*Staphylococcus aureus*, *Escherichia coli* and *Salmonella* spp). But, three brands only (S15M, S16M and S18M) were found to be contaminated with *Pseudomonas aeruginosea*, with counts of 400, 480 and 180 cfu/g , respectively in hair conditioning cream with proteins. While, *Bacillus cereus* found in hair conditioning cream with vitamins while, *Bacillus firms* and *Bacillus mycoides* were found in hair conditioning cream with nutrient. Forty nine isolates were isolated during the storage period and morphological as well as biological studies were selected four isolates and identification by API test.

Regarding to physical parameters, all samples were under the recommendable limits for physical characteristics, where, the pH values ranged from 4.8 to 9.3 and the viscosity values ranged from 38000 to 52000 cps.

Keywords: Cosmetics, hair conditioning cream, bacterial indicator, storage duration , *Pseudomonas aeruginosea , Bacillus* spp.

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INTRODUCTION

Cosmetics are defined as a material or tentacles of external parts of the human body mixture (skin, hair, nails, lips, external genitalia, teeth, mucous membrane of the oral cavity and nose) in order to cleaning, perfuming, changing as well as their appearance (protecting them and keeping in a good condition). Cosmetics include skin care products (creams, emulsions, lotion, gel and oil), face masks, based on the make-up (liquid, slurries and powder) cosmetics makeup or cosmetics, remove make-up, as a toilet soap(liquid or solid), shower gel, soap, the smell of deodorant, hair dyes, a permanent individual and install the hair, cosmetics hairdressing, hair cleaning (lotion, powder, shampoo and soap), moisturizing and conditioning hair (lotion , cream and oils), add-ons to improve hair property (lotion, gloss and nutritious fluid for hair) , shaving products (cream, foam and lotion), lotions used on the lips, mouth and cosmetic dental care (cleaning and perfuming), personal care products, sunbathing, cosmetics give color to the skin without exposure to the sun, skin-whitening cosmetics, cosmetics against wrinkles (Standard Egyptian No 7323/2011).

Hair conditioning cream is used to treating discolored hair, oily scalp and dandruff, it’s applied before washing hair with shampoo, and by use a shower cap during the application as it prevents dripping. After, rinse thoroughly kept for at least for fifteen to twenty minutes or more.

In daily life cosmetics are becoming very important because they are used daily and regularly by increasing numbers of the people as well as the quantities consumed each year.

Cosmetics products may be contaminated during manufacturing by microorganisms existing in the environment or in the raw materials which are mostly contain water and nutrient an appropriate for microbial growth.

The raw materials used in cosmetics products include, water, acids, alkalis, salts, oils, waxes, paraffins, fatty acids, alcohol, esters, surfactants, emulsifier, talc, clay, protein, starches, gums, resin, humectants, preservatives, antioxidants, chelating agents, color, pigments, fragrances and essential oils .

The possibility that cosmetic products may function as vehicles of pathogen transfer does not appear to have been investigated to any extent. In addition to this very important consideration must be taken *i.e.* there is the possibility that, bacteria present in unduly high levels at any point during its shelf life could contribute to physical deterioration of the product. The risk of this occurring is higher with many present-day moisturizing creams and lotions, which contain special additives (including plant extracts, fatty acids and vitamins) that could serve as substrates for bacteria.

Contamination of microorganisms in cosmetics may cause spoilage of the product and when pathogenic, they represent a serious health risk for consumers.

Cosmetics might contain microbes, due to impurity of raw material and might be contaminated during usage (Rope, 2002 and

Pinon *et al.*, 2007). Their microbiological load is strictly controlled at various manufacture stages and during shelf life. Microbial spoilage can not only alter physical properties of the product such as color, taste, odor and viscosity, but also deactivate crucial constituents depriving cosmetic of its features (Osungunna *et al.*, 2010 and Yorgancioglu and Bayramoglu, 2013). Microbiological contaminants may produce endotoxins and metabolites causing irritation and allergic reaction of the skin (Razooki *et al.*, 2009). They can be also pathogens which causing hazard to the human health (Lundov *et al.*, 2009 b).

Microorganisms can survive in environment that, fulfill their physical and chemical requirements for proliferation and further development. Most important physical requirements include suitable temperature and pH of the environment. Considering chemical ones, microorganisms require presence of moisture, available and easily metabolized nutrients as well as oxygen. Almost, all cosmetics fulfill all of the here in before described requirements for microbial growth. They are rich in free water, having pH close to neutral. Consumers keep them at home at room temperature, which is an optimum for proliferation. Most of the cosmetics are found in the bathroom, where the temperature and humidity are high. Depending on the type of closure, different amount of oxygen may access the cosmetic preparation. Composition of cosmetics varies from product to product. The specificity of cosmetic application requires that, its ingredients are nourishing and easily assimilated. Hence, such components as proteins, minerals, vitamins and glycerine are easily metabolized source of nitrogen, carbon, hydrogen as well as micro- and macro-elements,

necessary for microbial development (Rope, 2002 and Pinon *et al*., 2007).

While, no mandatory limits are given for microorganisms, industry guidance recommends. The Total Viable Counts (TVC) of <100 cfu/g for higher risk products (eye, baby products, and others), however, all cosmetic products must be devoid of pathogenic microorganisms, such as, *Pseudomonas aeruginosa, Staphylococcus aureus, Candida albicans* and *E. coli* (CTFA,1996).

Contaminants may be seen as sediments, turbidity and pigments such as the red prodigiosin of *Serratia marcenscens* and greenish pigments of *Pseudomonas* and these pigments may alter the products appearance (Sutton, 2008).

Adequate preservation and the use of noninvasive packages (such as tubes, pumps or narrow orifice containers) increase the chances that, contamination levels will remain low during storage and use of the product (Brannan and Dille, 1990).

Growth of microbes can produce enzymes that, causes degradation of active ingredients and changes in the pH. Cellulose polymers in cosmetics can act as targets for microbial attack, and support extensive growth under suitable conditions when converted from a stiff gel into a running liquid, thereby rendering the cosmetic unfit for use. Finally, changes in the products may become evident as unpleasant aromas and tastes, color changes, production of irritants, loss of activity, alterations in viscosity bulging / leakage of products, and visible surface growth. Therefore, it is important to improve the