BACTERIAL ADHERENCE TO COVERING MATERIALS IN FOOD INDUSTRY

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INTRODUCTION

Contamination is a serious problem for food industry, because it gives rise to the unacceptable product appearance for the human consumption. Food storage is a practice developed to great scale, reason for which the consequences of losses by contamination in this phase of production could be elevated and highly expensive. This phenomenon is generally a mixed process, in that participate bacteria, yeasts and filamentous fungi, presents in the own atmosphere, raw material, or workers; and a competitive process, in which those groups that prevail show a greater adaptation the conditions of storage, which they are pronounced in the product. Comparing filamentous fungi and bacteria in front of yeasts, these play a secondary role in the alteration of foods.

So that the microorganisms can proliferate in the refrigeration chambers and work-room, in the first place they must be able to adhere to their surfaces.

The appearance of little susceptible surfaces to the bacterial adhesion, would reduce the problems of microbial contamination to a great extent.

The existence of free negative charges, in the construction materials of the surfaces, would generate an antagonistic effect of charges as opposed to a high percentage of bacteria involved in these contaminations, gram negative bacteria, since these have, in its surface, negative charges what generates a electrostatic repulsion.

This characteristic that we could define innate to the material of the chambers and work-room could be seen affected in the time, by a bad conduct of cleaning, because this negative charge of the surface could disappear slowly by changes in pH, favoring therefore the bacterial adhesion. The only form to palliate this serious effect is making a good structured cleaning practices throughout the time.

In addition very frequently the microorganisms, are catched with organic or inorganic rest in the irregularities of the surface, hollows or breaches of the material, produced generally during the cleaning practices. The organic deposits presence (specially proteins and sugars) as well as cellular rest, favor the growth of bacteria and fungi, creating biofilms.

Biofilms are rests of organic and/or inorganic material deposited in the walls, protecting the microrganism. The present bacteria in biofilms can produce a gelatinous agent who helps to the adhesion and maintainance the biofilm.

In these biofilms, the microorganisms create their own microcosm, where they can use nutrients and continue proliferating.

In addition, other organisms, some of which are associate with negative effects to the human health can adhere to biofilm and increase with a sinergic effect the biofilm protective properties

The disinfection of the chambers and work-rooms does not assure sterility the surfaces. The bacteria can survive to the disinfection treatment and use the nutrients that are in the water. Diverse studies have demonstrated that bacterial cells that they adhere to the surfaces are more resistant to chlorine. For that reason, the important thing is to eliminate these biofilms beaten the surfaces with a good cleaning by drag to prevent the development of the microorganisms, mantainance antiadherent the clean surface.

Considering that prefabricated panels are constituted by three fundamental elements:

1.- Inner surface: Constitutes the first skin of the cover sandwich. He goes directly placed on the main structure of the building and fixed them.

2.-Isolation surface: Material with insulating capacity placed between the two skins of the panel prefabricated sandwich, with necessary benefits for its aim.

3.-Outer surface: Constitutes the second skin of the cover sandwich. It goes placed on the isolation, and fixed him. The selected type of plate will contribute the mechanical and resistant characteristics required by the client.

The aim of the study will be to evaluate the capacity of the microbial cells to adhere to the outer face of the prefabricated panels, to the being this face the one that goes to be in contact with foods.

For the accomplishment of the work species habitually isolated from atmosphere and surfaces of a storage chambers and manipulation room have been selected:

Enterococos can be present in the crude meat of cow, calf, pig, lamb or poultries, in milk without pasteurizar, nonpotable waters. After a period of incubation of five days it produces diarrea, abdominal pain similar to the one the appendicitis, vomits and fever.

Escherichia coli After an incubation of 24 hours, causes intense, diarrea abdominal pain and low fever. Its means of transmission are the bovine meat of crude, milk without pasteurizar, the fruits, vegetables and vegetables and the waters nontreated.

Listeriosis - disease whose causal agent is Listeria monocytogenes. Its origin is in fresh fruits and vegetables, foods process conserved in cold. Their symptoms cause that this problem is confused with the influenza, although the listeriosis can get to produce spontaneous abortions.

Salmonelosis is perhaps the more well-known nourishing contamination. His causal agent is Salmonella typhi. One propagates in the crude meat, specially the one of poultries. In order to incubate he needs more than 48 hours, and produces fever, migraine, pain in the joints, inflammation of the pharynx and abdominal pain.

Estafilococos, group formed by the Staphylococcus aureus has their origin in the skin, infected nasal graves and saliva of the people who manipulate foods, in the treated meat, the fish and in milk and its derivatives. It needs just a short time to incubate, of one to eight hours. Cause abdominal nauseas and vomits, migraine and fever.

Pseudomonas is the more frequent group of bacteria in fresh foods. Due to their great metabolic potential, the bacteria of these groups are important agents in the food alteration. Without considering the aspects of vegetable deterioration produced by species before mentioned, the Pseudomonas is one of the main groups responsible for meat alteration stored incorrectly in conditions of aerobiosis. Some bacteria of the group are psicrófilas reason why the alteration of the foods that also produce takes place during the conserve in refrigeration.

In addition to these bacteria Erwinia spp is included by its importance in the storage of fruits and vegetables due to the lost ones that it generates.

The work would consist of evaluating, the adhesion to the Glasliner materials (smooth, embossed type 1 and 2), in front of these typical indicators of contamination.

MATERIAL AND METHODS

Preparation of glasliner material for adhesion and biofilm culture

1. Measure the material surface .
2. Hygienic treatment of the material surface using chemical agent and dried.
3. Select the bacterial strain on pure culture.
4. Prepare microrganism control according to figure 1
5. Aliquots of 2 ml of microrganism control were added to materials (smooth Glasliner, embossed Glasliner type 1 and 2) , and incubated at the optimal temperature (37± 2°C) for 24± 2 hours. After that microrganisms suspension were removed, materials were washed twice and finally 2 ml of sterile destilled water were added.

Bacteria solution included on ice to decrease the temperature, was sonicated (Duty cycle = 80 - Output Control = 5 - Timer = 2 min) in order to removed the bacterial adherence to surface. The assay was completed according to figure 2

At the end of experiment microrganism density of control (without material) and sample were measure using Densimat equipment, and plates counts were expressed in UFC/cm^2. Three replicate determinations per strain were perfomed for each experiment.

RESULTS AND DISCUSSION

All the strains tested showed a lower adherence level using glaliner material compared with control.

The adherence population of the strains on glasliner materials are presented in fig 3. There were no significant difference between gram-positive and gram negative bacteria for adhesion to glasliner.

Results showed an adhesion level to smooth Glasliner similar to the observed in international scientific studies for materials authorized in the food industry, and an adhesion level smaller for embossed Glasliner type 1 and 2.

According to bibliography, comparing glasliner materials and glass microbial adhesion experiments, the adherence population on embossed glasliner is several logaritmical units less than glass adherence although incubation time for glass was just only 3 hours instead of 24h for glasliner material.

Consequently the embossed type 1 and 2 and smooth Glasliner materials can be used like covering in susceptible zones of microbial contamination.

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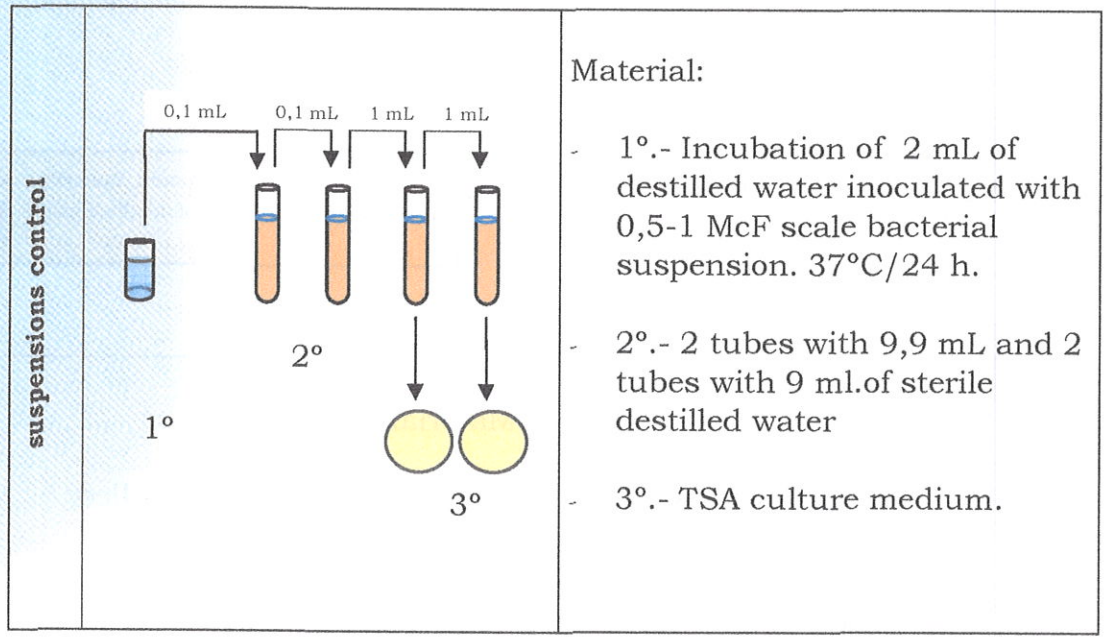
Fig 1


suspensions control
0,1 mL
0,1 mL
1 mL
1 mL
2°
1°
3°
Material:
- 1°.- Incubation of 2 mL of destilled water inoculated with 0,5-1 McF scale bacterial suspension. 37°C/24 h.
- 2°.- 2 tubes with 9,9 mL and 2 tubes with 9 ml.of sterile destilled water
- 3°.- TSA culture medium.

Microorg suspension+ material
37°C /24 H

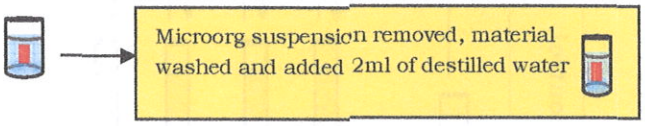
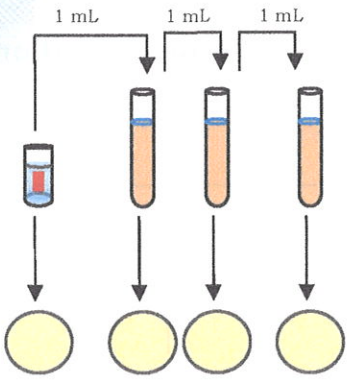
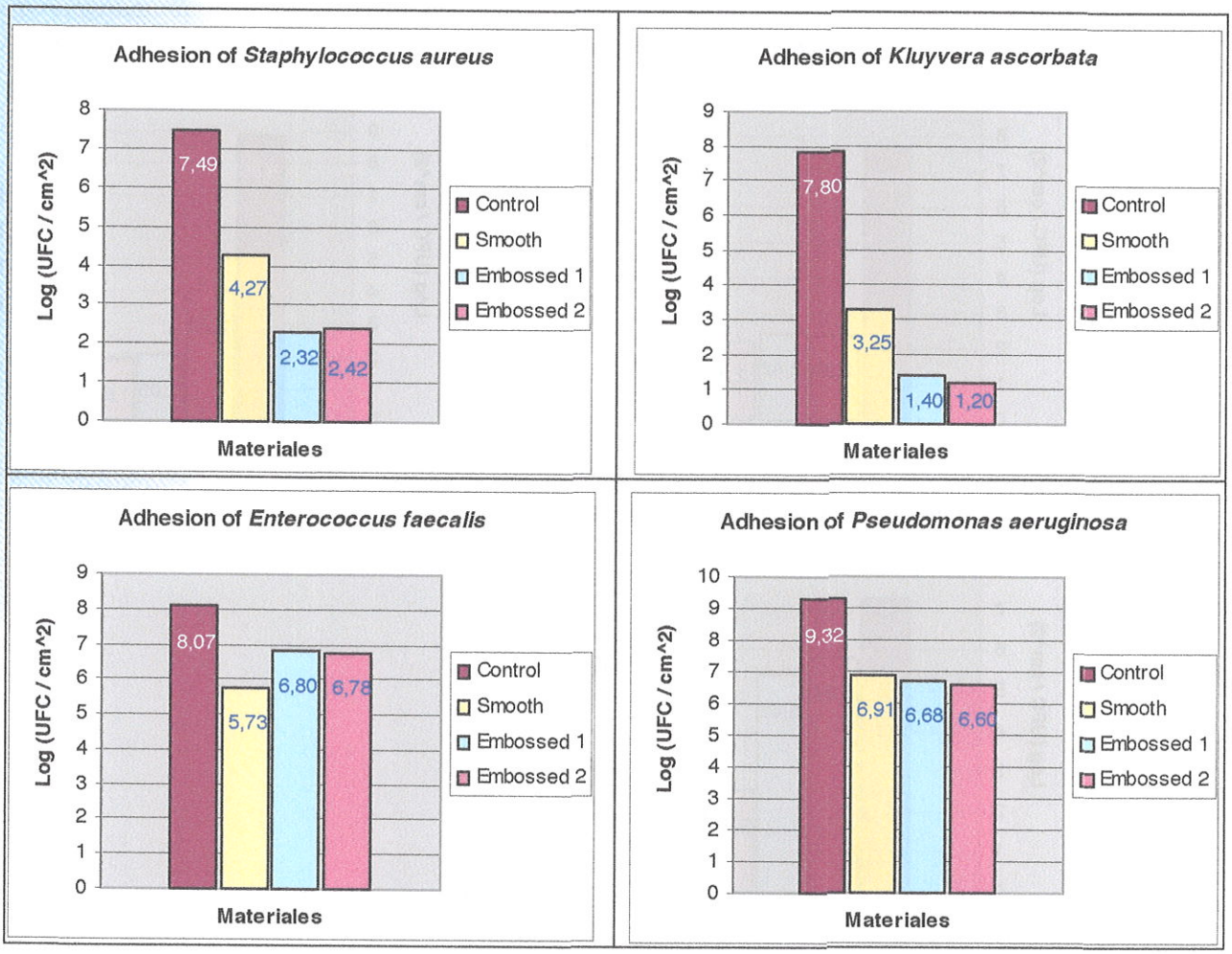


Fig 2

suspension sample		Material: - bacteria: 2 mL of destilled water with material after sonication. - 4 tubes with 9 mL of sterile destilled water. - TSA culture medium


Adhesion of Staphylococcus aureus
Log (UFC / cm^2)
7,49
4,27
2,32
2,42
Control
Smooth
Embossed 1
Embossed 2
Materiales
Adhesion of Kluyvera ascorbata
7,80
3,25
1,40
1,20
Adhesion of Enterococcus faecalis
8,07
5,73
6,80
6,78
Adhesion of Pseudomonas aeruginosa
9,32
6,91
6,68
6,60

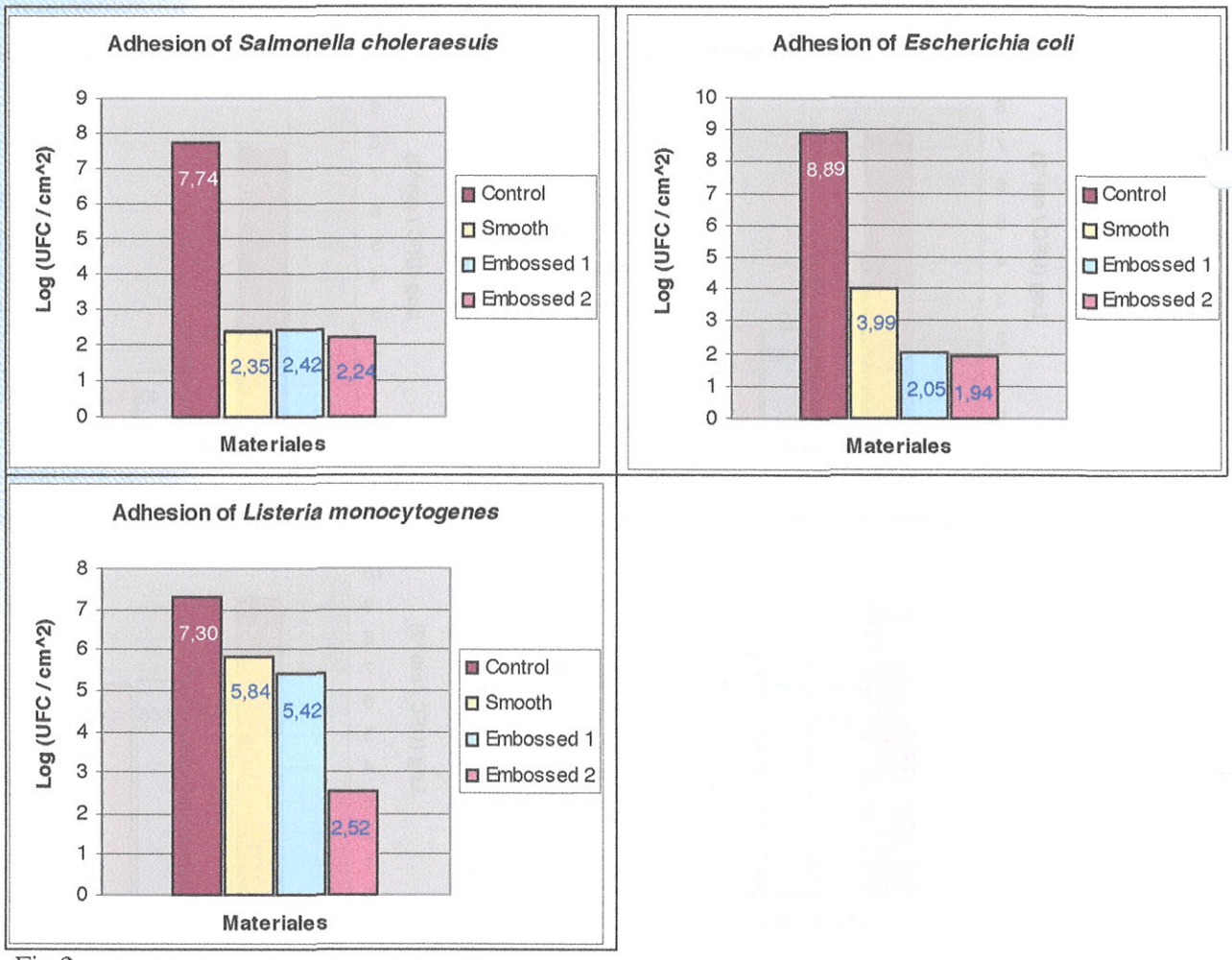

Adhesion of Salmonella choleraesuis
Log (UFC / cm^2)
7,74
2,35
2,42
2,24
Control
Smooth
Embossed 1
Embossed 2
Materiales
Adhesion of Escherichia coli
8,89
3,99
2,05
1,94
Adhesion of Listeria monocytogenes
7,30
5,84
5,42
2,52

Fig 3