Survival of Candida albicans in sea water

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Introduction

The contact of microbial cells with an adverse environment, may result in physiological damages which may be sublethal or produce the death of the cell. The physiological damage or stress exerted by the marine environment on the allochtonous bacteria can be studied by observing either the bacterial structural disorganization or its inability to grow in a selective medium. However, these stressed cells can be developed in cultural media which do not contain inhibitory substances (1).

Candida albicans is a component of the intestinal flora of animals and birds and its occurrence in natural waters is associated to fecal contamination (2). *C. albicans* has been proposed as a potential water quality indicator organism (3), and as an agent of mycotic infections in humans.

In this paper the influence of some environmental factors on the inactivation process of *C. albicans* by sea water is studied.

Materials and Methods

Five test solutions were investigated to study the effect of the different factors of the seawater on *C. albicans* (C.E.C.T., 1394): (a) unpolluted raw seawater, (b) artificial seawater, (c) filtered artificial seawater, supplemented with 1 % of sewage, (d) artificial seawater with light. Physiological saline solution (0.85 % NaCl) was used as control solution. All the test solutions were maintained in darkness and at a constant temperature of 18°C, except one artificial seawater solution that was subjected to constant sunlight.

The microbial suspensions were sampled at 0, 1, 3, 7 and 14 days from the start of the experiment. Enumeration of microorganisms was carried out by the spread plate technique on selective mCA agar, (2), and non-selective media (TSA) (Difco), from decimal dilutions of the test suspensions. All the tests were performed on triplicate plates for each dilution and medium.

Results and Discussion

No significant inactivating effects of artificial seawater, filtered seawater and artificial seawater supplemented with sewage was observed on the survival of *C. albicans*, because in these media, as well as in the saline solution, *C. albicans* concentrations remained more or less constant. The conditions which produce the highest negative effects on this pathogen were the established by raw seawater (0.28 % of survivors after 14 days) and, mainly, artificial seawater exposed to visible light, which provokes the inactivation of almost the total of the microbial titre (Figure 1).

The biotic unfiltrable factors were the principal responsibles for the inactivation of the microorganism populations in the sea. These biotic factors are mainly formed by predators (4), and micropredators (5). Another inactivation factor is the competition for nutrients by the autochtonous microflora (6,7).

Light action produces photooxidation of vital mechanisms of the cell (8). This inactivation effect is proportional to the intensity and time exposure to radiation, its effect being determined by the transparency and concentration of particulate matter dissolved in water (9).

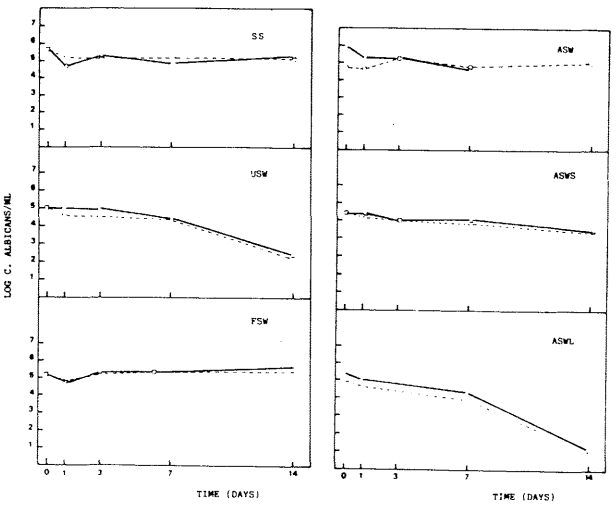

Figure 1 : Survival of C. albicans in : Saline solution (SS) ; untrated seawater (USW) ; filtered seawater (FSW) ; artificial seawater (ASW) ; artificial seawater plus sewage (ASWS) ; artificial seawater plus light (ASWL). (--- Recounts on mCA, —— Recounts on TSA).

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Comparison of faecal coliform levels in Mussel flesh and flesh/intervalvular fluid

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The scope of this investigation is to establish the difference betwéen faecal coliform levels in shellfish flesh and faecal coliform levels in the flesh and intervalvular fluid of shellfish.Obtained results would be used as the basis for the recomendations concerning the most appropriate method for for shellfish studies in the framework of our participation to WHO/UNEP MED POL Phase II Project.

Material and Methods

Samples (Mytilus galloprovincialis and their growing sea water) were collected in the coastal area of Split in 1986 through 1987.

Faecal coliforms were analysed in the mussel flesh and in the mussel flesh together with intervalvular fluid. At the same time faecal coliforms were studied in the mussel growing water.

Methods proposed by WHO/UNEP were used (mussel-multiple test tube method,[1] sea water-membrane filtrations method[2]).

Results and Discusion

High correlation was established between faecal coliform concentration in the mussel tissue alone and faecal coliform concentration in flesh/intervalvular fluid (Fig.1). The correlation coefficient was 0.96. No essential difference in concentration of FC were found between them.So it led us to the conclusion that both methods were equally suitable.

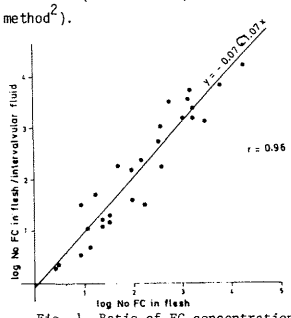

Fig. 1. Ratio of FC concentrations in flesh/intervalvular fluid to those in flesh.

The comparison of the faecal concentration in the flesh/intervalvular fluid and in flesh alone with that in the growing water shows their relationship to be for the most part proportional.This means that in more polluted areas the concentration of FC in flesh/intervalvular fluid is higher than in flesh alone (Fig.2).

The same conclusions could be drawn from the analyses of the relationship between faecal coliform concentration in flesh and that in growing water (Fig.3) and the faecal coliform concentration in the flesh/intervalvular fluid and growing water (Fig.4). In the former case the correlation coefficient was 0.75 and in the latter 0.80.

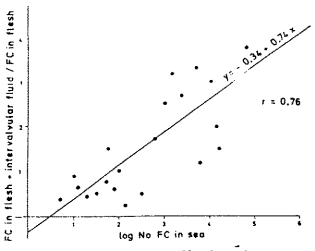

Fig. 2. Ratio of FC in flesh + intervalvular fluid/FC in flesh to FC concentrations in the sea.

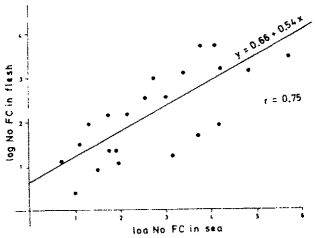

Fig. 3. Ratio of FC concentrations in flesh to those in the sea.

Conclusions

No essential difference in faecal coliform concentration in shellfish flesh alone and that in flesh/intervalvular fluid was established,which points to the fact that both methods are equally applicable.

However, we should like to recommend the flesh/intervalvular fluid method for determination of faecal coliform concentration from the following reasons:

- The coefficient of correlation with the growing water is slightly higher particularly in more polluted areas.
- The method is more simple since flesh needn't be separated from intervalvular fluid
- Both flesh and intervulvular fluid are used as human food.

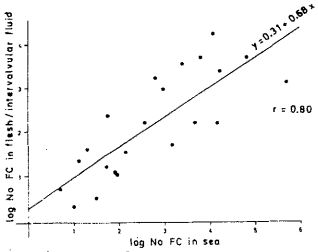

Fig. 4. Ratio of FC concentrations in flesh/intervalvular fluid to those in the sea.

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