THE EFFECT OF FILTER AIDS ON PRODUCT SUGAR MICROBIAL QUALITY

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Section D

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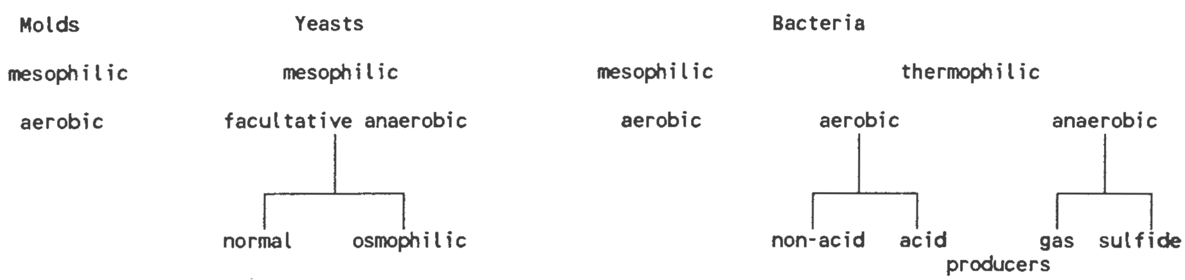
Introduction

Filtration of standard liquor is done to reduce the amount of solid impurities going to the final granulated sugar crystals. It also performs an important role in reducing the numbers of microorganisms found in product sugar. The elevated temperatures of 90-95°C necessary to reduce the viscosity of standard liquor for filtration effectively eliminate several classes of organisms. The microorganisms present in product sugar can be classified as shown in Table 1.



The elevated process temperatures eliminate all but the thermophilic bacteria. The other classes found in the product sugar are a result of contamination after crystallization. Therefore the thermophile counts of standard liquor sent to the pan floor can be used to evaluate filtration efficiency. Amalgamated has several customers who are thermophile sensitive and so filtration efficiency becomes a quality characteristic of interest.

Amalgamated facilities have used or are currently using two types of filter aid -- diatomaceous earth and perlite. Diatomaceous earth (D.E.) is the skeletal remains of microscopic plants called diatoms. These remains are mostly silica and have a variety of shapes and sizes. Perlite is perlite ore crushed and shattered at high temperatures. This process results in microscopic flat plates of filter aid material. Several studies were undertaken to evaluate these two types of filter aids based on their ability to remove thermophiles from factory juices.

<u>**Thick Juice Studies**</u>

Initial studies were done at our Twin Falls factory using thick juice from storage. Twin Falls was chosen because the industrial filters used for standard liquor filtration in Twin Falls could be isolated with different precoat and body feed material. This made it easier to evaluate a large number of combinations in a short time. Figures 1 and 2 summarize the data collected in two trials during two campaigns using six different precoat-body feed combinations. (The evaluations were based on total viable thermophiles as determined by plate count, as well as total visible organisms, viable and non-viable, as determined by direct microscopic observation. The first designation is the precoat and the second is the filter aid type used as a body feed. The "FW" types are diatomaceous earth and the "H" are perlite products. Figure 1 illustrates the effect of the various filter aids on the thermophilic plate counts. The samples were taken immediately before and after second filtration. The lowest counts were obtained when using D.E. as the precoat material. The poorest filtration efficiency was when perlite was used as both precoat and body feed. Figure 2 represents the average counts as determined by direct microscopic observation. The same general tendencies are seen with the exception of the case in which a coarse grade of D.E. (FW-14) was used as the precoat material. These results suggested that D.E. be preferred as a precoat material especially for second filtration. Perlite could be used for first filtration and as a body feed in second filtration if necessary. However, a drawback of these trials was that the thick juice had been filtered before storage. Therefore, it was desirable to evaluate the filter aids during beet campaign.

Standard Liquor Studies

Due to interest of mill personnel, the standard liquor studies were done at Nampa. Nampa uses plate and frame filtration for both first and second filtration. Based on the previous results the precoat of choice was FW-12. Two different body feeds were used: FW-12 and H-700. The H-700 is a grade of perlite roughly equivalent to the FW-12. A finer grade (H-635) is available but due to pressure drop problems during the tests in Twin Falls it was not used in these trials. Samples evaluated included fifth effect evaporator juice, high melter, precoat tank, first filtration (six plate and frame filters), second filtration (four plate and frame filters), the pan floor standard liquor tank, and both "wet" and "dry" sugar. Figures 3 and 4 summarize the average values obtained from these samples. Figure 3 demonstrates several interesting points. The counts after the fifth effect are comparatively low and the thermophile counts increase dramatically in both the high melter and the precoat tank. The D.E. body feed has a very beneficial effect on filtration as compared to the perlite. These results were obtained during normal operation over a period of five weeks. Figure 4 illustrates an even larger spread between the two filter aid types when compared on a total organisms count basis.

Filter Aids and Product Sugar Quality

As in any factory operation the economic value of using one filter aid over another has to be considered. Due to its lower bulk density the perlite is less expensive to use and results in good filter life. However, if the amount of thermophiles in the product sugar is a quality consideration the D.E. filter aids are preferable. Figures 5 and 6 compare Nampa and Nyssa over a two-year period. Nyssa was selected for comparison because they receive beets from the same geographical area and they use D.E. for second filtration. Nampa used perlite during the 1989-90 campaign and D.E. during the 1990-91 campaign with the exception of the above trial period. Figure 5 illustrates the effect the filter aid had on the quality factors of thermophiles in production sugar. Note that for the 1989-90 campaign Nampa was nearly twice as high in flat sours and total anaerobic thermophiles. Yet in 1990-91 using diatomaceous earth Nampa reduced both to the lower levels experienced in Nyssa production sugar. Figure 6 demonstrates similar results in the sugar after storage.

Conclusions

The thermophilic quality of product sugar can be directly effected by the type of filter aid used for final standard liquor filtration. Diatomaceous earth filter aids of comparable grades to FW-12 are the most effective in removing both non-viable and viable thermophilic organisms.

Filteraid Effect on Microbial Load
Thick Juice Total Plate Count

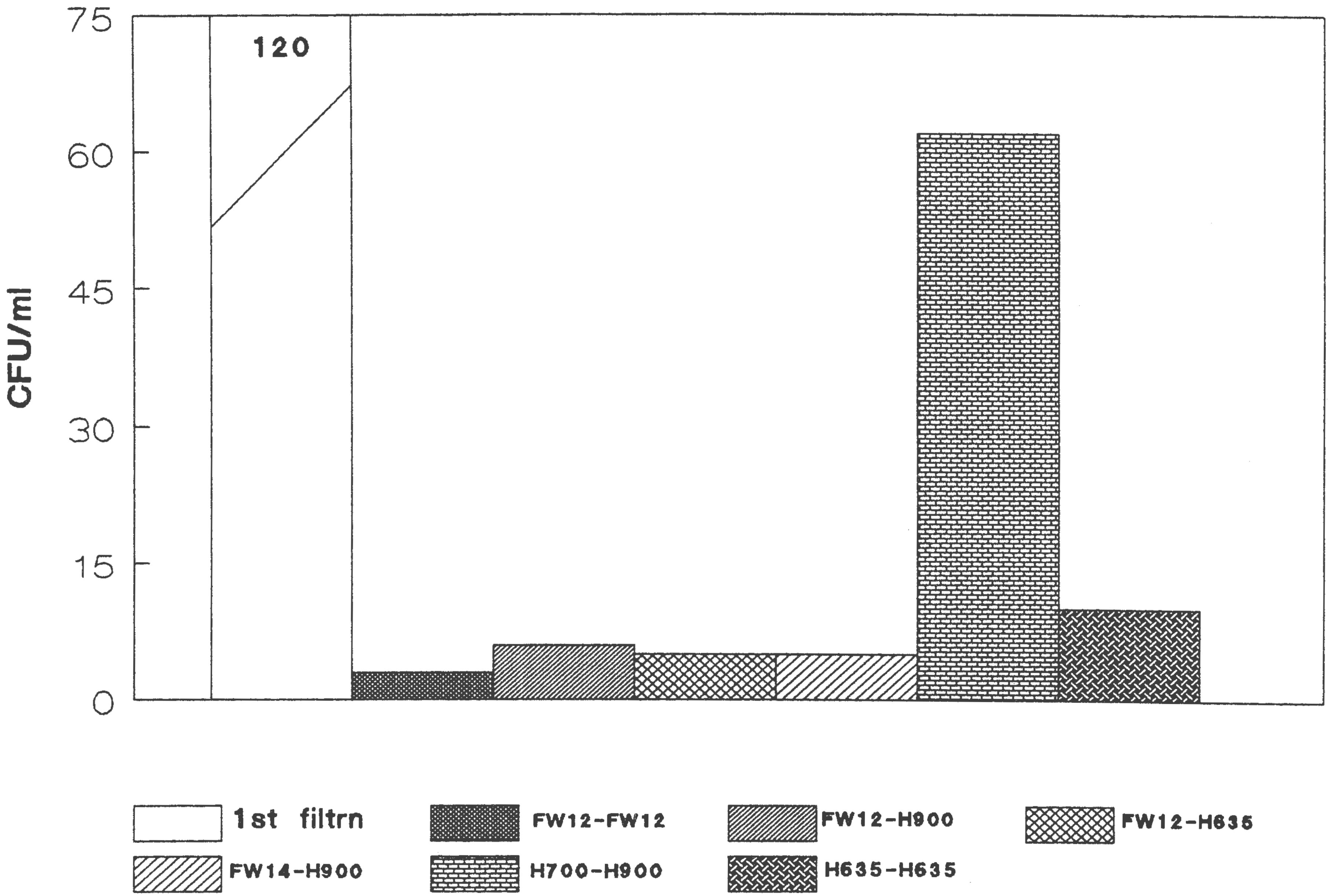


Figure 1

Filteraid Effect on Microbial Load

Thick Juice Direct Count

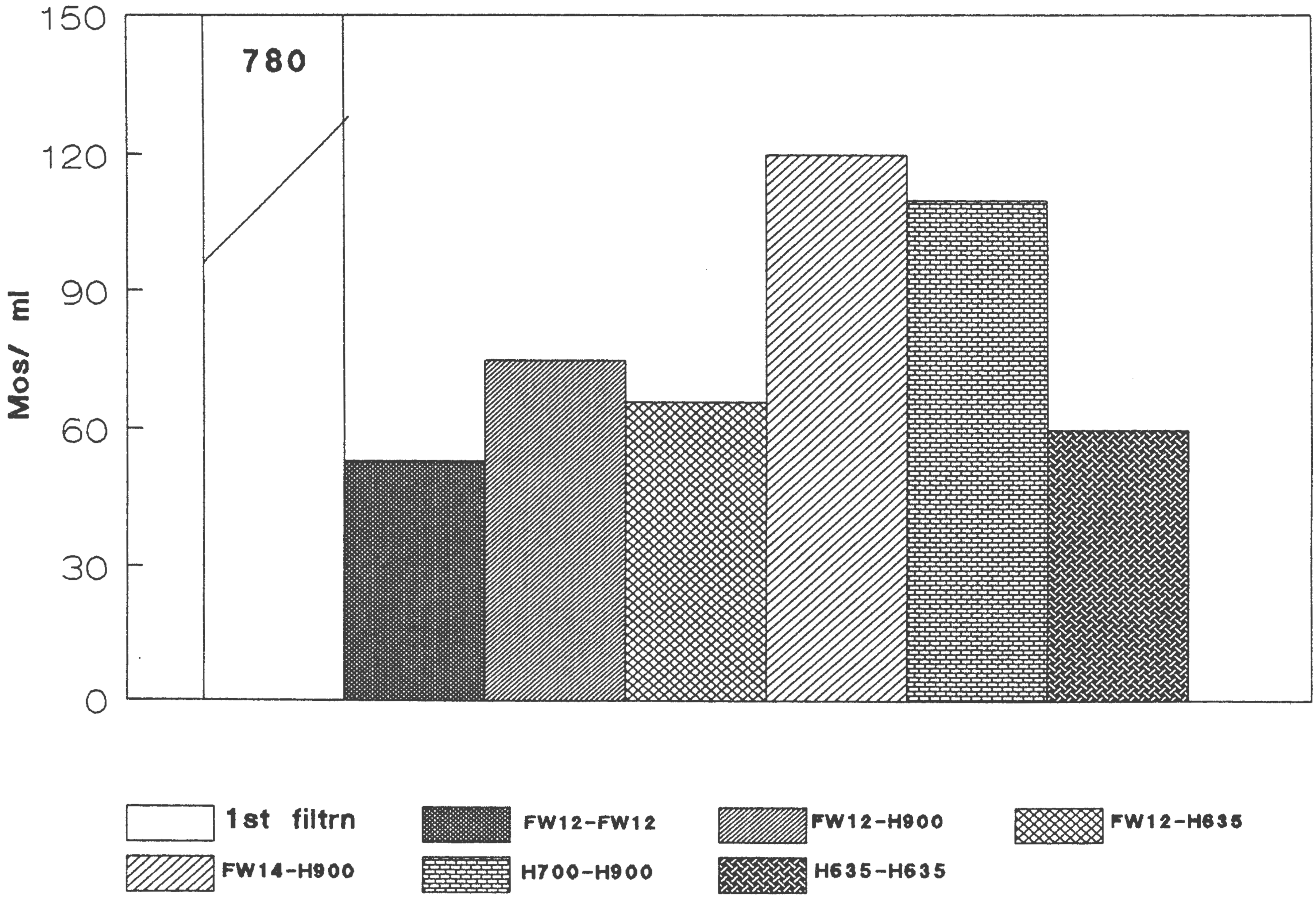


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Figure 2

Filteraid Effect on Microbial Load

Std. Liquor Total Plate Count

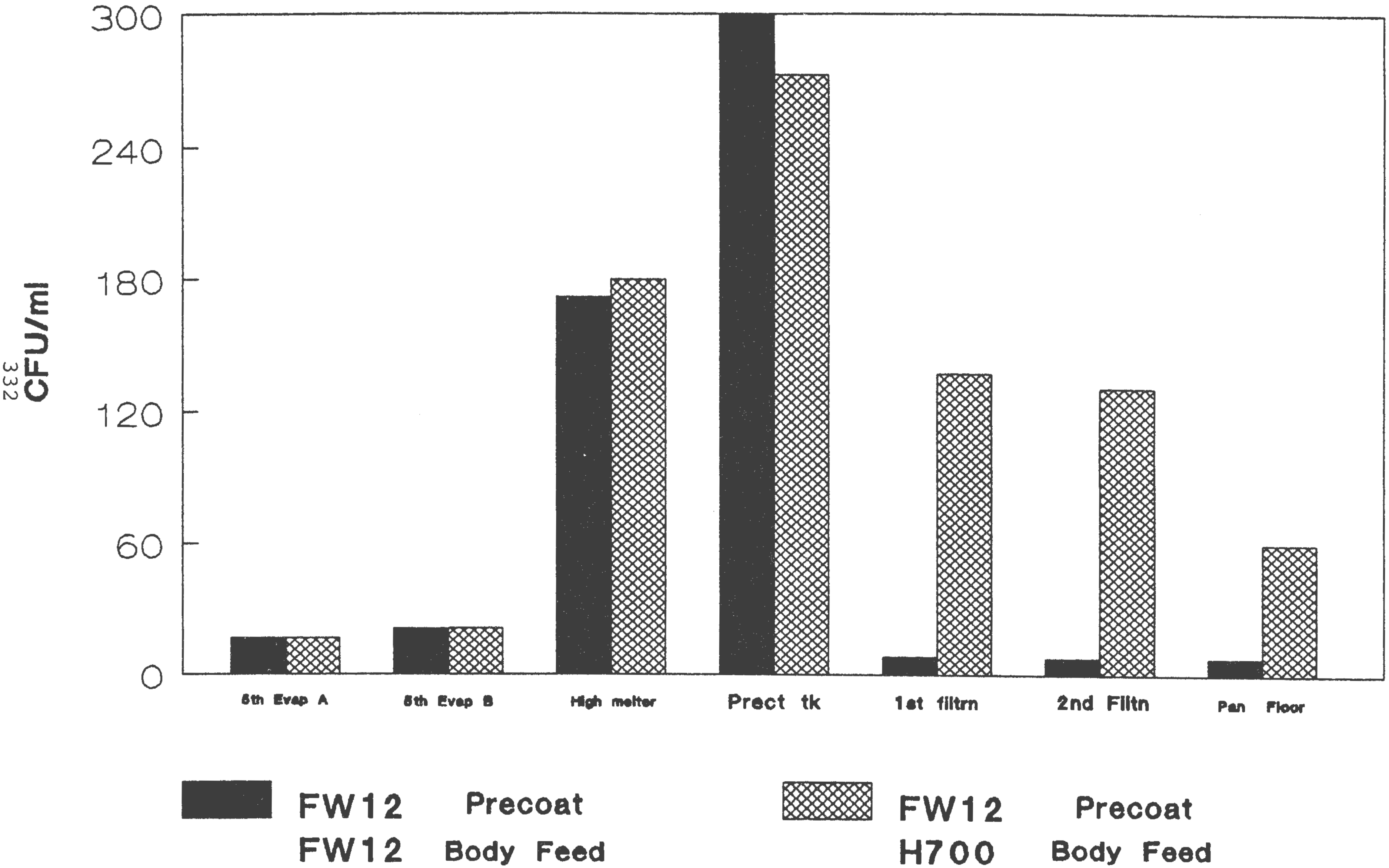

Figure 3

Filteraid Effect on Microbial Load

Std. Liquor Direct Count

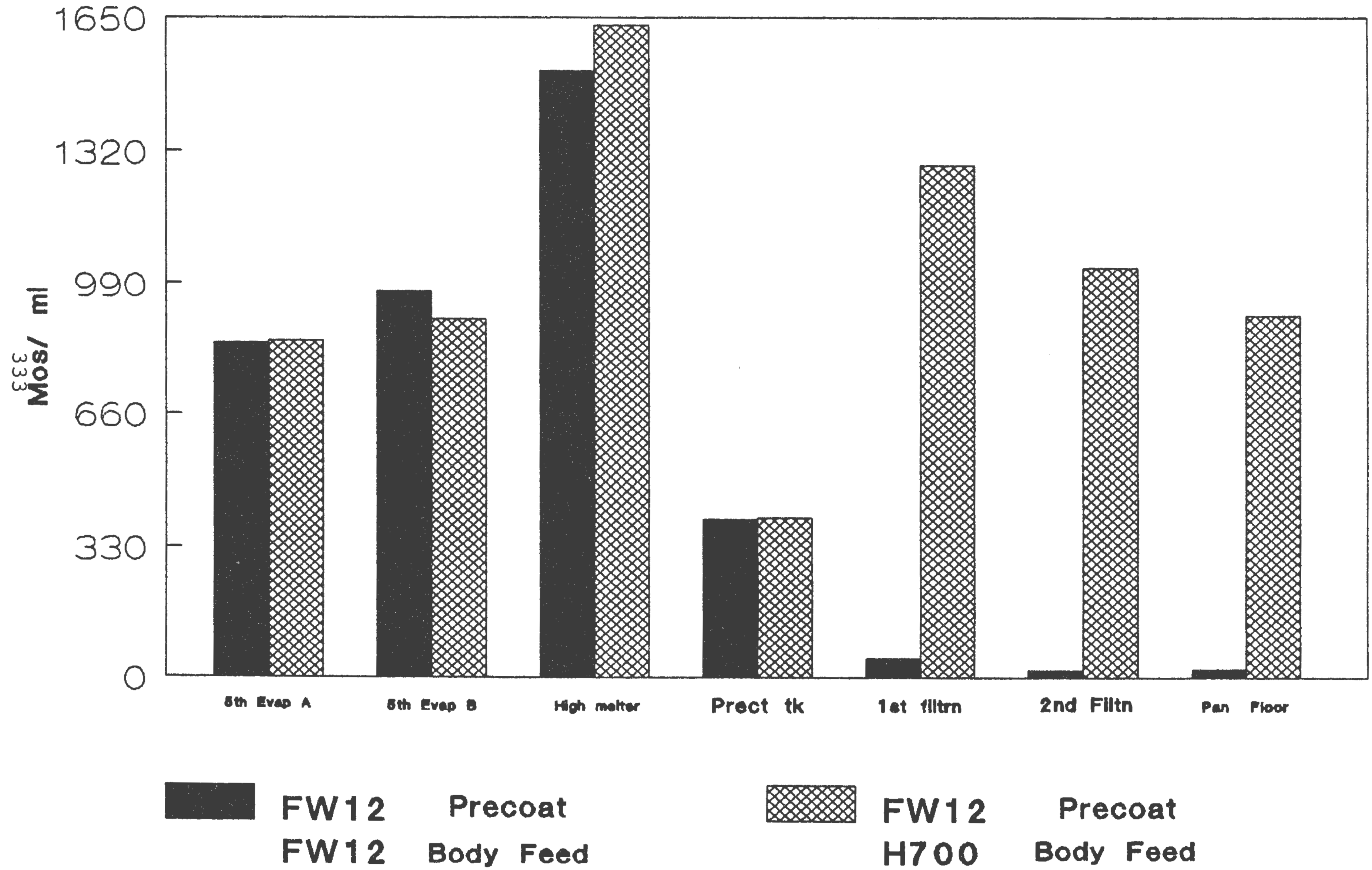

Figure 4

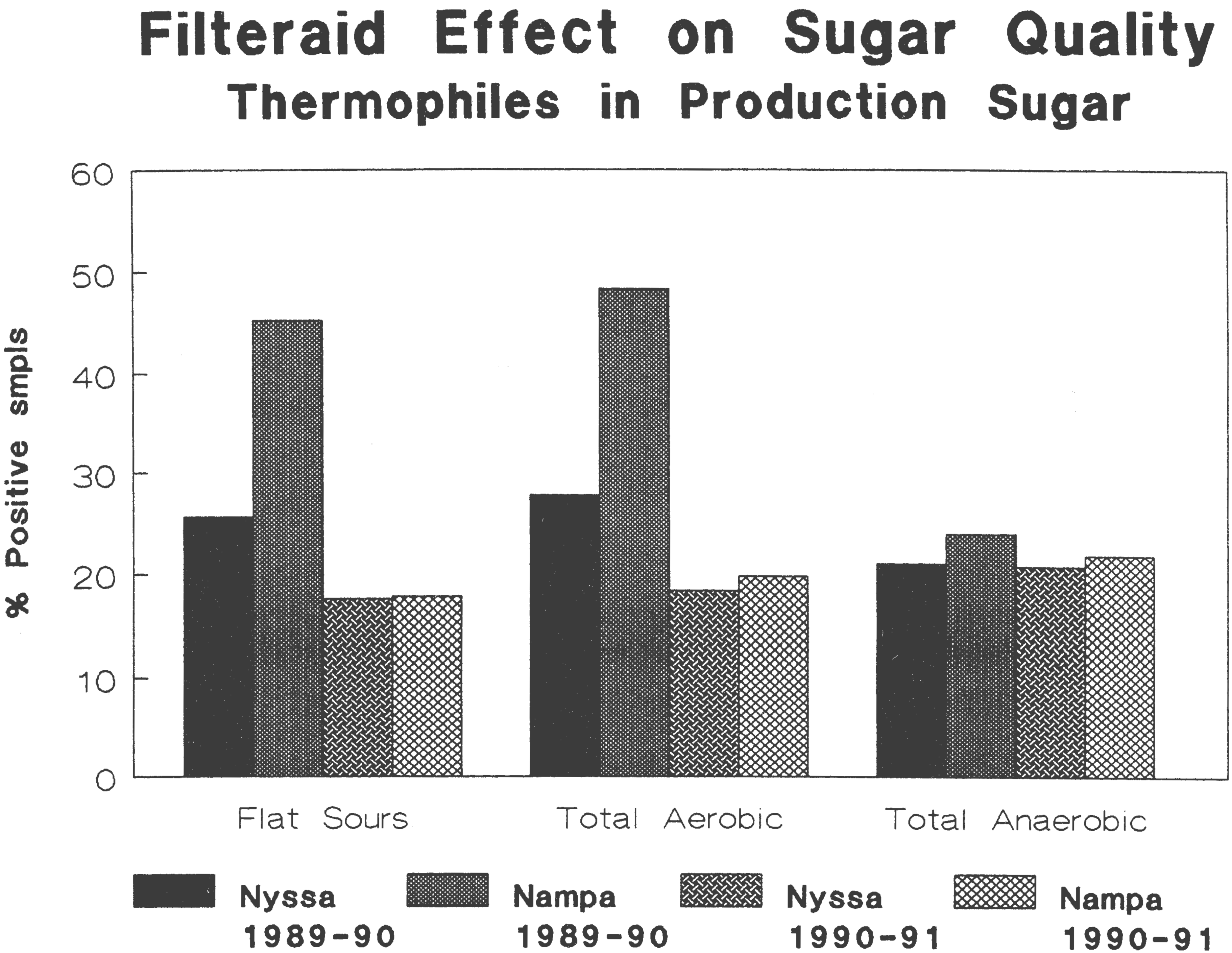
Filteraid Effect on Sugar Quality
Thermophiles in Production Sugar
% Positive smpls
60
50
40
30
20
10
0
Flat Sours
Total Aerobic
Total Anaerobic
Nyssa 1989-90
Nampa 1989-90
Nyssa 1990-91
Nampa 1990-91

Figure 5

Filteraid Effect on Sugar Quality
Thermophiles in Shipped Sugar

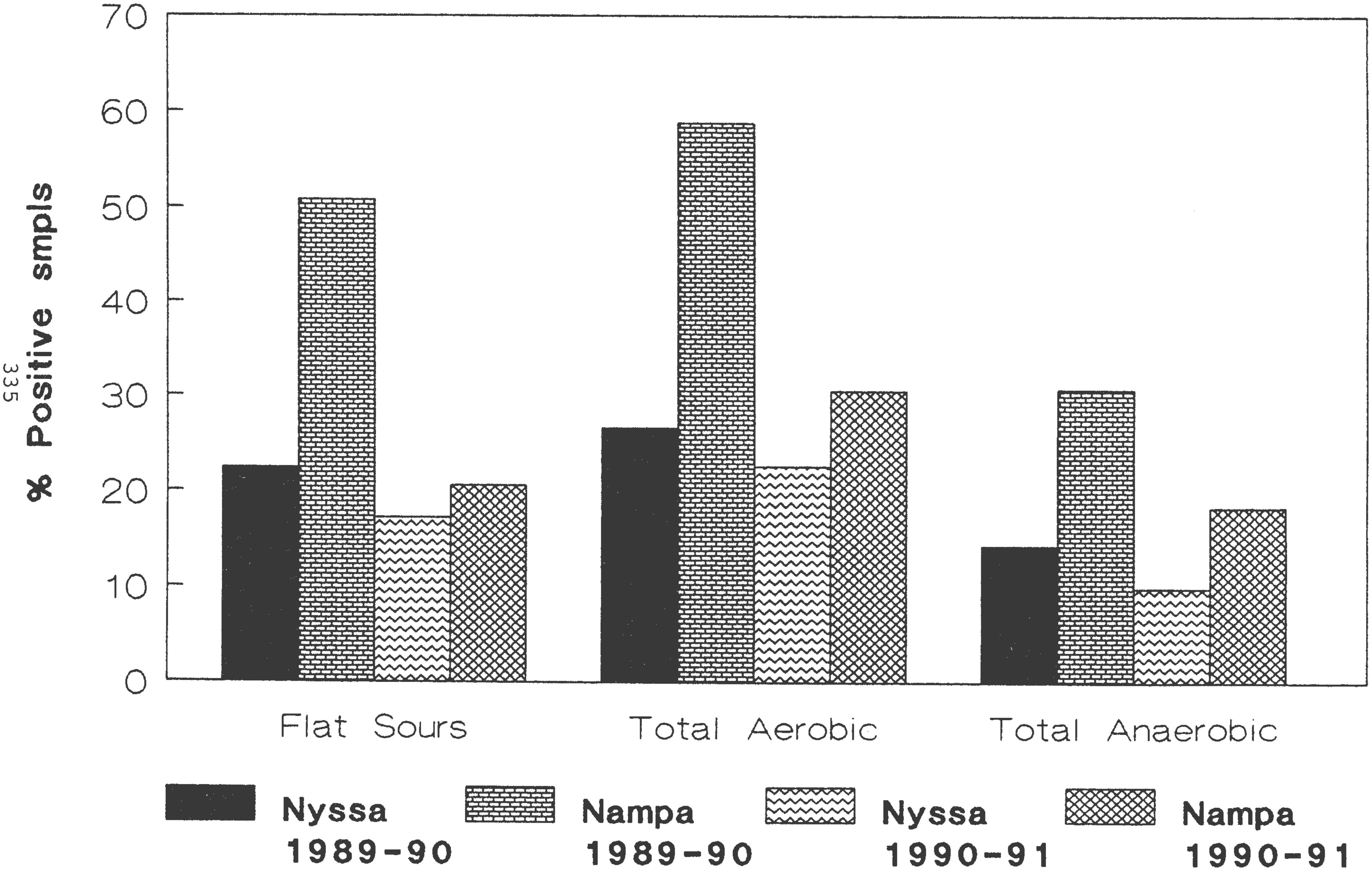

Figure 6