Egypt. J. Chem. **Vol. 64,** No. 2 pp. 713 - 720 (2021)

Egyptian Journal of Chemistry

http://ejchem.journals.ekb.eg/

pH Assists For Selective Determination Of Acyclovir By The Emission Enhancement Of Tb^{3+}Chemosensor In Tablet And Serum Samples

T. A. Amin, Mohammad E. Azab, M. S. A. Abdel-Mottaleb, M. S. Attia*

Chemistry Department, Faculty of Science, Ain Shams University, Abbassia 11566, Cairo, Egypt

Abstract

A new selective method for the determination of acyclovir in pharmaceutical tablet and serum samples was developed. The method depends on the luminescence enhancement of Tb^{3+} chemosensor with different concentrations of acyclovir at pH 10. Acyclovir can form a complex with Tb^{3+} ion of 3:1 molar ratio in DMSO, respectively. The luminescence intensity of Tb^{3+}-acyclovir complex increases as the concentration of the drug increases at λ_{ex}=320 nm, pH 10 in DMSO. The linear range for determination of the selected drug in DMSO 1.0 x 10^{-9} –1 x 10^{-5} mol L^{-1} the detection limits were 0.24 x 10^{-9} mol L^{-1}.

Keywords: Acyclovir; Tb- Acyclovir Complex; Luminescence Intensity; Enhancement.

1. Introduction

Acyclovir (ACV) 2 - Amino - 1,9 - dihydro - 9-((2-hydroxyethoxy) methyl) -3*H*-purin-6-one ($C_8H_{11}N_5O_3$), Fig. (1), it is an anti-viral drug, its Action is by converted to Acyclovir monophosphate by virus specific thymidine kinase then converted to thymidine triphosphate by other cellular enzymes. Dosages: for adults 400 or 200 mg/day 5days [1]. A number of assay methods have been reported for determination of acyclovir in biological fluids using capillary electrophoresis [2] or liquid chromatographic methods with pulsed amperometric detection [3], tandem mass spectrometry [4], fluorescence detection [5-7] or ultraviolet detection [8- 15]. In the published methods, liquid-liquid extraction with acetonitrile or mixture of isopropyl alcohol and dichloromethane as solvent has been used for sample preparation [4, 8, 9]. The disadvantage of these methods employing liquid-liquid extraction (with grate chemical consumption) of acyclovir from biological fluids is that they involve several steps yielding poor separation from the serum endogenous interferences. In the present work, the chemosensor Tb^{3+} ion in DMSO and at pH 10 is used for sensitive determination of acyclovir in serum and tablet samples. We determined acyclovir concentration in blood serum by luminescence enhancement of this chemosensor. This is a relatively simple and inexpensive technique providing a quick reproducible analysis and is relatively free from interference with coexisting substances.

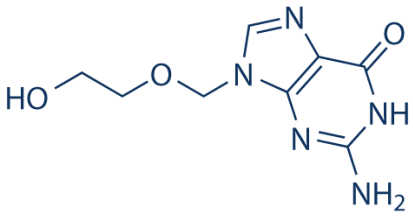

Fig. 1: Structure of Acyclovir

2. Experimental

2.1. Materials

Pure standard Acyclovir supplied by the National Organization for Drug Control and Research (Giza, Egypt). Pharmaceutical preparation (Acyclovir)

*Corresponding author e-mail: mohd_mostafa@sci.asu.edu.eg.; (M. S. Attia).
Receive Date: 27 August 2020, Revise Date: 18 September 2020, Accept Date: 04 October 2020
DOI: 10.21608/EJCHEM.2020.40799.2826

containing 400 mg/tablets of Acyclovir produced by Misr Company for pharmaceuticals.

2.2 Reagents

All solvents were purchased from Sigma–Aldrich. All chemicals used are of analytical grade and the solvents (Dimethyl sulfoxide, dimethyl formamide, acetonitrile and ethanol) are of HPLC grade. In the present investigation. The materials NH_4OH, HCL and Terbium nitrate were purchased from Sigma–Aldrich. A stock solution ($1x10^{-2}$ mol L^{-1}) of Acyclovir was prepared by exact weighing and dissolution in absolute acetonitrile. A stock solution (1.0×10^{-2} mol L^{-1}) of $Tb^{3+}$was freshly prepared by dissolving 0.0109g $Tb(NO_3)_3.5H_2O$ (delivered from Aldrich-99.99%) in small amount of Ethanol in 25 mL measuring flask, then dilute to the mark with the same solvent. The working solution of Tb^{3+} ion is of 1.0×10^{-4} mol L^{-1} was obtained by appropriate dilution of appropriated solvent. The pH of the working solution was adjusted to 4 and 10.7 for Acyclovir, by using 0.1 mol L^{-1} of NaOH and/or 0.1 mol L^{-1} of HCl solutions.

The Tb^{3+} complex was prepared by transferring of 0.1 ml aliquots of the drug working standard solution into a 5 ml volumetric followed by the addition of the required volume of Tb^{3+} solution. The solutions were then shaken vigorously before measuring their absorptions and luminescence spectra. Stock and working solutions are stored at 20ºC when are not in use.

2.3 Apparatus

All Luminescence measurements were carried out on a Meslo-PN (222-263000) z Thermo Scientific Lumina fluorescence spectrometer equipped with a 150 W Xenon lamp source and quartz cells of 1 cm path length. The slit widths of excitation and emission wavelength were 10nm/10nm and the range of wavelength was (400 – 720 nm). All absorption spectra were performed on Thermo UV-visible double beam spectrophotometer equipped with quartz cells in the range of (200-800nm). The separation of serum in samples was carried out by centrifuging of sample for 15 min at 4000 rpm on thermo scientific 300 centrifuge.

2.4 General Procedure

Preparation of lanthanide complex Tb^{3+}-Acyclovir solution: To 10 mL measuring flasks, solutions were added in the following order: 0.1 mL of 1.0×10^{-2} mol L^{-1} $Tb(NO_3)_3$ solution and 0.3 mL of 1.0×10^{-2} mol L^{-1} acyclovir solution to give 1.0×10^{-4} mol L^{-1} of $Tb(NO_3)_3$ and 0.3×10^{-4} mol L^{-1} of acyclovir. The mixture was diluted to the mark with DMSO. The above procedure was used for the subsequent measurements of absorption, emission spectra and effect of pH and solvents. The luminescence intensity was measured at $\lambda_{ex}/\lambda_{em}$ =320/545 nm, The UV absorption spectra were measured in the range of (200-800nm).

2. 5. Calibration curve:

After the preparation of the different standard solutions of Acyclovir in DMSO as described above, the chemo sensor Tb^{3+} was mixed with standard solution of Acyclovir in the cell of the spectrofluorimetric device, then the luminescence spectrum was measured at the selected excitation wavelength λ_{ex} = 320 nm.

2. 6. Determination of Acyclovir in pharmaceutical preparations

One tablet of pharmaceutical formulation Acyclovir 400 mg was carefully weighed and ground to finely divided powders. Accurate weights equivalent to $3.5\ x10^{-2}$ mol L^{-1} was dissolved in 50 mL DMSO and mixed well and filtered up using 12 mm filter papers. The concentration of the drug was determined by using different concentrations from the corresponding calibration graph.

2.7. Preparation of serum samples

The whole blood samples were collected from patients in the Egyptian police hospital in Serum Separator Tube (SST) - This tube contains a clot activator and serum gel separator. It has no anticoagulant, centrifuged for 10 min at 4000 rpm to obtain the separated serum available for analysis after decantation, 0.1 ml of serum was added to $1x\ 10^{-7}$ mol. L^{-1} of drug and 1.5 ml of $1x\ 10^{-4}$ of Tb(III) sensor in 1.0 cm cell, and the luminescence intensity was measured at $\lambda_{ex}/\lambda_{em}$=320/545 nm.

3. Result and discussion

3.1 Absorption and emission spectra

The absorption spectrum of acyclovir with Tb^{3+} complex is shown in Figure 2, comparing its spectrum before and after the addition of Tb(III) ion into its solutions in DMSO, red shift was observed which indicates that the acyclovir can form a complex with Tb(III) ion in ground state.

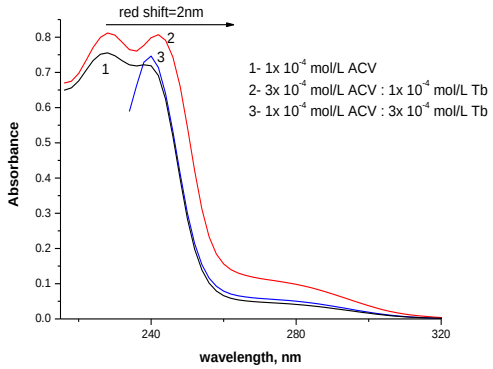

Fig. 2: Absorbance spectra of different molar ratios between Tb^{3+} and Acyclovir in DMSO.

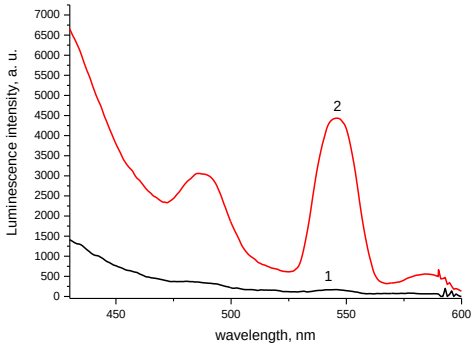

Fig. 3: Luminescence spectra of (1): 1 x 10^{-4} mol $L^{-1}Tb^{3+}$ and (2): 1 x 10^{-4} mol L^{-1} Tb^{3+} with 3 x 10^{-4} mol L^{-1} of Acyclovir in DMSO at λ_{ex}=320 nm.

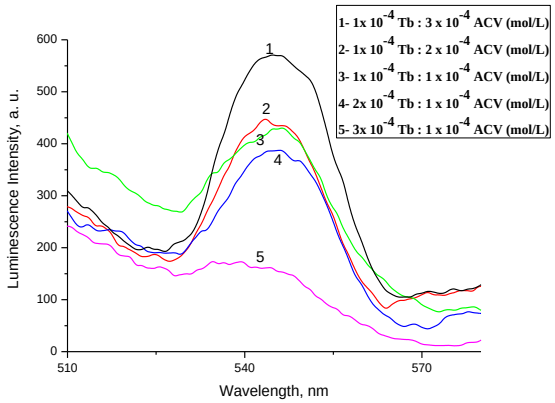

Fig. 4: Luminescence spectra of different Molar ratios between Tb^{3+} and 1 x 10^{-4} mol L^{-1}Acyclovir in DMSO at λ_{ex}=320 nm.

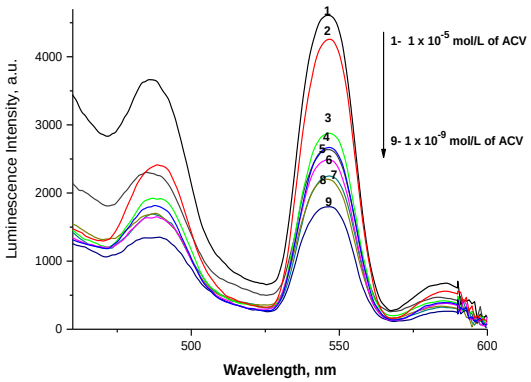

Fig. 5: Luminescence emission spectra of 1 x 10^{-4} mol L^{-1} Tb^{3+} in presence of different concentrations of ACv in DMSO at pH 10.

3.2. Emission spectra:

The luminescence emission spectra of Tb^{3+} with different concentrations of acyclovir is shown in Figure (3). From curve 1 in Figure 3 it can be seen that single Tb^{3+} ion has nearly no peak. After the addition of acyclovir to Tb^{3+} ion, the characteristic peaks of Tb^{3+} ion ($^5D_4 \rightarrow {}^7F_6$=490 nm, $^5D_4 \rightarrow {}^7F_5$=545 nm, $^5D_4 \rightarrow {}^7F_4$=590 nm, $^5D_4 \rightarrow {}^7F_3$=620 nm and $^5D_4 \rightarrow {}^7F_2$=650 nm) were appeared, (see curve 2 in Figure 3, which indicates that a good energy transfer from acyclovir to Tb^{+} in its complexes [10-15]. From Figure 4 the molar ratio between Tb^{3+} and acyclovir is 1:3 (metal: ligand) which indicates that the metal may coordinate to the drug from different sites and not only through oxygen of the ketone ring, but the more preferred coordination sites are the O of the ketone group. Figure 5 shows the emission spectra of Tb^{3+} with different concentrations of acyclovir in DMSO, the intensities of the characteristic peak at 545 nm of Tb^{3+} is enhanced linearly as the concentration of the acyclovir increases indicating that Tb^{3+} ion can be used as a chemo sensor for the drug.

3.3. Effect of experimental variables

3.3. 1 Effect of solvent

The influence of the solvent on the luminescence intensities of the solution containing 3.0x10^{-4} mol $L^{-1}$of Acyclovir and 1.0 x10^{-4} mol L^{-1}

Tb^{3+} was studied under the conditions studied above .The results show the enhanced emission of Tb^{3+}-Acyclovir in DMSO. This can be attributed to the formation of anhydrous solvates of Tb^{3+}-Acyclovir complex introducing solvent molecules in the first coordination sphere of Tb^{3+}-Acyclovir leads to the enhancement of the intensity of all transitions ($^5D_4 \rightarrow {}^7F_6$=490 nm, $^5D_4 \rightarrow {}^7F_5$=545 nm, $^5D_4 \rightarrow {}^7F_4$=590 nm, $^5D_4 \rightarrow {}^7F_3$=620 nm and $^5D_4 \rightarrow {}^7F_2$=650 nm), Figure 6.

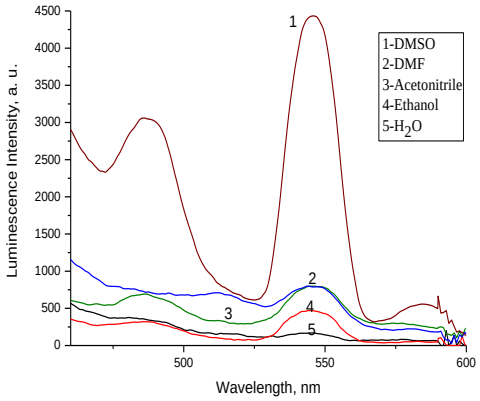

Fig. 6: Luminescence emission spectra of $1x10^{-4}$ mol L^{-1} Tb^{3+} in the presence of $3x10^{-4}$ mol L^{-1} of acyclovir at pH=10 in different solvents at λ_{ex}=320 nm.

By increasing the radiative rate, Tb^{3+}excited states will become less sensitive to deactivation process, ultimately resulting in a more efficiently emissive Tb^{3+}complex. Also, the luminescence intensities for the complexes in DMSO solutions are stronger than in ethanol. This may be due to vibrational energy transfer to solvent molecules. It is well known that the excited state of the lanthanide ions is efficiently quenched by interaction with high-energy vibrations like O-H groups thereby the luminescence of this complex in –OH containing solvents can be quenched easily because of the O-H oscillators. [15-26].

3.3. 2 Effect of pH

The pH of the medium has a great effect on the luminescence intensity of the Tb^{3+}-ACV complexes. Figure (7) show the luminescence intensity of the Tb^{3+}-ACV at different pHs ranged from 3 to 11 using 0.1mol L^{-1} of HCl and /or NaOH. The results obtained show that the maximum luminescence intensity is obtained at pH 10 for (ACV) Therefore, in the subsequent work; the pH of the tested solutions were adjusted by 0.1 mol L^{-1} of HCl and /or NaOH to pH 10 before each measurement.

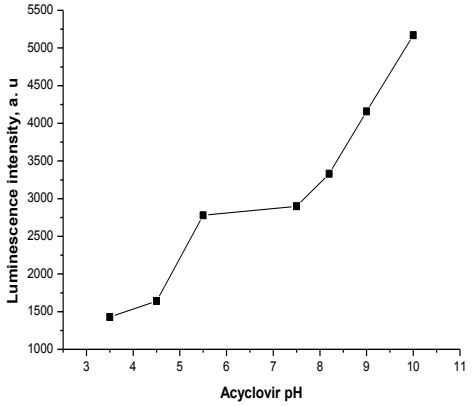

Fig. 7: Luminescence emission spectra of $1x10^{-4}$ mol L^{-1} of Tb^{3+} in the presence of $3x10^{-4}$ mol L^{-1} Acyclovir in DMSO at different pH at λ_{ex}=320 nm.

3.4. Linearity and validation parameters

3.4. 1 Linearity and range

A linear correlation was found between luminescence intensity of Acyclovir-Tb^{3+} complex at 545 nm and the concentration of Acyclovir shown in Figure (8). The five points ($1.7x10^{-4}$ to $2.12x10^{-8}$ mol L^{-1}) calibration curve was obtained by plotting the peak intensity of Tb^{3+} at λ_{em}=545 nm versus the concentration of Acyclovir and the graph was described by the regression equation Y= a + bX (where Y= luminescence intensity of the optical sensor at λ_{em}=545 nm; a = intercept; b= slope and x = concentration in mol L^{-1}). Regression analysis of luminescence intensity data using the method of least squares was made to evaluate the slope (b), intercept (a) and correlation coefficient R and the values were presented in Table (1).

3.4. 2 Detection and quantification limits

The limit of detection (LOD) and quantification (LOQ) calculated according to ICH guidelines [27] using the formula: LOD=3.3 S/b and LOQ = 10 S/b, (where S is the standard deviation of blank luminescence intensity values, and b is the slope of the calibration plot) are also presented in Table (1). The low value of LOD indicates the high sensitivity of the proposed method when compared by other methods. **3.4. 3 Accuracy and precision**

The results demonstrated that the proposed method is more accurate as well as more precise. These results complement the finding of the placebo blank analysis with respect to selectivity. To compute the accuracy and

precision, the assays were repeated three times within the day to determine the repeatability (intra-day precision) and three times on different days to determine the intermediate precision (inter-day precision) of the method. These assays were performed for three levels of the analyte. The results of this study are summarized in (Table 2). The percentage relative standard deviation (%RSD) values were ≤ 0.80 % (intra-day), ≤ 0.79 % (inter-day) of serum samples, respectively, the inter-day values indicating high precisions of the method. Accuracy was evaluated as percentage relative error (RE) between the measured mean concentrations and the taken concentrations of the Acyclovir. Bias {bias%=[(concentration found – known concentration)x100/known concentration] was calculated at each concentration and these results are also presented in Table (2). Percent relative error (%RE) values for ACV of ≤ 2.4 – 0.4 and 2.8 – 2.6 % for tablet and serum samples, respectively, demonstrates the high accuracy of the proposed method.

3.4. 4 Selectivity

The proposed method was tested for selectivity by placebo blank and synthetic mixture analysis. A placebo blank of (ACV) containing non-medicinal ingredients cellulose, indigotine, lactose, magnesium stearate, povidone, and sodium starch glycolate was extracted with DMSO and solution made as described under "analysis of dosage forms". A convenient aliquot of solution was subjected to analysis according to the recommended procedures. In the method of analysis, there was no interference by the inactive ingredients. A separate test was performed by applying the proposed method to the determination of (ACV) in a synthetic mixture. To the placebo blank of similar composition, different amount of (ACV) in pharmaceutical formulation of Acyclovir tablets was added, homogenized and the solution of the synthetic mixture was prepared as described "under analysis of dosage forms" and the (ACV) 400 mg was prepared as described before. The filtrate was collected in a 100-ml glass bottle, making the necessary dilutions to form the final concentration $1x10^{-6}$ mol L^{-1} of Acyclovir. The resulting solution was assayed (n=3) by proposed method which yield% average recovery of 100.2± 0.12, and 98.6 ± 0.42 for tablet and serum samples, respectively.

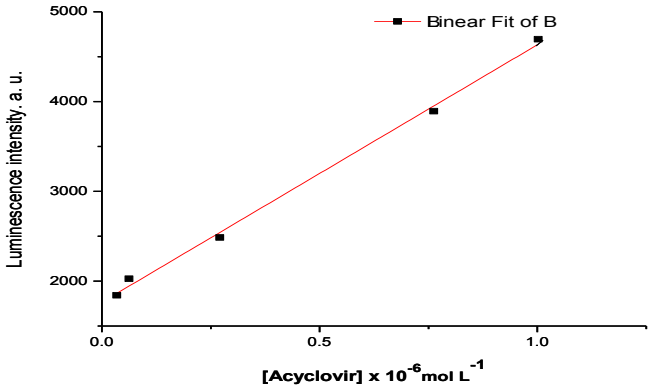

Fig. 8: Linear relationship between luminescence intensity of Acyclovir-Tb^{3+} complex at λ_{em}=545 nm and concentration of Acyclovir.

Table (1) sensitivity and regression parameters for optical sensor.

Parameter	(ACV)
λ_{em}, nm	545
Linear range x 10^{-6}, mol L^{-1}	0.001 – 10.0
Limit of Detection (LOD) x 10^{-9}, mol L^{-1}	0.24
Limit of quantification (LOQ) x 10^{-9}, mol L^{-1}	0.72
Intercept (a)	76
Slope (b) $x10^{-6}$	184
Standard deviation $x10^{-6}$	1.2
Variance (S^2) $x10^{-12}$	1.52
Regression Coefficient	0.98

Table 2: Evaluation of intra-day and inter-day precision for optical sensor Tb^{3+}-(ACV)

Sample	Actual (ACV) found x 10^{-5}	Intra-day precision (readings, n=3)			Inter-day precision (readings, n=3)		
		(ACV) average found±CL	%RE	%RSD	(ACV) average found±CL	%RE	%RSD
(ACV)	5	4.98	0.4	0.55	4.87	2.6	0.64
serum	5	4.87	2.6	0.80	4.86	2.8	0.79

CL. Confidence limits were calculated from: CL = ± tS/$(n)^{1/2}$. The tabulated value of t is 4.303, at the 95% confidence level. S = standard deviation=[(average N-value1)^2 + (average N-value2)^2 + (average N-value3)^2]$^{1/2}$. N =number of measurements. %RE. the percent relative error. =[(concentration proposed – concentration known)/concentration known)] x 100%RSD. relative standard deviation. = [S/(average measurement)]x100.

4. Conclusion

The Tb^{3+} ion solution in DMSO has high sensitive characteristics peaks in the presence of Acyclovir. The proposed method for the determination of Acyclovir offers simple, rapid and sensitive method for the analysis of Acyclovir in DMSO and pH 10 with linear range of ($1.0 \times 10^{-5} – 1.0 \times 10^{-9}$) mol L^{-1} and detection limit of 0.24×10^{-9} mol L^{-1}. The developed optical sensor is selective, accurate and attractive for routine control analysis of the drug.

5. References

1. Goodman and Gilman's. The Pharmacological Basis of Therapeutics, 11th ed., McGrow Hill, New York, 2011: pp. 1247- 1250.
2. Vo HC, Henning PA, Leung DT, Sacks SL. Development and validation of plasma assay for acyclovir using high-performance capillary electrophoresis with sample stacking. J Chromatogr B Analyt Technol Biomed Life Sci. 2002; 772 (2): 291-7.
3. Kishino S, Takekuma Y, Sugawara M, Shimamura T, Furukawa H, Todo S, Miyazaki K. Liquid chromatographic method for the determination of ganciclovir and/or acyclovir in human plasma using pulsed amperometric detection, J Chromatogr B Analyt Technol Biomed Life Sci. 2002; 780 (2): 289-94.
4. Shao C, Dowling T, Haidar S, Yu LX, Polli JE, Kane MA. Quantification of acyclovir in human plasma by ultra-highperformance liquid chromatography-heated electrospray ionizationtandem mass spectrometry for bioequivalence evaluation. J Anal Bioanal Techniques. 2012; 3:4.
5. Perrottet N, Beguin A, Meylan P, Pascual M, Manuel O, Buclin T, Biollaz J, Decosterd LA. Determination of acyclovir and ganciclovir in human plasma by liquid chromatography-spectrofluorimetric detection and stability studies in blood samples. J Chromatogr B Analyt Technol Biomed Life Sci. 2007; 852 (1-2): 420-9.
6. Dao YJ, Jiao Z, Zhong MK. Simultaneous determination of acyclovir, gagciclovir, and penciclovir in human plasma by highperformance liquid chromatography with fluorescence detection. J Chromatogr B Analyt Technol Biomed Life Sci. 2008; 867 (2): 270- 6.
7. Zeng L, Math CE, Shaw PJ, Earl JW, McLachlan AJ. HPLC fluorescence assay for acyclovir in children. Biomed Chromatogr. 2008; 22 (8): 879-87.
8. Emami J, Bazargan N, Ajami A. HPLC determination of acyclovir in human serum and its

application in bioavailability studies. Research in Pharmaceutical Sciences. 2009; 4 (1): 47-54.

9. Bahrami G, Mirzaeei SH, Kiani A. Determination of acyclovir in human serum by high-performance liquid chromatography using liquid-liquid extraction and its application in pharmacokinetic studies. J Chromatogr B Analyt Technol Biomed Life Sci. 2005; 816 (1-2): 327-31.
10. Attia, M. S., Khalil, M. H., Abdel-Mottaleb, M. S. A., Lukyanova, M. B., Alekseenko, Yu. A., Lukyanov, B. (2006). Effect of Complexation with Lanthanide Metal Ions on the Photochromism of (1, 3, 3-Trimethyl-5_-Hydroxy-6_-Formyl-Indoline-Spiro2, 2-[2H] chromene) in Different Media. Int. J. Photoenergy, 2006, 1–9. https://doi.org/10.1155/IJP/2006/42846.
11. Attia, M. S., Essawy A. A., Youssef A. O., Mostafa, M.S. (2012). Determination of Ofloxacin using a Highly Selective Photo Probe Based on the Enhancement of the Luminescence Intensity of Eu^{3+} - Ofloxacin Complex in Pharmaceutical and Serum Samples. J. Fluoresc. 2, 557-564. doi: 10.1007/s10895-011-0989-x.
12. Attia, M.S., Othman, A.M., Youssef, A.O., El-Raghi, E., (2012). Excited state interaction between Hydrochlorothiazide and Europium ion in PMMA polyme, and its application as optical sensor for Hydrochlorothiazide in tablet and serum samples, J. Lumines., 132, 2049-2053. doi.org/10.1016/j.jlumin.2012.03.012.
13. Attia, M. S., Youssef, A. O., Essawy, A. A. (2012). A novel method for tyrosine assessment in vitro by using fluorescence enhancement of the ion-pair tyrosine- neutral red dye photo probe. Anal. Methods. 4, 2323–2328. doi.org/10.1039/C2AY25089F.
14. Attia, M. S., Youssef, A. O., El-Sherif, R. H. (2014). Durable diagnosis of seminal vesicle and sexual gland diseases using the nano optical sensor thin film sm-doxycycline complex. Anal. Chim. Acta. 835, 56–64. doi.org/10.1016/j.aca.2014.05.016.
15. Attia, M.S., Diab, M., El-Shahat, M.F., (2015). Diagnosis of some diseases related to the histidine level in human serum by using the nano optical sensor Eu–Norfloxacine complex, Sensors and Actuators B. 207, 756–763. doi: 10.1016/j.snb. 2014.10.132.
16. Attia, M. S., Youssef, A. O., Khan, Z. A., & Abou-Omar, M. N. (2018). Alpha fetoprotein assessment by using a nano optical sensor thin film binuclear Pt-2-aminobenzimidazole-Bipyridine for early diagnosis of liver cancer. Talanta. 186, 36–43. doi.org/10.1016/j.talanta.2018.04.043.
17. Attia, M. S. and Al-Radadi, N. S. (2016). Progress of pancreatitis disease biomarker alpha amylase enzyme by new nano optical sensor. Biosens. Bioelect. 86, 413-419. doi.org/10.1016/j.bios.2016.06.079.
18. Attia, M. S., and Al-Radadi, N. S. (2016). Nano optical sensor binuclear Pt-2-pyrazinecarboxylic acid-bipyridine for enhancement of the efficiency of 3-nitrotyrosine biomarker for early diagnosis of liver cirrhosis with minimal hepatic encephalopathy. Biosens. Bioelect. 86, 406-412. doi.org/10.1016/j.bios.2016.06.074.
19. Attia, M. S. (2017). Nano optical probe samarium tetracycline complex for early diagnosis of histidinemia in new born children. Biosens. Bioelect. 94, 81-86. doi.org/10.1016/j.bios.2017.02.018.
20. Attia, M. S., Ali, K., El-Kemary, M., & Darwish, W. M. (2019). Phthalocyanine-doped polystyrene fluorescent nanocomposite as a highly selective biosensor for quantitative determination of cancer antigen 125. Talanta, 201, 185–193. doi.org/10.1016/j.talanta.2019.03.119.
21. Attia, M. S., Mahmoud, W. H., Youssef, A. O., Mostafa, M. S. (2011). Cilostazol Determination by the Enhancement of the Green Emission of Tb^{3+} Optical Sensor. J Fluoresc. 21, 2229-2235. doi.org/10.1007/s10895-011-0927-y.
22. Attia, M.S., Ramsis, M.N., Khalil, L.H., Hashem, S.G., (2012). Spectrofluorimetric assessment of chlorzoxazone and Ibuprofen in pharmaceutical formulations by using Eu-tetracycline HCl optical sensor doped in sol–gel matrix. J. Fluoresc., 22 ,779–788. doi.org/10.1007/s10895-011-1013-1.
23. Elabd, A. A., and Attia, M. S. (2015). A new thin film optical sensor for assessment of UO^{2}_{2+} based on the fluorescence quenching of Trimetazidine doped in sol gel matrix, J. Lumines.165, 179-184. doi.org/10.1016/j.jlumin.2015.04.024.
24. Elabd A.A. and Attia M.S. (2016). Spectroflourimetric assessment of UO22+ by the quenching of the fluorescence intensity of Clopidogrel embedded in PMMA matrix. J. Lumines. 165. doi: 10.1016/j.jlumin.2015.04.024.
25. Essawy, A. A. and Attia, M. S. (2013). Novel application of pyronin Y fluorophore as high sensitive optical sensor of glucose in human serum. Talanta. 107, 18-24. doi.org/10.1016/j.talanta. 2012.12.033

26. Hamed, E.,Attia, M.S., Bassiony, K. (2009). Synthesis, spectroscopic and thermal characterization of Copper (II) complexes of folic acid and their absorption efficiency in the blood, J. Bioinorg. chem. appl. 1-7. doi.org/10.1155/ 2009/979680.
27. Attia, M.S., Youssef, A.O., Ismael, A.M., Gaafer, R., Adel, A., Twfik, A., Wafeey, A., Afify,H.G. and Sayed, A., Highly Sensitive Eu3+ Doped in Sol-Gel Matrix Optical Sensor for The Assessment of Ciprofloxacin in Different Real Samples, Egypt. J. Chem., 61, 121 –129 (2018).
28. Abd-Elzaher, M.M., Ahmed, M.A., Farag, A.B., Attia, M.S., Youssef, A.O. and Sheta, S.M., Egypt. J. Chem. 59,701-718 (2016).
29. Safwat A. Mahmoud, Mostafa A. El-Aasser and M. S. Attia, Spectrofluorometric Determination of Alpha Fetoprotein in Different Serum Samples of Liver Cancer by Tb-acetyl Acetone Complex Embedded in Polymethylmethacrylate Optical Sensor, Egypt. J. Chem. 62, 1317- 1325 (2019)
30. Attia, M.S., Youssef, A.O., El Sheikh, R., Mahmoud, W.H., Hefny, A.H., Esam, M., Saber, A., Atef, I., Ismael, A.M. and Eissa, M., Gatifloxacin Assessment by the Enhancement of the Green Emission of Optical Sensor Tb3+ Doped In Sol-Gel Matrix, Egypt. J. Chem. 60, 929 - 935 (2017).
31. Abdallah, L., Attia, M.S. and Abdel-Mottaleb, M.S.A., Nalbuphin HCl Assessment by the quenching of the Emission of Tb -4'carboxybenzo-18crown-6-ether optical Sensor, Egypt. J. Chem., 62, 247 - 255 (2019)
32. Guideline, I.H.T., Validation of analytical procedures: text and methodology. *Q2 (R1), 1*, 1-15(2005).

مساعدة الأس الهيدروجيني في تعيين اسيكلوفير عن طريق زيادة انبعاث المحس الضوئي التربيم الثلاثي في عينات الأقراص والمصل

طارق احمد امين: محمد عماد عزب: محمد صبري احمد عبدالمطلب : محمد سعيد عطيه
قسم الكيمياء ، كلية العلوم ، جامعة عين شمس ، العباسية 11566 ، القاهرة ، مصر

تم تطوير طريقة انتقائية جديدة لتقدير الأسيكلوفير في الأقراص وعينات المصل. تعتمد الطريقة على زيادة شدة الانبعاث الفلورسيني لايون Tb^{3+} في وجود تركيزات مختلفة من الأسيكلوفير عند درجة الحموضة 10. يمكن أن يشكل الأسيكلوفير متراكب مع أيون Tb^{3+}بنسبة 1: 3 مولار في DMSO . تزداد شدة الانبعاث الفلوسيني لمركب Tb^{3+} -acyclovir مع زيادة تركيز الدواء عند λ_{ex} = 320 نانومتر ، ودرجة الحموضة 10 فيDMSO . و تم رسم علاقة خطية في مدى 1.0 x 10^{-5} - 1x 10^{-9} مول /لتر في مذيب الداي ميثيل سلفواكسيد ز.