

SALMONELLA INACTIVATION PROCESS IN ESTUARINE WATERS.

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ABSTRACT

A study was made of the inactivation processes of genus Salmonella in the marine environment. The time required for salmonella populations to decline by 90 % (T_{90}) were as long as 75 minutes, although minimum concentration were recorded at 45 minutes. These values are higher than those obtained for Total Coliforms (TC), Faecal Coliforms (FC), and for the analogous Faecal Streptococcus (FS).

The decrease in microorganism concentrations in marine and estuarine environments is produced by two different processes : physical dispersion and dilution, and biological inactivation (2). Biological inactivation plays an important part in seawater auto-purification which results from a combination of activities, (a) physical, (b) biological, and (c) chemical, as follows (4):

- (a) Sunlight and other solar radiations, adsorption and sedimentation, temperature, and salinity.
- (b) deficiency of nutrients, predation by other microorganisms, antibiosis, and the action of specific bacteriophages.
- (c) Action of inorganic salts and heavy metals.

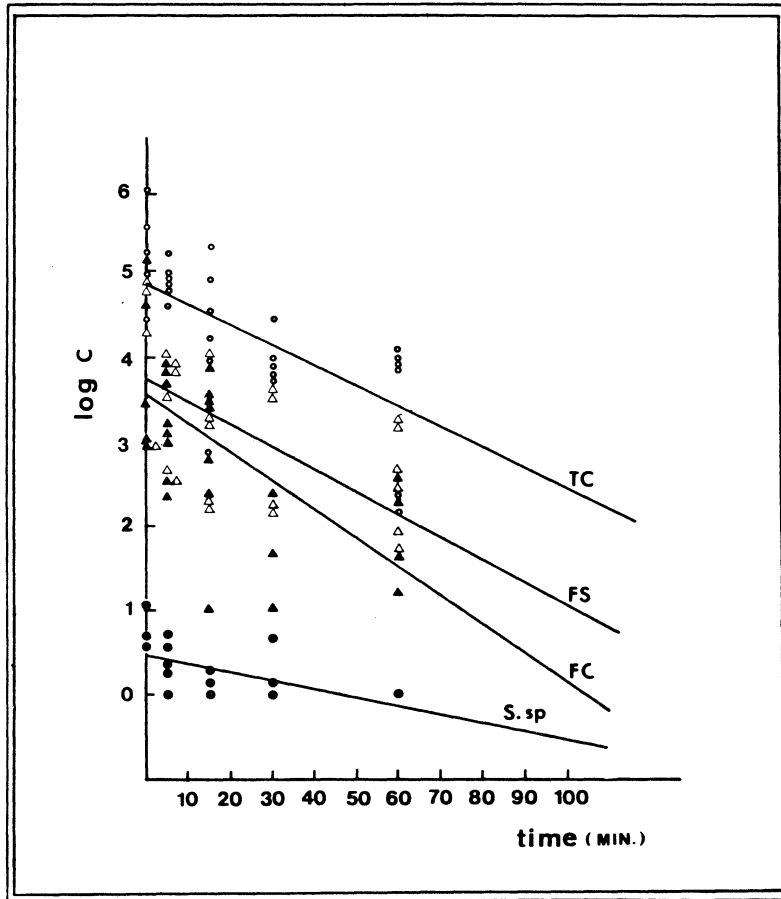
Quantification was by the NMP technique (1) and we used the method and medium described by Morinigo et al. (5). Microbial inactivation studies employed Pearson's method (7), and the process was evaluated by a model of logarithmic decrease and by plotting the T_{90} parameters (time taken to reach 90 % mortality of the initial population).

Sample collections for the microbial inactivation study were made in the river Guadalhorce estuary (Malaga, Spain) at ten monthly intervals during the period September 1983 to June 1984.

From the results shown in Figure 1 it can be seen that the average T_{90} value for Salmonella, as a function of the linear equation, is 75 minutes when calculated theoretically by applying the equation given by Cederwall (3). In comparison with the T_{90} values for TC, FC, and FS, of 40, 30, and 45 minutes, respectively. This salmonella value is very high, but it must be understood that in the marine environment the salmonella concentrations are very small and only reach the minimal level for their detection at 45 minutes. In spite of this, these organisms still showed T_{90} values higher than those for the other three microorganisms in the study. A possible explanation of this phenomena may be that the Salmonella strains and the other bacteria are under stress before their discharge into the marine environment and that the Salmonella strains, being more resistant to this environment are able to survive for longer and so show elevated T_{90} values.

The T_{90} values obtained in this study are very different to those of Borrego et al. (2) which are less than 5 minutes, but these earlier studies were made in sea water in zones affected by heavy sewage discharge from submarine outfalls. Furthermore Borrego et al. (2) employ standard technique using commercial culture media while in this present study a highly selective culture medium (6), was employed which in itself increases Salmonella recuperation indices.

FIGURE I



○—○ TC/Time; $y = -0.02x + 4.87$ ($r=0.70$; $p < 0.001$)
 ▲—▲ FC/Time; $y = -0.03x + 3.58$ ($r=0.58$; $p < 0.001$)
 △—△ FS/Time; $y = -0.02x + 3.73$ ($r=0.56$; $p < 0.001$)
 ●—● S.sp/Time; $y = -0.01x + 0.49$ ($r=0.71$; $p < 0.001$)

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