Title: ADHESION THERMODYNAMIC OF THE FOOD PROCESSING SURFACE FUNCTIONALIZED WITH SILVER NANOPARTICLES

Authors: Araújo, E.A.[1], Bernardes, P.C.[2], Gonçalves, L.D.A[1],Júnior, J.F.Q.F. [3], Ferreira, D.C., Andrade, N.J.[3]

Affiliation: [1] Universidade Federal do Triângulo Mineiro (Av. Randolfo Borges Júnior, 1250, Bairro Univerdecidade, Uberaba – MG, CEP: 38064-200), [2] Universidade Federal do Espírito Santo – Campus Alegre (Alto Universitário, s/n, Bairro Guararema, Centro de Ciências Agrárias, Alegre –ES, CEP: 29500-000)**,** [3] Universidade Federal de Viçosa (Av. PH Rolfs, s/n Campus Universitário, Viçosa – MG CEP: 36570-000.

Abstract:

Currently, the food industry increases investments in microbiological quality of products and gradually improves technologies and develops new processes to increase quality and food safety. Strategies have emerged with the potential to inhibit microbial attachment, such as the application of cover containing compounds with anti-adhesive property to bacteria and other microorganisms. In this context, this work had the objective to determine the variation of the free energy of hydrophobic interaction (ΔG^{TOT}) of microbial surfaces *Escherichia coli* (ATCC 11229) and *Staphylococcus aureus* (ATCC 6538) and of the processing surfaces: stainless steel control and functionalized with silver nanoparticles (Ag NPs), surfaces polyethylene (PE) control and with Ag NPs, as well as the variation of free energy of adhesion ($\Delta G_{adhesion}$) between the antimicrobial surfaces and bacterial surfaces. The $\Delta G_{adhesion}$ value allows to evaluate the thermodynamic of the adhesion process, which is thermodynamically favorable when $\Delta G_{adhesion}$ <0 and unfavorable when $\Delta G_{adhesion}$> 0. The values of the ΔG^{TOT} and $\Delta G_{adhesion}$ were obtained from measured of the contact angle formed on surfaces by three liquids with different polarities using the goniometer. From these measures were calculated ΔG^{TOT} and $\Delta G_{adhesion}$ values using the equations proposed by Van Oss. Both surface functionalized or not with Ag NPS of stainless steel and PE were considered hydrophobic (ΔG^{TOT} <0) and the bacterial surfaces were considered hydrophilic (ΔG^{TOT} >0). The values obtained for the $\Delta G_{adhesion}$ showed that the adhesion thermodynamics of each bacterial species on the stainless steel control and functionalized with Ag NPs was favorable and also for the same bacterial species in the PE control and functionalized with Ag NPs. Therefore, the Ag NPs, used in the preparation of surfaces, in this study, were not able to modify the physicochemical characteristics of functionalized surfaces when compared to controls surfaces to become them less adherent to bacteria which would hinder the adhesion process and the consequent formation of biofilms.

Key-words: silver nanoparticle, adhesion thermodynamic, stainless steel, polyethylene.

Support Agency: CNPq