**Drug Stability Analyzer**

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**ABSTRACT**

Crewmembers of current and future long duration spaceflights require medicines to overcome the deleterious effects of weightlessness, sickness and potential injuries. Unfortunately, recent studies have shown that many of the medicines (pharmaceutical drugs) currently used degrade more rapidly in space, losing their potency well before the typical 1 to 2 year expiration dates.¹ To complicate matters, the degradation products of some drugs can be toxic, such as p-aminophenol formed from acetaminophen (Tylenol®), which can cause liver damage.² Consequently there is a need for a space-worthy analyzer that can monitor the degradation of these drugs to improve the understanding of space-induced degradation, so that drug types, formulations, and packaging can be improved, and supplies can be selected to match mission length. The ability of the analyzer to nondestructively quantify the amount of the active pharmaceutical ingredient (API) and the degradation products would also allow assessing drug potency at the time of use to ensure crewmember safety.

In an effort to address these needs, we have been investigating the ability of Raman spectroscopy to monitor degradation and determine if a drug is suitable for use based on the presence of 90% or more of the original API concentration. Raman spectroscopy measures the vibrational modes of molecules, which allows identification of virtually any substance, including drugs. Furthermore, it is a “point-and-shoot” technology, in that the sample is simply placed at the laser focal point to make a measurement, typically in 1 minute or less. Here we will present Raman measurements of acetaminophen (Figure 1), azithromycin, epinephrine, lidocaine, and their degradation products at percent level concentrations, in actual formulations, and 90%/10% drug/degrandent mixtures using a compact, low mass, spectrometer.

![Raman Spectra](image.png)

**REFERENCES**


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