**University of Central Florida**
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# Nylon Microplastics Analysis using Room-Temperature Fluorescence Spectroscopy

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Due to the frequent use of plastics in daily life, encountering microplastic trace evidence in forensic investigations is a common occurrence. Nylons are a plastic class known to be strong and durable, and they are used in a variety of products. Nylon is also a popular choice among 3D printing materials, and its strength and durability lend itself to printing tools like keys and even firearms. The analysis of trace evidence from 3D printed materials has not received as much attention as other microplastics, however what has been published used the standard techniques of microscopy, infrared spectroscopy, Raman spectroscopy, and mass spectrometry. Nylons are known to have fluorescent impurities created during the polymer's synthesis and processing, so this work set out to develop a method to analyze nylon microplastics using room-temperature fluorescence spectroscopy. By analyzing impurities in the sample, fluorescence spectroscopy can provide additional information about the evidence's source that other non-destructive methods do not. Excitation-emission matrices, excitation and emission spectra, and synchronous fluorescence spectra were collected from pellets of four different nylons. Using these spectra, all nylons could be distinguished from one another. A trace evidence simulation was then performed with fragmented pellets and a 3D printed key, and the trace microplastics were shown to have spectra that were consistent with those of the bulk plastic. This method was then improved by applying chemometric algorithms to differentiate two nylons with similar fluorescence spectra, as well as by using a sample substrate to improve the signal-to-background ratio. Overall, this work presents forensic scientists with a powerful new tool to analyze nylon microplastics and generate more reliable conclusions.