#14

THE EFFECT OF SUBSTRATUM SURFACE TOPOGRAPHY ON THE RETENTION OF MICROORGANISMS AND ORGANIC MATERIAL ON DEFINED SURFACES

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ABSTRACT

It is generally acknowledged that an increased substratum surface roughness affects the retention of microorganisms on that surface. However, this premise is only valid for certain feature dimensions: if the features are considerably larger than the microbial cells, then retention is not significant; if the features are of microbial dimension, then retention is a problem. If features are linear (eg scratches), then cocci may be trapped, but rod shaped bacteria may not – depending on alignment within or across features. This is also true for more well separated features, such as pits. For features of dimension considerably smaller than cells, several additional factors require consideration Substrata fabricated with regular nano-dimension features have actually been observed to reduce microbial attachment and retention.

On hygienic food contact surfaces, the roughness levels are low. The surfaces are required to be inert, hard, impervious and of good cleanability. Few microorganisms would be expected on such surfaces, in the presence of organic material derived from the food being processed. Wear of these surfaces results in scratches (eg on stainless steel). These features have been shown, using atomic force microscopy (AFM) to enhance the strength of attachment of microbial cells. The AFM probe is scanned across the surface using increasing force until cells are dislodged. Furthermore, using epifluorescence microscopy, it was shown that organic material was retained in these features. Substrata with features of defined size and shape were fabricated and the retention of microorganisms and organic material on these surfaces has been monitored. The effect of organic material on the retention of microorganisms was also assessed, and was shown to be complex, being related to the surface topography and to the size of the microbial cells.

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