

DEFENCE ANNOUNCEMENT

Final Examination for the Degree of MSc

NARJES AL ALI

Date: May 24, 2018

Time: 9:00 am to 12:00 pm

Location: FS128

Examining Committee

Dr. Yoshi Mine, Chair

Dr. Keith Warriner, Advisor

Dr. Joseph Odumeru, Advisory Committee Member

Dr. Jeff Farber, Department Member

TITLE: Inactivation of *Salmonella* and *Enterococcus faecium* NRRL B-2354 Surrogate on Flax Seed using an Ethanol-Peroxyacetic Acid Based Sanitizer Applied on a Laboratory and Commercial Scale

ABSTRACT: There continues to be salmonellosis linked to low moisture foods such as flax seed. Decontaminating low moisture foods is challenging due to the sensitivity to moisture, the need to retain seed viability (in the case of seeds) and enhanced stress resistance of *Salmonella* under dry conditions. In the following, a peroxyacetic acid-ethanol based sanitizer has been evaluated for inactivating *Salmonella* Newport & Cubana on flax seed at laboratory scale & commercial scale respectively. *Salmonella* Newport was spray inoculated onto flax seeds and recovered in saline to give a recovery of 80% of the original inoculum. *S. Cubana* introduced onto flax seed underwent a decline from 6.41 ± 0.36 Log cfu/g to 4.39 ± 0.06 Log CFU/g over 5 days then levels remained stable at 4.47 ± 0.20 Log CFU/g for the remainder of the 21 Day storage period. At the end of the storage period the seeds were treated with the ethanol-peroxyacetic acid sanitizer at a dose of 40 ml/kg then allowed to dry over a 24h period. The efficacy of the sanitizer was dependent on the concentration applied and method of recovery. With regards the latter, the log count reduction was significantly higher when saline was used to recover survivors compared to Tryptic Soy Broth (TSB) supplemented with glycerol (1-10% w/v). The log reduction of *Salmonella* was further increased if the sanitizer treated flax was left 24h prior to enumerating survivors due to die-off of sub-lethally injured cells. When the sanitizer was applied at a dose of 80 ml/kg then seeds left for 24h, the log reduction of *Salmonella* on flax was 2.50 ± 0.17 log CFU when saline was used to recover the pathogen that compares to 3.09 ± 0.17 log CFU when recovered in TSB-1% glycerol. A range of *Salmonella* and different seed types could be effectively decontaminated using the optimised treatment although lower log reductions were obtained on nuts. Large scale (110 kg) studies were performed using *Enterococcus faecium* NRRL B-2345 as a surrogate for *Salmonella*. The treatment (40 kg sanitizer per tonne) supported a 5.33 log CFU/g reduction of the surrogate compared to 4.19 log CFU/g for the same sanitizer application at laboratory scale trials. In conclusion, the study demonstrated that the ethanol-peroxyacetic acid sanitizer could effectively control *Salmonella* on flax seed and that treatments applied on a commercial scale are more effective compared to those undertaken within the laboratory environment.