Benchtop Testing Supporting Feasibility to Conduct In Vivo Studies of Synthetic Turf/Recycled Tire Crumb Rubber

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Over 12,000 synthetic turf fields exist in the US, with up to 1200 added annually. A primary component of synthetic turf is crumb rubber (CR) infill, which is derived from recycled automotive tires containing potential carcinogenic and toxic substances. However, the potential for human exposure from playing on these fields is not well understood. As such, likely exposure scenarios in humans that could be translated into exposure routes for in vivo testing were evaluated. Benchtop trials were conducted to evaluate various CR formulations for bedding (incidental contact), feed (indirect ingestion), oral gavage (direct consumption), and dermal (direct contact) exposures. Due to the physical characteristics of CR (irregular sized particles of ground tires that encompass a large size range and composition), physical manipulation methods were performed prior to testing. Milling was not feasible due to the characteristics of rubber (elasticity and thermal properties) and the additional additives employed during the grinding process; therefore, CR was sieved into various particle sizes for evaluation in each exposure scenario. Bedding and feed formulations were prepared at 50:50 (wt:wt) CR:bedding and at 50,000 ppm in feed with various sieved fractions of CR (greater than 170 µm). The formulations were rotated on an orbital shaker for four days to evaluate uniformity and potential for vapor off-gassing (bedding only). Uniformity of the feed formulations was maintained over four days of shaking. While larger CR particles maintained uniformity with the bedding, smaller particles settled to the bottom of the cage. No vapor off-gassing was observed for the bedding. Corn oil gavage formulations were prepared as homogenous suspensions at concentrations up to 200 mg/mL using CR with a particle size no greater than 170 µm. Particle sizes and concentrations greater than 170 µm resulted in blockage of the gavage needle during dispensing. Dermal administration of CR suspensions was determined to not be feasible due to clumping of CR in the vehicle, preventing homogeneous formulations. From this study, three potential human exposure scenarios (incidental exposure, indirect ingestion, and direct consumption) were identified as feasible exposure regimens for in vivo testing.