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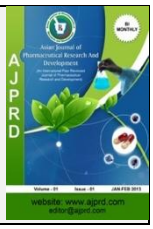

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Research Article

Application of Ultraviolet Spectrophotometry with Dual Wavelength Method for the Simultaneous Determination of Ecstasy Tablet Content

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A B S T R A C T

Objective: Ecstasy is a type of narcotic tablet and is very popularly used as a stimulant. The main content is Methylene dioxymetamphetamine (MDMA) and Methamphetamine (MA), but because a large amount of demand is not balanced with sufficient supply, ecstasy tablets are often adulterated with various contents, such as Paracetamol (PCT), Caffeine (KFN) and Ephedrine (EFD). Ecstasy tablets are often combined with other active compounds so that they can cause problems in determining the levels of tablets carried out in the Police Forensic Lab, so a cheaper, effective, and fast method is needed in determining the levels of these tablets.

Methods: The research was conducted experimentally with the spectrophotometric method, namely the dual-wavelength method, then the validation was tested based on the validation parameters, namely linearity, accuracy, precision, LOD and LOQ. Then, this method was applied to determine levels of MA, EFD, KFN and PCT in tablet preparations.

Results: The results showed that the application of the dual-wavelength method for the assay was carried out at λ 250.6 nm and 263 nm for KFN, at λ 263 nm and 281.8 nm for MA, at λ 259.4 nm and 255 nm for PCT at λ 255 nm and 236 nm for EFD, respectively. with a level result of 40.05; 1.63; 38.11; 20.21 for MA, EFD, KFN and PCT respectively, and with good precision and accuracy

Conclusions: The dual-wavelength ultraviolet spectrophotometric method was successfully applied to determine the levels of MA, EFD, KFN and PCT mixtures in tablets.

Keywords: *methamphetamine, ephedrine, caffeine, paracetamol, dual wavelength method.*

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INTRODUCTION

Ecstasy is the name for narcotics in tablet form, its general content is 3,4-methylenedioxy ethamphetamine (MDMA), methamphetamine / N.alpha.S-dimethyl-benzeneethanamine and other analogues, this compound is a class of synthetic narcotics, has a complex effect, is both stimulant and hallucinogenic. Ecstasy tablets are often combined with other active compounds such as paracetamol, caffeine and ephedrine. Ecstasy is a synthetic drug that can change mood and perception in terms of awareness of objects and surrounding conditions [1,2].

Based on the experience of the author who analyzed the content of ecstasy tablets at the North Sumatra Police Forensic Laboratory, it was found that ecstasy tablets contained 4 compound components, namely Methamphetamine (MA), Ephedrine (EFD), Caffeine (KFN) and Paracetamol (PCT). Methamphetamine and

Ephedrine have similar groups where the difference is that only in the EFD group there is an OH group on the carbon atom number 3, so it is difficult to determine the levels of these compounds[1]. Ecstasy tablets are often combined with other active compounds so that they can cause problems in determining the levels of tablets carried out in the Police Forensic Lab, so a cheaper, effective, and fast method is needed in determining the levels of these tablets. There are various kinds of content determination methods, one of which is spectrophotometry. Spectrophotometry is a simple, effective, fast and relatively inexpensive method when compared to other methods[3,4].

The dual-wavelength method (DWM)spectrophotometric method is one of the spectrophotometric methods that can be used for direct mixture analysis of several substances without having to separate, easy to apply for routine analysis and without the need for derivatization first, although with an adjacent wavelength [3,5]. The spectrophotometric method using the dual-wavelength method (DWM) has been carried out by Bindaiya, et al., (2010) for the determination of the levels of nitazoxadine and ofloxacin, as well as the research of Jain, et al., (2010) for the simultaneous determination of the levels of drotaverine HCl and aceclofenac in tablet preparations provide accurate, precise and selective results [6,7]. Based on the description above, this study will simultaneously analyze the levels of ecstasy tablets containing Methamphetamine, Ephedrine, Caffeine and Paracetamol compounds without the dual-wavelength method (DWM).

MATERIAL AND METHODS

Material

Ecstasy tablets were obtained from the evidence of confiscation at the North Sumatra Police forensic laboratory. Raw Material Methamphetamine (Cerilliant®), Ephedrine (Malladi), Caffeine (Sigma-Aldrich), Paracetamol (Anqiu lu'an), All other chemicals and reagents used were for an analytical grade.

Apparatus and conditions

UV-Visible Spectrophotometer (Shimadzu 1800) with a computer equipped with UV probe 2.43 software (UV-1800 Shimadzu), the absorption was recorded at a wavelength of 200-400 nm using a 1 cm cuvette using UV-probe software. Analytical balance (sartorius), sonicator (Branson 1510) glass tools, mortal and other tool required in sample preparation.

Preparation of standard stock solution

Carefully weighed 50 mg EFD, KFN and PCT it to a 50mL volumetric flask dissolved it in methanol; phosphate buffer pH 5 by adding it to the line. Standard stock solution concentration was 1000 µg / mL 5 ml of parent solution transferred to a 50 mL volumetric flask diluted it using methanol; phosphate buffer pH 5 by adding it to the line, and the concentration would be 100 µg / mL.Methamphetamine solution with a concentration of 1000 µg / ml then taken 18 ml is sufficient to obtain a concentration of MA solution of 360 µg / ml.

Determination of Absorption Maximum Spectrum and Spectrum absorption ratio

Methamphetamine solution with a concentration of 360 µg / ml, EFD 361 µg / ml, KFN 8.5 and PCT 6.5 µg / ml. The absorption spectrum of MA ratios is in the range 200-520 µg / ml, EFD is in the range 195-527 µg / ml, KFN is in the range 4.5-12.5 µg / ml and PCT is in the range 3.5-9. 5 µg / ml, as well as a mixture of both the drugs in the same concentration range, was prepared for Dual wavelength method.

Procedure method

The spectrum of MA show identical absorbance at 263 nm (λ1) and 250.6 nm (λ2) therefore these two wavelengths were selected for the analysis of KFN. In EFD, two wavelengths at 255 nm (λ3) and 259.4 nm (λ4) have a difference in absorbance of zero in the single spectrum EFD, so that these wavelengths can be used for PCT measurements in drug mixtures. In KFN, two wavelengths at 263 nm (λ5) and 281.8 nm (λ6) are obtained which have a zero absorbance difference in the single KFN spectrum, so that at these wavelengths it can be used to measure MA in drug mixtures. In PCT, two wavelengths at 255 nm (λ7) and 236 nm (λ8) are obtained which have a zero absorbance difference in the single spectrum of PCT, so that these wavelengths can be used for EFD measurements in drug mixtures.

Validation test

Linearity

Standard solution of MA, EFD, KFN and PCT for absorption spectrum was made and measured at the selected wavelength points 263 nm and 250.6 nm for MA, wavelength points 255 nm and 259.4 nm for EFD, wavelength points 263 nm and 281.8 nm for KFN and wavelength points 255 nm and 236 nm for PCT. The difference in the absorbance value of the two wavelengths is used to obtain the regression equation for each component at the selected wavelength[8,9].

The precision of the method

Reparability of the methods was studied by repeating the methods six times. The determination of precision is based on the relative standard deviation (RSD) value 2%[8,9].

Recovery test

Recovery test was calculated by measured recovery percentage in three specific points which were: 80%, 100%, and 120%. In each of the specific points, the test used 70% from the sample and 30% from the pure active substances (standard addition method)[8,9].

Preparation of sample solution

Twenty tablets were weighed and crushed until homogeneous. Next, the amount of powder weighed to the equivalent of 50 mg was calculated. It must be weighed up to six replications, then put in a 50 mL volumetric flask and diluted with methanol; phosphate buffer pH 5 (with sonicator for 15 minutes), then refluxed with methanol; phosphate buffer pH 5 to mark the line, shaken until homogeneous. The solution is then filtered, approximately

10 mL of the first filtrate is discarded. Take 5 mL, put it in a 50 mL flask and re-dilute it with methanol; phosphate buffer pH 5 until a solution of 100 µg / mL is obtained. Absorption is measured at 200-400 nm wavelengths.

RESULT AND DISCUSSION

Study of overlain spectra and selection of wavelength

In a study of overlain with the correct concentration and according to the lambert-beer law and following the $A\frac{1}{1}$rule, the respective drug concentrations were measured, namely Methamphetamine (MA), Ephedrine (EFD), Caffeine (KFN) and Paracetamol (PCT). at concentrations of 360 µg / ml, 361 µg / ml, 8.5 µg / ml, 6.5 µg / ml respectively and their mixtures in the same concentration were scanned each with a range of 200-400 nm1. The observed overlain spectra of the solubility of MA, EFD, KFN and PCT are shown in Figure 1.

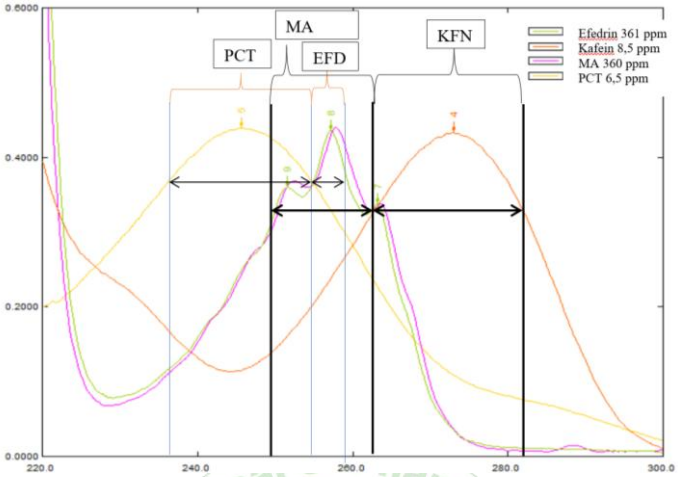

Figure: 1 Overlain spectrum of MA, EFD, KFN and PCT

Table: 1 Result of calibration readings for MA, EFD, KFN and PCT

Concentration (ppm) MA	The difference in absorbance of the mixture of the four compounds was at 263 and 281.8 nm	Concentration (ppm) EFD	The difference in absorbance of the mixture of the four compounds was at 255 and 236 nm
200	0.0112	195	0.0159
280	0.0159	278	0.0218
360	0.0193	361	0.0293
440	0.0243	444	0.0355
520	0.0277	527	0.0437
Concentration (ppm) KFN	The difference in absorbance of the mixture of the four compounds was at 250.6 and 263 nm	Concentration (ppm) PCT	The difference in absorbance of the mixture of the four compounds was at 259.4 and 255 nm
4.5	0.4394	3.5	0.2988
6.5	0.6053	5	0.4255
8.5	0.8009	6.5	0.5449
10.5	0.9484	8	0.6442
12.5	1.1222	9.5	0.7609

From the study of overlain two-wavelength spectra were selected for MA 263 nm and 250.6 nm where the absorbance difference is 0 so that it can be used for KFN analysis, while for KFN 263 nm and 281.8 nm are used for MA analysis. In EFD the two-wavelength spectrum was chosen for the 255 nm and 259.4 nm EFD where the absorbance difference was 0 so that it could be used for PCT analysis, while for PCT 263 nm and 281.8 nm were used for EFD analysis. For the calibration curve, from the spectrum of the ratio of the mixture of the four drugs in the same concentration range, the Dual wavelength method was made. The results of the calibration readings for MA, EFD, KFN and PCT are shown in Table 1.

Assay for the commercially available tablet dosage form is performed and the results are shown in Table 2.

Method validation:

The developed method is validated for linearity, precision and accuracy.

Linearity

The calibration curves of MA, EFD, KFN and PCT were linear in the range 200-520µg/ml, 195-527µg/ml, 4.5-12.5 µg/ml and 3.5-9.5µg/ml respectively.

The regression equations of calibration curves were Y_{MA} = 5.3581X - 0.0003, r = 0.9990 for MA; Y_{EFD}= 8.1966X – 0.0002, r = 0.9993 for EFD; Y_{KFN} = 0.0894X - 0.0189, r = 0.9990 for KFN; Y_{EFD} = 0.0799X – 0.0128, r = 0.9990 for PCT.

Precision

The relative standard deviation (% R.S.D.) for the dual-wavelength method is obtained as follows 1.59; 18.41; 0.55 and 1.82 for MA, EFD, KFN and PCT, respectively

Limit of Detection (LOD) and Limit of Quantitation (LOQ)

LOD for MA, EFD, KFN and PCT were found to be 30.07 µg/mL each; 25.50 µg/mL; 0.71 µg/mL and 0.55 µg/mL. LOQ for MA, EFD, KFN and PCT were found to be 91.13 µg/mL respectively; 77.29 µg / mL; 2.15 µg / mL and 1.68 µg /mL. The validation results are shown in Table 3.

Recovery

The percentage of drug recovery from marketed formulations was determined by addition of standard pure drugs at three (80%, 100%, and 120%) known concentrations and excellent recovery was obtained at each level. The recovery percentages for MA, EFD, KFN and PCT were 101.12%, 100.16%, 99.84% and 100.10%.

Table 2: Results of simultaneous estimation of MA, EFD, KFN and PCT by Dual Wavelength spectrophotometry method

Component	Content (%)
MA	40.05
EFD	1.63
KFN	38.11
PCT	20.21

Table 3: Optical characteristics of the proposed methods and results of formulation analysis & precision study

No.	Parameter	MA	EFD	KFN	PCT
1	Analytical wavelengths for determination (nm)	263 and 281.8	255 and 236	250.6 and 263	259.4 and 255
2	Lamber beer (µg/mL)	200-520	195-527	4.5-12.5	3.5-9.5
3	Regression equation	Y_{MA} = 5.3581X - 0.0003	Y_{EFD} = 8.1966X – 0.0002	Y_{KFN} = 0.0894X - 0.0189	Y_{EFD} = 0.0799X – 0.0128
4	Correlation coefficient	0.9990	0.9993	0.9990	0.9990
5	Accuracy (%)	101.12	100.16	99.84	100.10
6	Presisi (RSD) (%)	1.59	18.41	0.55	1.82
9	LOD (µg/mL)	30.07	25.50	0.71	0.55
10	LOQ (µg/mL)	91.13	77.29	2.15	1.68

CONCLUSION

The proposed multiple wavelength method provides accurate and precise results for the determination of MA, EFD, KFN and PCT in tablet mix formulations without prior separation and is being easily applied for routine analysis. The most attractive features of the dual-wavelength method are its simplicity and speed. The validation method has been proven by various tests of linearity, accuracy and precision. The proposed method is successfully applied for the determination of this drug in tablets.

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