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Alkaline Hydrolysis of Prion-Positive Materials for Purposes of Disposal

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The purpose of this study was to validate the efficacy of alkaline hydrolysis as an alternative disposal method to rendering for disposing of bovine specified risk materials and other biological materials potentially infected or contaminated with infectious prions (PrP^{Sc}). A mouse bioassay, performed in collaboration with the USDA-APHIS-Wildlife Services-National Wildlife Research Center (NWRC) in Fort Collins, CO, compared the efficacy of alkaline hydrolysis and commercial rendering for inactivating mouse-adapted scrapie prions. Female C57/BL6 mice (N=120) were randomly divided into four treatment groups (n=30) and each mouse was injected intraperitoneally with their designated inoculum. Treatment groups 1 and 2 served as the negative and positive controls, respectively. Group 3 was inoculated with rendered scrapie-positive mouse brain material to investigate the effectiveness of commercial continuous-flow rendering practices to reduce or eliminate PrP^{Sc}. Group 4 was inoculated with hydrolyzed scrapie-positive mouse brain material to deduce the sterilizing effect of alkaline hydrolysis on PrP^{Sc}. Mice were monitored for overt signs of disease and those showing signs were euthanized to prevent undue suffering. Brains were obtained from all mice that died (or were euthanized) and analyzed with an ELISA or western blot diagnostic assay for the presence of PrP^{Sc}. Results indicated that the continuous-flow rendering treatment used for preparing the rendering treatment group inoculum failed to completely eliminate PrP^{Sc}; it delayed, but did not stop, clinical mouse-adapted scrapie transmission. Compared to positive controls, the rendering treatment group experienced a 45-day average delay in days to death (250 days vs. 205 days for positive controls; $P < 0.0001$) and a 73.9% death loss ($P = 0.0094$). Positive controls suffered 100% death loss. More importantly, the results validated the efficacy of the alkaline hydrolysis treatment to inactivate all PrP^{Sc} as no mice succumbed to the disease ($P < 0.0001$). Based on the results of the study, alkaline hydrolysis should be considered by the animal rendering and beef packing industries as an alternative to incineration, landfill burial, and rendering for disposing of bovine specified risk materials, animal carcasses, and other biological tissues potentially infected or contaminated with PrP^{Sc}.

Key words: alkaline hydrolysis, commercial rendering, mouse survival study, prion inactivation

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