



## Young Forensic Scientists Forum—2020

### Y7 Ultraviolet (UV) Absorption Properties of Synthetic Cathinones

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**Learning Overview:** After attending this presentation, attendees will understand how UV/Visible (UV/Vis) spectrophotometry can be used to determine the wavelength maxima and molar absorptivity of synthetic cathinones.

**Impact on the Forensic Science Community:** This presentation will impact the forensic science community by reporting the UV/Vis spectrophotometric properties of synthetic cathinones, including the wavelength maxima and molar absorptivity in methanol, and how this information can be used to screen seized drugs for these compounds.

Seized drug analyses are routinely performed and are a major part of the workload in crime laboratories across the country. Typically, color or spot tests are used to presumptively identify a controlled substance with subsequent confirmation by Gas Chromatography/Mass Spectrometry (GC/MS). While most traditional drugs of abuse, such as heroin and cocaine, can be presumptively identified by common color tests, this is not the case with synthetic cathinones. The Scientific Working Group for the Analysis of Seized Drugs (SWGDRUG) has published recommendations for the minimum requirements for the forensic identification of seized drugs.<sup>1</sup> In these recommendations, SWGDRUG has classified analytical techniques incorporated within an analysis scheme into three categories based upon the level of selectivity they achieve. UV/Vis is listed as a category B technique since it is not very selective, particularly when compounds have similar structural properties. For this reason, it has not been a commonly used technique for screening seized drugs. There is very little data reported in the peer-reviewed literature about the UV/Vis spectral properties of synthetic cathinones. For this reason, and the fact that there is limited presumptive test options for these compounds, the UV/Vis spectral properties were investigated. The determination of wavelength maxima and molar absorptivities in methanol were determined for more than 20 synthetic cathinones. Hopefully, this information will be useful to practitioners analyzing seized drugs.

A Beckman Coulter® DU-800 UV/Vis spectrophotometer, Mettler Toledo LabX™ UV/Vis spectrophotometer, and a Cary 3500 UV/Vis spectrophotometer were used to create calibration curves based on dilutions sets prepared using Cerilliant® and Cayman Chemical certified reference standards. Nine working solutions were created from a 10- $\mu\text{g}/\text{mL}$  stock solution of each synthetic cathinone by diluting with American Chemical Society (ACS) -grade spectrophotometric methanol. The concentrations ranged from  $5 \times 10^{-5}\text{M}$  (stock) to  $5 \times 10^{-6}\text{M}$ . A set of stock and working solutions for each synthetic cathinone was prepared in duplicate from separate certified standards with different lot numbers. Spectra were acquired on all three aforementioned instruments for each synthetic cathinone for each dilution set. All spectral data acquired were processed using Microsoft® Excel® for MAC® (version 16.30) to determine molar absorptivity, standard deviation, and Coefficient of Variation percentage (CV%).

Data obtained on all three UV/Vis spectrophotometers were in excellent agreement (CV% < 4%). Wavelength maxima varied slightly for all cathinones depending on the functional group substitution. Methyleneoxy-ring substitution resulted in multiple wavelength maxima. For all cathinones analyzed in methanol, the wavelength maxima were in the range of 230.6nm (methylone) to 279.4nm (methedrone). Regression analysis of plotted data (absorption vs. concentration) resulted in good linear correlation (all above  $R^2=0.99$ ) for every synthetic cathinone analyzed on all three instruments. Molar absorptivity values in methanol ranged from  $1.18 \times 10^5\text{L}\cdot\text{cm}^{-1}\cdot\text{mol}^{-1}$  (methcathinone) to  $1.97 \times 10^5\text{L}\cdot\text{cm}^{-1}\cdot\text{mol}^{-1}$  (methylone).

This presentation reports spectral data for more than 20 synthetic cathinones that have not been reported previously. This includes wavelength maxima and molar absorptivity data recorded from cathinones in methanol. Although UV/Vis spectrophotometry is not highly selective, the information reported here can be used with other analytical data to identify and quantify synthetic cathinones. Sample preparation is simple and the analysis is not time consuming. This study demonstrates that UV/Vis spectrometry has the potential to be used as a screening tool in crime laboratories for the analysis of synthetic cathinones in drug seizures.

#### Reference(s):

1. Scientific Working Group for the Analysis of Seized Drugs Recommendations, Version 8.0, 2019:June 13. [www.swgdrug.org](http://www.swgdrug.org) (last accessed on 31Oct19).

#### Forensic Chemistry, Synthetic Cathinones, UV/Visible Spectrophotometry