Heat Melt Compaction as an Effective Treatment for Eliminating Microorganisms from Solid Waste.

Mary P. Hummerick, Richard F. Strayer, Lashelle E. McCoy, Jeffrey T. Richards, Anna Maria Ruby, Raymond M. Wheeler.

One of the technologies being tested at Ames Research Center as part of the logistics and repurposing project is heat melt compaction (HMC) of solid waste to reduce volume, remove water and render a biologically stable and safe product. Studies at Kennedy Space Center have focused on the efficacy of the heat melt compaction process for killing microorganisms in waste and specific compacter operation protocols, i.e., time and temperature, required to achieve a sterile, stable product. The work reported here includes a controlled study to examine the survival and potential re-growth of specific microorganisms over a 6-month period of storage after heating and compaction. Before heating and compaction, ersatz solid wastes were inoculated with *Bacillus amyloliquefaciens* and *Rhodotorula mucilaginosa*, previously isolated from recovered space shuttle mission food and packaging waste. Compacted HMC tiles were sampled for microbiological analysis at time points between 0 and 180 days of storage in a controlled environment chamber. In addition, biological indicator strips containing spores of *Bacillus atrophaeus* and *Geobacillus stearothermophilus* were imbedded in trash to assess the efficacy of the HMC process to achieve sterilization. Analysis of several tiles compacted at 180°C for times of 40 minutes to over 2 hours detected organisms in all tile samples with the exception of one exposed to 180° C for approximately 2 hours. Neither of the inoculated organisms was recovered, and the biological indicator strips were negative for growth in all tiles indicating at least local sterilization of tile areas. The findings suggest that minimum time/temperature combination is required for complete sterilization. Microbial analysis of tiles processed at lower temperatures from 130°C-150°C at varying times will be discussed, as well as analysis of the bacteria and fungi present on the compactor hardware as a result of exposure to the waste and the surrounding environment. The two organisms inoculated into the waste were among those isolated and identified from the HMC surfaces indicating the possibility of cross contamination.