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Alterations with Biotic Origin in Metallic Containers

[1]C. Adelantado, [2]J. Codina, [2]I. González, [2]J. Ll. Martí, [2]R. Martínez and [1]M.A. Calvo
[1]Facultad de Veterinaria, Universidad Autónoma de Barcelona, Spain
[2]Campus Universitario de Bellaterra, 08193 Bellaterra (Barcelona), Spain

Abstract: The implication of some bacteria and fungi in alterations in containers and metallic substrata are described in this study and SEM pictures are also provided to check which kind of microorganisms produce alterations in samples collected from pipes, metallic containers intended for water pipes, purifiers and industrial mushroom production. Among the most commonly found microorganisms we may cite *Sphaerotilus* sp., *Galionella* sp., *Desulfotomaculum* sp., *Pseudomonas* sp., *Bacillus* sp., *Micrococcus luteus, Paecilomyces* sp., *Aspergillus niger, Aspergillus* sp. and *Cladosporium* sp.

Key words: Biofouling, biocorrosion, metals, SEM, water

INTRODUCTION

It is been shown all along the years, that several microorganisms induce biofouling formation. This concept can be defined as the undesired accumulation of deposits of a biological nature on a surface. This accumulation when talking about microorganisms, may consist of microorganisms, polymeric materials secreted by these organisms, particulate matter of different origin and mainly of water[1].

Some of these microorganisms do not only form biofouling, but they can also cause biocorrosion on containers and substrata made of metal, even of stainless steel and because of that, they may cause severe alterations in distributive and productive systems of industrial fluids as well as water.

These microorganisms (bacteria and fungi) have also been found in flowing water, activated sludge and even sewage[2-4] and in several cases these microorganisms cause technological problems such as biocorrosion on metallic surfaces and pipe clogging[5].

The main objective of this study was to show the implications of those microorganisms in the detected alterations in some pipes and metallic containers intended for water pipes, purifiers or even industrial mushroom production.

MATERIALS AND METHODS

This study was conducted in the Autonomous University of Barcelona, during the 2003-2005 period. This study was carried out after receiving 21 samples in the laboratory. These samples were divided into three groups according to their origin: 10 were collected from residues found in the inner part of metallic pipes, with different appearance and colour (reddish, whitish, orange). Four samples were collected from other metallic sources such us containers intended for mushroom culture or purifier pipes and the rest of the samples (7) were water samples from those pipes which showed the presence of residues.

All the samples inoculated in Tryptone Soy Agar for bacteria and Sabouraud Dextrose Agar with tetracycline clorhydrate and Czapek-Dox Agar for fungi. Specific culture media were also used for the isolation of *Galionella* sp., *Pseudomonas* sp., *Sphaerotilus* sp. and *Desulfotomaculum* sp.

Plates were incubated under different conditions of temperature (ranging from 28 to 37°C), environment (aerobic and anaerobic) and time (from 1 to 10 days).

When growth was observed in the plates, they were prepared for scanning electron microscopy according to the methodology described by Calvo[4]. They were examined under a scanning electron microscope (Zeiss DSM-962) at 15 Kv.

RESULTS AND DISCUSSION

Several genera were isolated and most of them seem to have a direct implication in the possible damage and corrosion of these metals. The microorganisms found, could be divided into two groups:

Moulds and yeasts: *Paecilomyces* sp., *Aspergillus niger, Aspergillus* sp. and *Cladosporium* sp.

Bacteria: *Sphaerotilus* sp., *Galionella* sp., *Desulfotomaculum* sp., *Pseudomonas* sp., *Bacillus* sp.

Corresponding Author: M. Àngels Calvo Torras, Facultad de Veterinaria, Universitat Autónoma de Barcelona, Spain
Tel: 0034935811748 Fax: 0034935812006

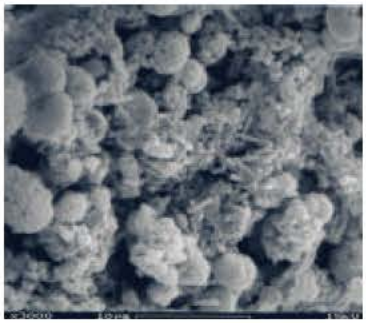

Fig. 1: *Paecilomyces* sp. conidia and *Sphaerotilus* sp.

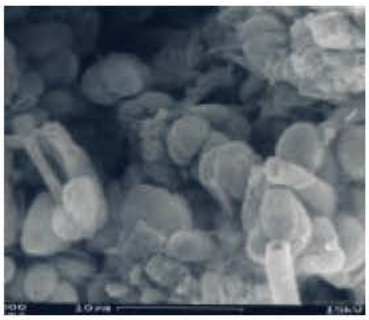

Fig. 2: *Paecilomyces* hpphae conidiophores and conidia

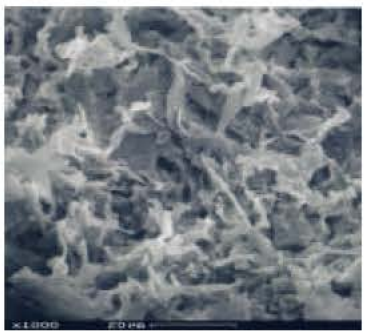

Fig. 3: Residues

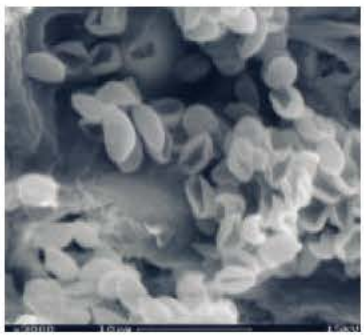

Fig. 4: *Cladosporium* conidia

Fig. 5: *Aspergillusd* conidia

Fig. 6: *Sphaerotilus* sp. and mouds conidial

Fig. 7: Biofouling

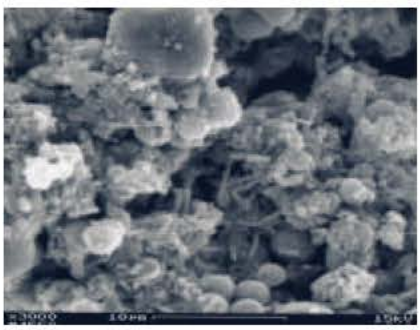

Fig. 8: *Sphaerotilus* sp.

and *Micrococcus luteus*. Present findings fit with the results of many researchs[1-3].

Some examples of the presence of the strains isolated from the residues analyzed are shown in the following microphotographs (Fig. 1 to 8). Most of the microorganisms that grew in the plates, were also observed in the microphotographs and checked by measuring their size and having into account specific morphological characteristics from each one. At the same time, we may say that these alterations are produced by these microorganisms metabolic requirements.

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