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Preliminary Evaluation of commercial off the shelf (COTS) packing materials for Flight Medication Dispenser (FMD) Technology Development

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With the advent of longer duration space missions, pharmaceutical use in space has increased. During the first 33 space shuttle missions, crew members took more than 500 individual doses of 31 different medications . Anecdotal reports from crew members described medications as generally “well tolerated” and “effective”. However, reported use of increased medication doses and discrepancies in ground vs. flight efficacy may result from reduced potency or altered bioavailability due to changes in chemical and/or physical parameters of pharmaceutical stability. Based on preliminary results from a ground-based irradiation and an inflight study on pharmaceutical stability, three susceptible medications, Amoxicillin/Clavulanate and Sulfamethoxazole/trimethoprim antibiotics tablets and promethazine (PMZ), an antihistamine were selected for testing using two types of Oliver-Tolas bags, TPC-1475(Clear) and TPF-0599B (Foil) for radiation Shielding effectiveness. The material composition of the bags included aluminum coated Mylar sheathing coated with multifunctional nanocomposities based on polyethylene with dispersed boron-rich nanophases. Two bags of each medication were irradiated for different time intervals with 14.6 rad/min to achieve 0.1 Gy, 1 Gy and 10 Gy of cumulative radiation dose. Active pharmaceutical content (API) in each medication was determined and results analyzed. No significant difference in API content was observed between control and irradiated samples for both antibiotic tablets suggesting both types of bags may offer protection against gamma radiation; results with PMZ were inconclusive. These preliminary results suggest that Oliver-Tolas TPL-1475 and TPF-0599B materials may possess characteristics suitable for protection against ionizing radiation and can be considered for designing and further testing of FMD technology.