BIOLOGICAL CHARACTERISTICS OF SOME MICROBES CONTRIBUTING IN BIOFILM FORMATION

By

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B.Sc. Agric. Sci. (Microbiology), Fac. Agric., Zagazig Univ., 2004
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APPROVAL SHEET

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Date: / / 2015

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Title of Thesis: Microbiological Characteristics of Some Microbes Contributing in Biofilm Formation.

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ABSTRACT

The aims of this study were to determine microbial population contributing in natural biofilm. In addition to, study the behavior and biological characteristics of two pathogenic bacteria including *L. monocytogenes* and *S.* Typhimurium in biofilm state. To achieve first aim, forty eight natural biofilm samples were collected from different types of microhabitats to determine the characteristics of the predominant microorganisms. The results of natural biofilm samples showed that the most frequent pathogens were *Staph. aureus*, *L. monocytogenes*, *Salmonella* spp and *Candida albicans* in all tested samples. While, to achieve second aim, water distribution system model was designed for testing of these bacteria. Six samples of synthetic biofilm were collected at three different biofilm ages (10, 40 and 90 days-old). The collected biofilm samples were exposed to different antimicrobial agents. Results cleared that the highest growth of *L. monocytogenes* and *S.* Typhimurium biofilm was reported in I pipe material. Results showed the log reduction of 90 days-old *L. monocytogenes* biofilm formation, when exposed to 3.0 mg/l of chlorine dose, on six pipe materials; PVC, PP, PE, I, Cu and R been 3.96, 4.16, 4.21, 4.17, 4.32 and 4.03 CFU/cm^2, respectively. While, the effective MICs of Ag ions were 500 mg at 5 min against 90 days-old *L. monocytogenes* and 300 at 15 min for *S.* Typhimurium biofilm. Additionally, the effective MICs of AgNPs were recorded 500 mg at 15 min for 90 days-old *L. monocytogenes* and 500 mg at 10 min for *S.* Typhimurium. On the other hand, the results of antibiotic susceptibility indicated the planktonic cells were more sensitive than the biofilm cells. Also, the longest survival time in tested water of *L. monocytogenes* and *S.* Typhimurium biofilm cells scraped from I pipe material was observed. In contrast, the shortest survival time of biofilm cells scraped from Cu pipe material was recorded.

Key words: Biofilm, pathogenic microbes, EPS, chlorine, AgNPs, antibiotics.

DEDICATION

I dedicate this work to whom my heartfelt thanks; to my mother, my wife and my son (Mazen), for their patience, help and for all the support they lovely offered along the period of my post graduation.

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CONTENTS

INTRODUCTION

Drinking water distribution systems (DWDS) are complicated engineering systems consisting of pipes, storage vessels, fittings, and valves. DWDS are made of a variety of different materials such as cast iron, polyvinyl chloride (PVC) and polyethylene (PE) that interact with the bulk water. The water that consumers drink at the tap has traveled potentially large distances taking significant durations through the distribution network and it is accepted that from leaving the treatment plant deterioration in quality might occur. This deterioration in water quality will be influenced by factors such as decay of disinfectant residual, temperature, hydraulic regime, water residence time and bacterial regrowth (Ramos *et al.,* 2010).

The supply of safe drinking water to the public is one of the great technological advancements of the 19th century, as well as a major technological challenge (Poitelon *et al.,* 2009). It is well known that microorganisms are widely present in the drinking water treatment systems especially, in the storage tanks, filter systems, and the interior of pipe walls (Bonadonna *et al.,* 2009).

Uncontrolled and excessive microbial growth not only leads to the deterioration of water quality and the associated undesirable tastes, odors, and visual turbidity, but can also cause process malfunctioning such as clogging of filters, biofouling and biocorrosion (Hammes *et al.,* 2008). Additionally, many problems in DWDS can be associated with