دراسة تحليليّة طيفيّة لتحديد ديكلوفيناك البوتاسيوم بشكل إفرادي أو بالمشاركة في بعض المستحضرات الصّيدلانية

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الملخص

تم تطوير طريقة بسيطة وغير مكلفة وسريعة لقياس الطيف الضوئي للأشعة فوق البنفسجية والتحقق من صلاحيتها لتحديد ديكلوفيناك البوتاسيوم (DICLO-K) بالمشاركة مع الباراسيتامول (PARA) في المادة الأوليّة والأشكال الصيدلانية للمضغوطات. تم تطبيق طريقة المشتق الطيفي الأول (^{1}DS) لتقدير ديكلوفيناك البوتاسيوم وباراسيتامول على الترتيب. تم تحديد ديكلوفيناك البوتاسيوم عند 257 نانومتر ($^1D_{257}$) وتم تحديد باراسيتامول عند 275.5 نانومتر ($^1D_{275.5}$). كان المجال الخطي واقعاً ما بين (1.8 – 60.0) ميكروغرام/مل من أجل ديكلوفيناك البوتاسيوم و(1.2 – 27.0) ميكروغرام/مل من أجل باراسيتامول، أظهرت دراسة الانحدار معاملات ارتباط جيدة R^2 = 0.99998 وR^2 = 0.99988 من أجل ديكلوفيناك البوتاسيوم وباراسيتامول، على الترتيب. كان حد الكشف (LOD) وحد التحديد الكمي (LOQ) 0.33 ميكروغرام/مل و1.01 ميكروغرام/مل من أجل ديكلوفيناك البوتاسيوم و0.05 ميكروغرام/مل و0.17 ميكروغرام/مل من أجل باراسيتامول على الترتيب. تم تطبيق الطريقة بنجاح لتحديد ديكلوفيناك البوتاسيوم وباراسيتامول في المستحضرات الصيدلانية للمضغوطات ذات العلامات التجارية الصيدلانية السورية بجرعات مختلفة. كانت الطريقة المطبقة بسيطة ومباشرة وحساسة ولا تتطلب أي عمليات استخلاص مسبقة، ما يسمح بتطبيقها في التحاليل الروتينية وضبط الجودة.

الكلمات المفتاحية: ديكلوفيناك البوتاسيوم (DICLO-K)، باراسيتامول (PARA)، الاشتقاق الطيفي.

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Analytical Spectrophotometric Study for Determining Diclofenac Potassium Individually or in Combination in Some Pharmaceutical Preparations

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ABSTRACT

Simple, inexpensive, rapid, UV spectrophotometric method has been developed and validated for the estimation of diclofenac potassium (DICLO-K) and paracetamol (PARA) in raw material and tablets pharmaceutical formulations. First derivative spectrophotometric (^{1}DS) method was applied for the determination of (DICLO-K) and (PARA), respectively. (DICLO-K) was determined at 257.0 nm ($^1D_{257.0}$) and (PARA) was determined at 275.5 nm ($^1D_{275.5}$). Linearity ranges were (1.8 – 60.0) μg/mL for (DICLO-K) and(1.2 – 27.0) μg/mL for (PARA), regression study showed a good correlation coefficients R^2 = 0.99998 and R^2 = 0.999**8**8 for (DICLO-K) and (PARA), respectively. The limit of detection (LOD) and limit of quantification (LOQ) were to be 0.33 μg/mL and 1.01 μg/mL for (DICLO-K), 0.05 μg/mL and 0.17 μg/mL for (PARA), respectively. The method was successfully applied for the determination of (DICLO-K) and (PARA) in tablets pharmaceutical formulations in Syrian pharmaceutical products. The proposed method is simple, direct, and sensitive and does not require any pre-extraction process. Thus, the method could be ready to apply in routine analysis and quality control.

KEYWORDS: Diclofenac Potassium (DICLO-K), Paracetamol (PARA), Derivative spectrophotometry.

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INTRODUCTION

Diclofenac potassium: Potassium 2-[2-[(2,6-dichlorophenyl) amino] phenyl] acetate or Diclofenac potassium (DICLO-K), fig. 1, is a white or slightly yellowish, slightly hygroscopic, crystalline powder [1]. Sparingly soluble in water, freely soluble in methanol, soluble in ethanol, slightly soluble in acetone.

(DICLO-K) is a non-steroidal anti-inflammatory drug (NSAID) that exhibits anti-inflammatory, analgesic, and antipyretic activities in animal models. The mechanism of action of (DICLO-K) tablets, like that of other NSAIDs, is not completely understood but involves inhibition of cyclooxygenase (COX-1 and COX-2).

Paracetamol: N-(4-Hydroxyphenyl) acetamide or Paracetamol (PARA), fig. 2, is a white or almost white crystalline powder. Sparingly soluble in water, freely soluble in alcohol, very slightly soluble in methylene chloride [1]. (PARA) is a p-aminophenol derivative that exhibits analgesic and antipyretic activity. It does not possess anti-inflammatory activity. (PARA) is thought to produce analgesia through a central inhibition of prostaglandin synthesis.

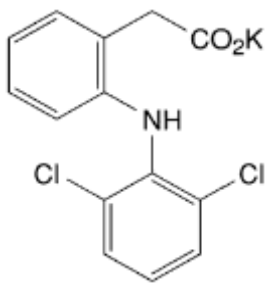

Fig. 1: Chemical structure of Diclofenac potassium.

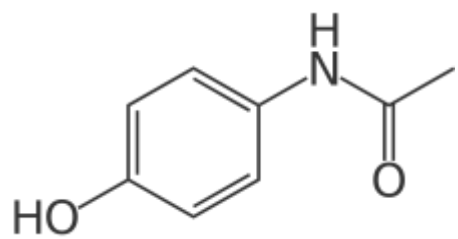

Fig. 2: Chemical structure of Paracetamol.

The determination of these drugs is a frequent analytical problem in quality control of the pharmaceutical industries. The study of two drugs in this work showed a strong overlap between their absorption spectra. Hence, their simultaneous determination is hard when conventional spectrophotometric techniques are used, so we used the spectral derivation method to determine the two compounds.

Various methods have been proposed to determine the amount of (DICLO-K) and (PARA) in some pharmaceutical formulations, such as high performance liquid chromatographic method (HPLC) [2–3], reverse phase high performance liquid chromatographic method (RP-HPLC) [4–6], spectrophotometric method (UV) [3,7–11], high performance thin-layer chromatographic (HPTLC) [10,12–14].

The aim of this work is to develop a simple and accurate spectrophotometric method for simultaneous determination of (DICLO-K) and (PARA) in some tablets pharmaceutical formulations without prior treatment by derivative spectrophotometry (^{1}DS).

1-EXPERIMENTAL

1-1- Apparatus

All spectral measurements were carried out using a T80+, UV/Vis. spectrophotometer PG instrument Ltd (UK), connected to computer, quartz cells 1 cm. Ultrasonic bath Daihan (China), and stirrer Velp Scientifica (Europe).

1-2- Chemical reagents

(DICLO-K) is from Cipla, pvt. Ltd Mumbai (India), purity 99.64%, Mw=334.2 g/mol. (PARA) is from Abbott Health care pvt. Ltd., Mumbai (India), purity 99.80%, M_w= 151.2 g/mol and Sodium Hydroxide min. 99.00% from HIMEDIA (India), Double distilled water.

1-3- Standard stock solutions

600 μg/mL solution of (DICLO-K) and 300 μg/mL solution of (PARA) were prepared by separately dissolving appropriate weights of raw material in Sodium Hydroxide 0.01 M, after taking the purity of the material on consideration. The working standard solutions of each pharmaceutical sample is prepared by appropriate dilutions of stock solutions with Sodium Hydroxide to give concentrations between (1.8 - 60.0) μg/mL of (DICLO-K) and (1.2 - 27.0) μg/mL of (PARA).

1−4- Sample preparations

Five Syrian products were studied:

- Twenty tablets of each trademark products [Parafenac (HUMAN Pharma), Diclotamol-K (APHAMEA pharmaceuticals)] (DICLO-K)/(PARA) 50/500 mg/tablet, were weighed and finely powdered, and an accurate weight equivalent to one tablet of 50 mg (DICLO-K) and 500 mg (PARA) was dissolved in NaOH 0.01 M.

The sample solution was filtered through a 3-paper filter (Whatman, England), placed in a flask of 100 mL, and adjusted to volume with sodium hydroxide 0.01 M. Then 1 mL of the previous solution was taken and placed in a 25 mL volumetric flask, and adjusted to volume with sodium hydroxide 0.01 M, which considered as a stock solution. Then 1 mL of the stock solution was taken into a 10 mL volumetric flask and adjusted to volume with NaOH 0.01 M, to obtain a theoretical concentration equivalent to 2.0 µg/mL of (DICLO-K). Then 0.600 mL of the stock solution was taken into a 10 mL volumetric flask and adjusted to volume with NaOH 0.01 M, to obtain theoretically equivalent to 12.0 µg/mL of (PARA). The blank was NaOH 0.01 M.

- Twenty Dopran 500 mg/tab. (OUBARI PHARMA) were weighed and finely powdered, and took an equivalent to one tablet 500 mg (PARA), then dissolved in 100 mL NaOH 0.01 M. The sample solution was filtered through a 3-paper filter (Whatman, England). Then 1 mL of the previous solution was taken into a 25 mL volumetric flask, and adjusted to volume with sodium hydroxide 0.01 M. Then transferred 0.500 mL into a 10 mL volumetric flask and adjusted to volume with NaOH 0.01 M. (PARA) was a theoretically equivalent to 10 µg/mL.
- Twenty Flam-K 50 mg/tab. (from DIAMOND PHARMA) were weighed and finely powdered, and took an equivalent to one tablet 50 mg (DICLO-K)/tab., dissolved in 100 mL NaOH 0.01 M. The sample solution was filtered through a 3-paper filter (Whatman, England). Then took 0.400 mL into a 10 mL volumetric flask and adjusted to volume with NaOH 0.01 M. (DICLO-K) was a theoretically equivalent to 20 µg/mL.
- Twenty Paracetamol Barakat 1000 mg/tab. (BARAKAT) were weighed and finely powdered, took an equivalent to one tablet 1000 mg (PARA)/tab., dissolved in 250 mL NaOH 0.01 M. The sample solution was filtered through a 3-paper filter (Whatman, England). Then 1 mL of the previous solution was taken into 25 mL volumetric flask, and adjusted to volume with sodium hydroxide 0.01 M. Then took 0.625 mL into a 10 mL volumetric flask and adjusted to volume with NaOH 0.01 M. (PARA) was theoretically equivalent to 10 µg/mL.

1−5- Diclofenac potassium and Paracetamol spectra

Absorption Zero-order spectra for each standard pharmaceutically raw samples 30 µg/mL (DICLO-K) and 15 µg/mL (PARA) solutions were recorded within the wavelengths range of (220 – 350) nm against the blank [all the addition constituents without (DICLO-K) and (PARA)], as seen in fig. 3 .(DICLO-K) cannot be determined by direct measurement of absorbance at 275.5 nm, and (PARA) cannot also determined by direct measurement of absorbance at 257.5 nm, because of the overlapped spectra.

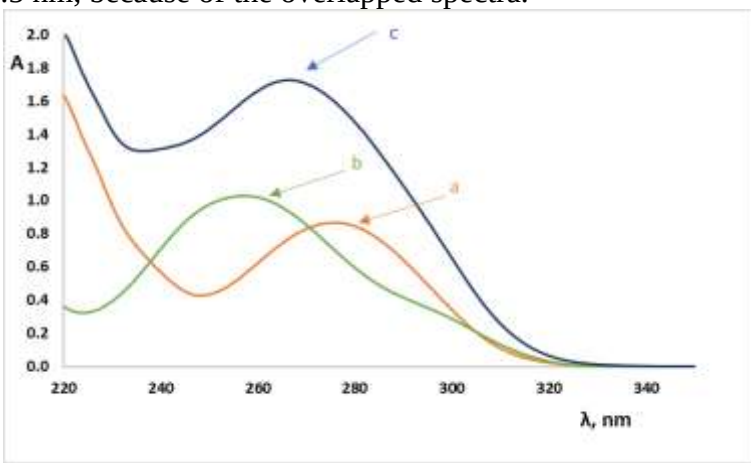

Fig. 3: Zero-order spectra:
a: $C_{(DICLO-K)}$ = 30 µg/mL, b: $C_{(PARA)}$ = 15 µg/mL.
c: mixture of $C_{(DICLO-K)}$ = 30 µg/mL and $C_{(PARA)}$ = 15 µg/mL.

On the other hand, derivative spectrophotometry showed more resolution. Where it made the determination of previous mixture possible without pretreatment.

The first derivative spectrum at zero-crossing point was used to determine (DICLO-K) in the presence of (PARA) at 257.0 nm (fig. 4, a).

The first derivative spectrum at zero-crossing point was used to determine (PARA) in the presence of (DICLO-K) at 275.5 nm (fig. 4, b).

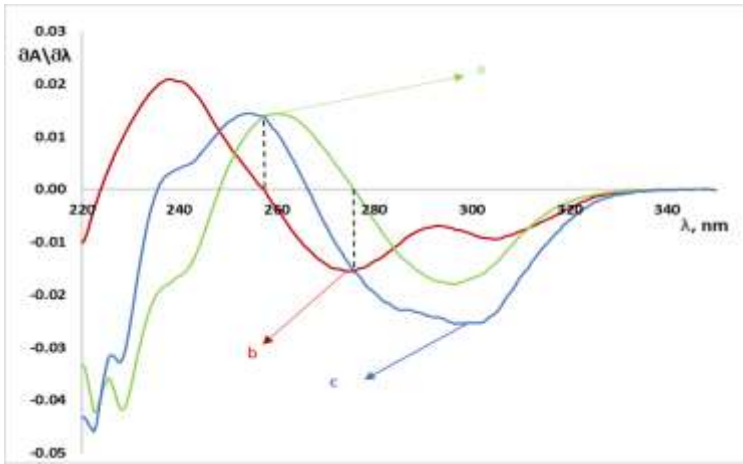

Fig. 4: First derivative spectra:
a: $C_{(DICLO-K)}$ = 30 µg/mL, b: $C_{(PARA)}$ = 15 µg/mL.
c: mixture of $C_{(DICLO-K)}$ = 30 µg/mL and $C_{(PARA)}$ = 15 µg/mL.

2- RESULTS AND DISSCUSSION

2-1- Linearity

Figs. 5 and 7 show the calibration curve for (DICLO-K) and (PARA) respectively. Five standard solutions for each concentration were prepared and the absorbance was measured of each solution five times at 257.0 nm for (DICLO-K) and at 275.5 nm for (PARA). The concentrations linearity of (DICLO-K) were in the range (1.8 – 60.0) μg/mL and the concentrations linearity of (PARA) were in the range (1.2 – 27.0) µg/mL. Fig 6 and 8 present (DICLO-K) and (PARA) first derivative spectra respectively for different concentrations.

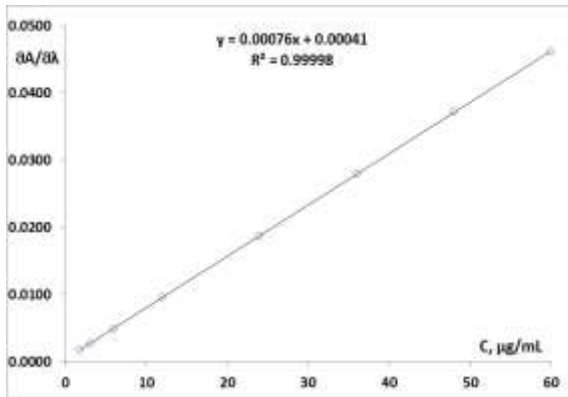

Fig. 5: Calibration curve for (DICLO-K).
n = 5 for each concentration.

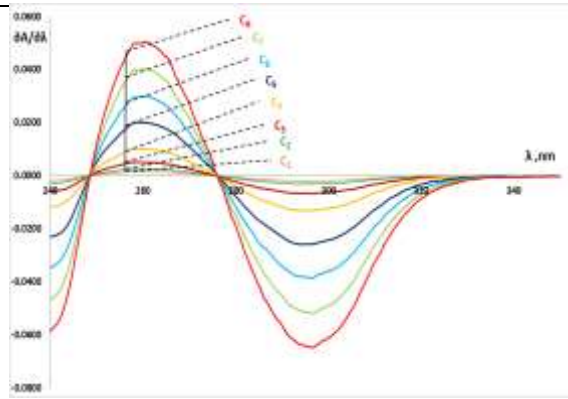

Fig. 6: First derivative spectra for (DICLO-K):
C_1 = 1.8 µg/mL, C_2 = 3.0 µg/mL, C_3 = 6.0 µg/mL, C_4 =12.0 µg/mL,
C_5 = 24.0 µg/mL, C_6 = 36.0 µg/mL, C_7 = 48.0 µg/mL, C_8 = 60.0 µg/mL.

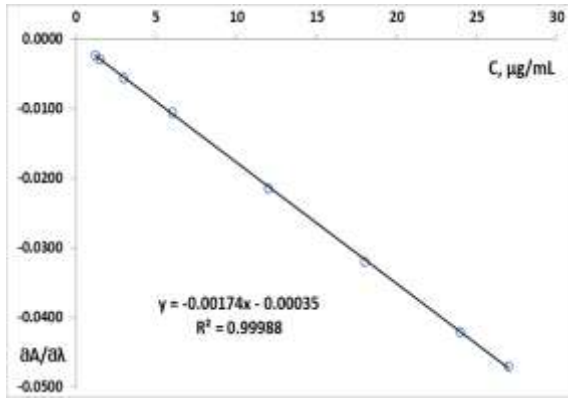

Fig. 7: Calibration curve for (PARA).
n =5 for each concentration.

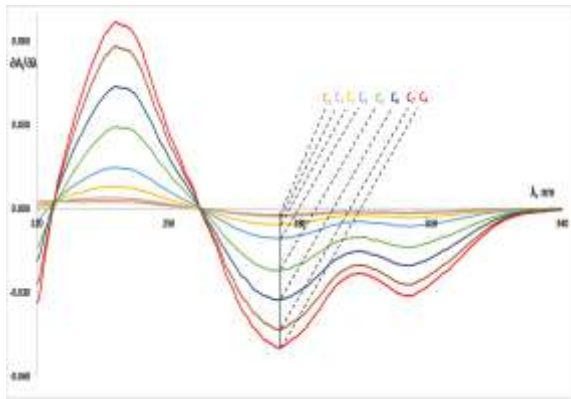

Fig. 8: First derivative spectra for (PARA):
C_1 = 1.2 µg/mL, C_2 = 1.5 µg/mL, C_3 = 3.0 µg/mL, C_4 = 6.0 µg/mL,
C_5 = 12.0 µg/mL, C_6 = 18.0 µg/mL, C_7 = 24.0 µg/mL, C_8 = 27.0 µg/mL.

2-2- Limit of Detection (LOD) and Limit of Quantification (LOQ)

In order to the measurement LOD and LOQ of (DICLO-K) and (PARA), five concentrations of each were analyzed in five replicates table 1. LOD and LOQ were calculated by using the following equations:

$$LOD = \frac{3.3 \times SD}{m} \quad ; \quad LOQ = \frac{10 \times SD}{m}$$

where SD is the standard deviation of y intercepts of regression lines and m is the slope of the calibration curve.

Table 1: Statistical data for calibration graphs.

Method	Analyte	Selected Wavelength (nm)	Linearity rang μg/mL	Correlation coef. (R^2)	LOD μg/mL	LOQ μg/mL
^{1}DS	(DICLO-K)	^{1}D 257.0	1.8 – 60.0	0.99998	0.33	1.01
^{1}DS	(PARA)	^{1}D 275.5	1.2 – 27.0	0.99988	0.05	0.17

2-3- Accuracy

To determine the precision and accuracy of the proposed method, five replicate determinations were carried out on five different concentrations of standards (DICLO-K) and (PARA) table 2.

Table 2: Accuracy for determining of (DICLO-K) and (PARA).

Method	Raw sample	Theoretical Concentration μg/mL	$\bar{x}$ Found Concentration μg/mL	SD μg/mL	Precision RSD %	Accuracy %
First Derivative λ = 257.0 nm	(DICLO-K)	12.00	12.09	0.09	0.74	100.75
		24.00	24.09	0.11	0.46	100.38
		36.00	36.36	0.30	0.83	101.00
		48.00	48.30	0.60	1.24	100.63
		60.00	60.12	0.61	1.01	100.20
First Derivative λ = 275.5 nm	(PARA)	3.00	3.02	0.07	2.32	100.67
		12.00	12.17	0.05	0.41	101.42
		18.00	18.20	0.05	0.27	101.11
		24.00	24.04	0.09	0.37	100.17
		27.00	26.81	0.31	1.16	99.30

$\bar{x}$: mean of five replicated determinations, Accuracy (%) = (found concentration/theoretical concentration x 100).

Precision (RSD %) = (standard deviation/mean concentration) x 100.

2-4- Precision

In order to demonstrate the precision of the proposed method, intra-day and inter-day variability studies were performed at three different concentrations (24, 36, 48) μg/mL of (DICLO-K) and (12, 18, 24) μg/mL for (PARA) at the same day, in two hours interval and at three different days, knowing that the prepared sample was repeated

for every measurement. Method efficiency was tested in terms of RSD% for both intra-day and inter-day precisions. The precision was ascertained by carrying out five replicates of standards (DICLO-K) and (PARA) under study and the mean was calculated. The results are presented in tables 3, 4.

The RSD% results were not more than 1.11% for (DICLO-K) and 0.87% for (PARA).

Table 3: Intra-day precision for determination of (DICLO-K) and (PARA).

Method	Raw sample	Concentration µg/mL	Found concentration µg/mL.					
			*Time I	Precision RSD %	*Time II	Precision RSD %	*Time III	Precision RSD %
[1]DS	(DICLO-K)	24.00	24.12	0.62	24.14	0.99	24.25	1.11
		36.00	36.22	0.55	36.20	0.61	36.07	0.86
		48.00	48.20	0.56	48.01	0.65	48.07	0.42
[1]DS	(PARA)	12.00	12.17	0.58	12.20	0.41	12.11	0.41
		18.00	18.19	0.33	18.18	0.33	18.12	0.28
		24.00	24.05	0.25	24.16	0.62	24.09	0.87

*n = 5

Table 4: Inter-day precision for determination of (DICLO-K) and (PARA).

Method	Raw sample	Concentration µg/mL	Found concentration µg/mL.					
			*Time I	Precision RSD %	*Time II	Precision RSD %	*Time III	Precision RSD %
[1]DS	(DICLO-K)	24.00	24.12	0.62	24.09	1.03	24.22	0.83
		36.00	36.22	0.55	36.30	0.80	36.33	0.69
		48.00	48.20	0.56	48.12	0.52	48.20	0.56
[1]DS	(PARA)	12.00	12.17	0.58	12.18	0.57	12.07	0.66
		18.00	18.19	0.33	18.24	0.49	18.20	0.33
		24.00	24.05	0.25	24.02	0.50	23.97	0.38

*n = 5

2-5- Robustness

The robustness of an analytical procedure is measurement of its capacity to maintain unaffected results by a very small variation of some parameters and provides an indication of its reliability during normal usage. The studied variables parameters were rang, scan speed and the wavelength which performed at three different concentrations (24, 36, 48) µg/mL for (DICLO-K) and (12, 18, 24) µg/mL for (PARA). The results in table 5 showed no significant differences.

Table 5: Robustness test for (DICLO-K) and (PARA).

Method	parameter	Deviation	$\bar{x}$ (µg/mL)	SD (µg/mL)	RSD %	Per %	$\bar{x}$ (µg/mL)	SD (µg/mL)	RSD %	Per %	$\bar{x}$ (µg/mL)	SD (µg/mL)	RSD %	Per %
^{1}DS 257.0 nm	Slit range	2	24.22	0.11	0.45	100.92	36.20	0.17	0.47	100.56	48.01	0.16	0.33	100.02
	2	1	23.83	0.11	0.46	99.29	36.28	0.20	0.55	100.78	48.22	0.20	0.41	100.46
	Scan speed (Fast)	Fast	24.22	0.11	0.45	100.92	36.20	0.17	0.47	100.56	48.01	0.16	0.33	100.02
		Medium	24.22	0.11	0.45	100.92	36.20	0.17	0.47	100.56	48.01	0.16	0.33	100.02
		Slow	24.25	0.22	0.91	101.04	36.28	0.20	0.55	100.78	48.22	0.20	0.41	100.46
	Wave length	+0.5 nm	23.80	0.26	1.09	99.17	36.07	0.20	0.55	100.19	48.04	0.25	0.52	100.08
		- 0.5 nm	24.15	0.12	0.50	100.63	36.30	0.21	0.58	100.83	48.30	0.20	0.41	100.63
^{1}DS 275.5 nm	Slit range	2	12.31	0.21	1.71	102.58	18.31	0.13	0.71	101.72	24.12	0.12	0.50	100.50
	2	1	12.17	0.09	0.74	101.42	18.16	0.10	0.55	100.89	24.18	0.15	0.62	100.75
	Scan speed (Fast)	Fast	12.31	0.21	1.71	102.58	18.31	0.13	0.71	101.72	24.12	0.12	0.50	100.50
		Medium	12.13	0.09	0.74	101.08	18.14	0.07	0.39	100.78	24.17	0.13	0.54	100.71
		Slow	12.14	0.05	0.41	101.17	18.12	0.05	0.28	100.67	24.03	0.19	0.79	100.13
	Wave length	+0.5 nm	12.17	0.03	0.25	101.42	18.12	0.40	2.21	100.67	24.04	0.05	0.21	100.17
		- 0.5 nm	12.17	0.03	0.25	101.42	18.05	0.35	1.94	100.28	24.21	0.06	0.25	100.88

$\bar{x}$: mean of five replicated determinations.

2-6- Recovery

The recovery was studied by three addition standards (80 %, 100 %, and 120 %) for every product. table 6 presents the recoveries results for Parafenac, Diclotamol-K, Flam-K, Dopran and Paracetamol Barakat.

Table 6: Recoveries of (DICLO-K) and (PARA) products.

Method	Products	Pharmaceutical dosage	Sample µg/mL	Added µg/mL	Total Found $\bar{x}$ µg/mL	Recovery %	*SD µg/mL	*RSD %	Recovery Average %
^{1}DS	DOPRAN	(PARA) 500 mg/tab.	10.01	8.01	18.03	100.12	4.53	4.52	100.40
				10.01	20.06	100.40	1.55	1.54	
				12.01	22.10	100.67	2.17	2.16	
^{1}DS	PARACETAMOL BARAKAT 1000	(PARA) 1000 mg/tab.	10.07	8.06	18.16	100.37	2.18	2.17	100.32
				10.07	20.19	100.50	4.58	4.56	
				12.08	22.16	100.08	1.81	1.81	

[1]DS	FLAM-K	(DICLO-K) 50 mg/tab.	19.96	15.97	36.01	100.50	3.81	3.79	100.71
				19.96	40.09	100.85	1.12	1.11	
				23.95	44.10	100.79	2.22	2.20	
[1]DS	PARAFENAC	(DICLO-K) 50 mg/tab.	2.01	1.61	3.62	100.00	2.21	2.21	99.97
				2.01	4.01	99.50	1.99	2.00	
				2.41	4.41	100.42	1.58	1.57	
[1]DS	PARAFENAC	(PARA) 500 mg/tab.	12.03	9.62	21.68	100.31	1.89	1.88	100.07
				12.03	24.04	99.83	1.63	1.63	
				14.44	26.48	100.07	1.51	1.51	
[1]DS	DICLOTAMOL-K	(DICLO-K) 50 mg/tab.	1.99	1.59	3.59	100.63	1.94	1.93	100.38
				1.99	3.99	100.50	1.75	1.74	
				2.39	4.38	100.00	1.83	1.83	
[1]DS	DICLOTAMOL-K	(PARA) 500 mg/tab.	12.04	9.63	21.68	100.10	1.94	1.94	100.19
				12.04	24.12	100.33	2.56	2.55	
				14.45	26.51	100.14	1.74	1.74	

$\bar{x}$: mean of five replicated determinations.
* Calculated from recovery.

3- Application

The method was applied for quantitative determination of (DICLO-K) and (PARA) in Syrian pharmaceutical tablets products FLAM-K, PARAFENAC, DICLOTAMOL-K, DOPRAN and PARACETAMOL BARAKAT for five different batches for each one. The samples were prepared as mentioned before in the section of samples preparation and analyzed. Quantitative analysis was done by using calibration curve. The obtained results are summarized in tables (7- 13).

Table 7: Results of (DICLO-K) dose in FLAM-K tablets.

Product	FLAM-K (50 mg/tab).					
Batches	Sample concentration mg/tab.	*Concentration $\bar{x}$ mg/tab.	SD mg/tab.	RSD %	Per %	LC = $\bar{x}$±[t × SD/(n)½] mg/tab.
B_1	50 mg	49.11	0.38	0.77	98.22	49.11 ± 0.472
B_2		50.16	0.38	0.76	100.32	50.16 ± 0.472
B_3		49.90	0.49	0.98	99.80	49.90 ± 0.609
B_4		50.63	0.52	1.03	101.26	50.63 ± 0.646
B_5		50.43	0.50	0.99	100.86	50.43 ± 0.622
RSD %	0.76 - 1.03					
Per %	98.22 - 101.26					

Table 8: Results of (DICLO-K) dose in PARAFENAC tablets.

Product	PARAFENAC (50/500 mg/tab).					
Batches	Sample concentration mg/tab.	*Concentration $\bar{x}$ mg/tab.	SD mg/tab.	RSD %	Per %	LC = $\bar{x}$±[t × SD/(n)½] mg/tab.
B_1	50 mg	50.99	1.80	3.53	101.98	50.99 ± 2.238
B_2		48.36	1.47	3.04	96.72	48.36 ±1.828
B_3		50.33	1.80	3.58	100.66	50.33 ± 2.238
B_4		49.67	1.47	2.96	99.34	49.67 ± 1.828
B_5		50.33	1.80	3.58	100.66	50.33 ± 2.238
RSD %	2.96 - 3.58					
Per %	96.72 - 101.98					

Table 9: Results of (DICLO-K) dose in DICLOTAMOL-K tablets.

Product	DICLOTAMOL-K (50 /500 mg/tab).					
Batches	Sample concentration mg/tab.	*Concentration $\bar{x}$ mg/tab.	SD mg/tab.	RSD %	Per %	LC = $\bar{x}$±[t × SD/(n)½] mg/tab.
B_1	50 mg	50.99	1.80	3.53	101.98	50.99 ± 2.238
B_2		52.30	2.33	4.46	104.60	52.30 ± 2.897
B_3		52.96	1.47	2.78	105.92	52.96 ± 1.828
B_4		49.67	1.47	2.96	99.34	49.67 ± 1.828
B_5		48.36	1.47	3.04	96.72	48.36 ± 1.828
RSD %	2.78 - 4.46					
Per %	96.72 - 105.92					

Table 10: Results of (PARA) dose in DOPRAN tablets.

Product	DOPRAN (500 mg/tab).					
Batches	Sample concentration mg/tab.	*Concentration $\bar{x}$ mg/tab.	SD mg/tab.	RSD %	Per %	LC = $\bar{x}$±[t × SD/(n)½] mg/tab.
B_1	500 mg	500.29	4.36	0.87	100.06	500.29 ± 5.421
B_2		502.59	5.22	1.04	100.52	502.59 ± 6.490
B_3		500.86	3.75	0.75	100.17	500.86 ± 4.662
B_4		507.76	6.86	1.35	101.55	507.76 ± 8.529
B_5		502.01	2.40	0.48	100.40	502.01 ± 2.984
RSD %	0.48 - 1.35					
Per %	100.06 - 101.55					

Table 11: Results of (PARA) dose in DOPRAN tablets.

Product	PARACETAMOL BARAKAT (1000 mg/tab).					
Batches	Sample concentration mg/tab.	*Concentration $\bar{x}$ mg/tab.	SD mg/tab.	RSD %	Per %	LC = $\bar{x}$±[t × SD/(n)½] mg/tab.
B_1	1000 mg	1007.47	4.81	0.48	100.75	1007.47 ± 5.980
B_2		986.78	4.81	0.49	98.68	986.78 ± 5.980
B_3		1009.77	4.81	0.48	100.98	1009.77 ± 5.980
B_4		993.68	3.15	0.32	99.37	993.68 ± 3.916
B_5		1013.22	2.57	0.25	101.32	1013.22 ± 3.195
RSD %	0.25 - 0.49					
Per %	98.68 - 101.32					

Table 12: Results of (PARA) dose in DICLOTAMOL-K tablets.

Product	DICLOTAMOL-K (50 /500 mg/tab).					
Batches	Sample concentration mg/tab.	*Concentration $\bar{x}$ mg/tab.	SD mg/tab.	RSD %	Per %	LC = $\bar{x}$±[t × SD/(n)½] mg/tab.
B_1	500 mg	502.16	2.00	0.40	100.43	502.16 ± 2.487
B_2		504.55	2.00	0.40	100.91	504.55 ± 2.487
B_3		506.94	2.00	0.39	101.39	506.94 ± 2.487
B_4		501.68	1.69	0.34	100.34	501.68 ± 2.101
B_5		498.80	2.00	0.40	99.76	498.80 ± 2.487
RSD %	0.34 - 0.40					
Per %	99.76 - 101.39					

Table 13: Results of (PARA) dose in PARAFENAC tablets.

Product	PARAFENAC (50/500 mg/tab).					
Batches	Sample concentration mg/tab.	*Concentration $\bar{x}$ mg/tab.	SD mg/tab.	RSD %	Per %	LC = $\bar{x}$±[t × SD/(n)½] mg/tab.
B_1	500 mg	501.68	2.40	0.48	100.34	501.68 ± 2.984
B_2		505.03	1.31	0.26	101.01	505.03 ± 1.629
B_3		507.42	2.73	0.54	101.48	507.42 ± 3.394
B_4		501.20	2.00	0.40	100.24	501.20 ± 2.487
B_5		497.84	1.31	0.26	99.57	497.84 ± 1.629
RSD %	0.26 - 0.54					
Per %	99.57 - 101.48					

*Average of five replicates for four degrees of freedom and a 95% confidence interval, where the tabulated t-value is 2.78

4- Conclusion

We developed a new method, which is suitable for the identification and quantification of (DICLO-K) in raw material and Syrian tablets formulations. A good percentage of recovery shows that the method can be successfully used in pharmaceutical quality control and routine analyses. The proposed method is simple, sensitive, rapid, specific, a low cost. It could be applied for quality control of (DICLO-K) in pharmaceutical factories. The levels of (DICLO-K) and (PARA) compounds in the analyzed preparations were found to be within the permissible limits set by the USP legislation not less than (NLT) 90.0 % and not more than (NMT) 110.0 % for (DICLO-K) and NLT 95.0 % and NMT 105.0 % for (PARA) [1].

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