

ATOMIC FORCE MICROSCOPY OF THE ANTIBACTERIAL EFFECTS OF CHITOSANS ON *BACILLUS CEREUS* (AND ITS SPORES)

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Chitosan is known to be a non-toxic, biocompatible and antibacterial agent – with an associated potential for several applications^[1]. The aim of this work was to elucidate the relationship between the molecular weight (MW) of chitosan and its antimicrobial activity upon both vegetative and resistance forms of *Bacillus cereus*. Atomic Force Microscopy (AFM) imaging was used to obtain high resolution images of the effect of the chitosans on the bacterial morphology. The results of the antibacterial assays showed that antimicrobial effect is strongly dependent on the cell stage and on the MW of the chitosan: it increased with MW for the vegetative form, and the opposite for the spores. The images obtained reveal that higher MW chitosans (i.e. 610 and 100 kDa) formed a slimy layer around both forms of *B. cereus*. Chitosan oligomers (<3 kDa) images also disclosed survival strategies used by *B. cereus* such as clustering formation, on the other hand no clear changes were observed over spores morphology. However, nanoindentation experiments with the AFM revealed mechanical changes in the cell wall caused by the aforementioned oligomers, correlated to damage caused by the polymers. The antibacterial assays and AFM results are correlated and help us to understand the mechanism of action and efficacy of chitosans against this food spoilage microorganism.

References:

[1] R. Jayakumar, N. Nwe, S. Tokura and H. Tamura, *International Journal of Biological Macromolecules* **40** (2007) 175-181.

Figures:

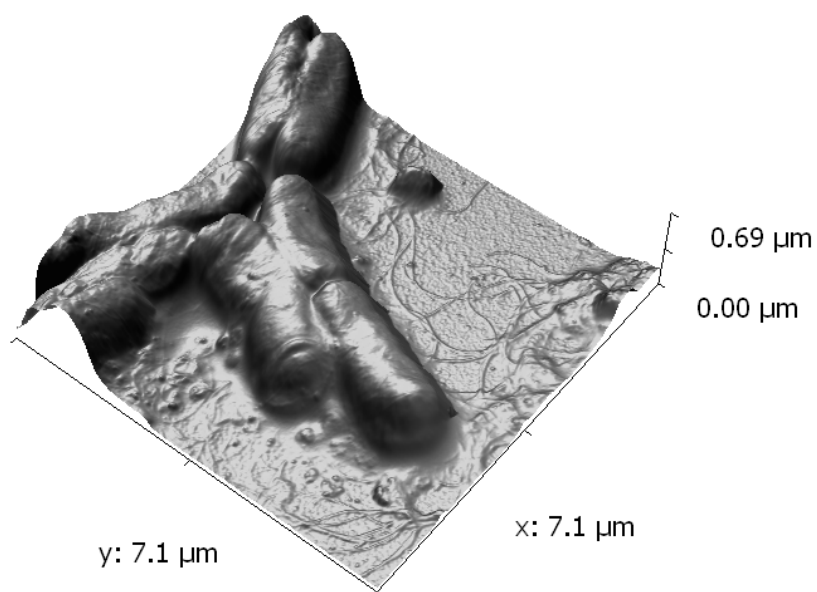


Figure 1 – 3D AFM image of *B. cereus* control in the vegetative form.

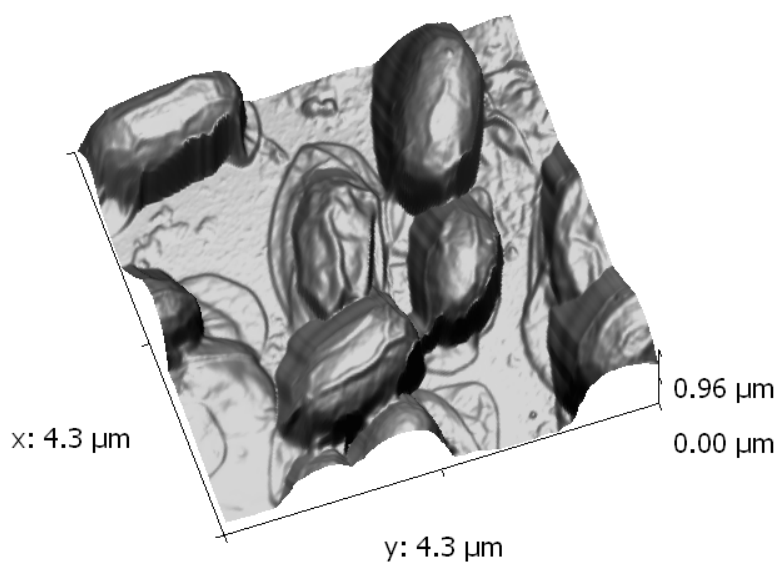


Figure 2 – 3D AFM image of *B. cereus* spores control.