Ain Shams University
Faculty of Science
Chemistry Department

Photophysical studies and photoanalytical techniques for assessment of some important compounds

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By

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Approval sheet

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Nalbuphine HCl Assessment by the Quenching of the Emission of Tb -4'Carboxybenzo-18crown-6-Ether Optical Sensor

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THE EFFICIENCY of excited-state interaction between $Tb^{3+}$and the 4'carboxybenzo-18crown-6-ether **(CCE)** has been studied in different solvents and pH. The high luminescence intensity of Tb-complex in DMF at 545 nm was obtained. The photo physical properties of the green emissive Tb^{3+}complex have been elucidated. The Tb- **CCE** was used as photo probe for the assessment ofNalbuphine HCl in the pharmaceutical amp and serum samples at pH 6.5 and λ_{ex} = 285 nm with a linear range $5x10^{-8}$ to $1.2x10^{-6}$ mol L^{-1} ofNalbuphine HCl, correlation coefficient of **0.993** and detection limit of 9.4 $x10^{-9}$ mol L^{-1}.

Keywords: **N**albuphine HCl (NAL); Tb-4'carboxybenzo-18crown-6-ether; Quenching; Luminescence; Photo probe.

Introduction

Nalbuphine (NAL) (m)-17-(cyclobutylmethyl)-4,5a-poxymorphinan-3,6a,14-triol (Fig. 1) is semi synthetic narcotic agonist–antagonist of the phenanthrene series. Structurally, it is closely related to naloxone, an antagonist of the opiate receptors and to oxymorphone, a narcotic agonist. Nalbuphine has been shown to be approximately equianalgesic to morphine, yet with a ceiling effect on ventilator depression and fewer adverse effects than pethidine or pentazocine. As an analgesic agent, it is almost as potent as morphine and has been widely used in the treatment of acute and chronic pain [1].

Its main advantages over morphine are a ceiling effect of respiratory depression, low tolerance liability and a lack of significant withdrawal symptoms. It is available as an injection for intramuscular and intravenous administration. The usual recommended doses are 10–20 mg by intravenous or intramuscular injection every 3–4 h. A few methods have been described to detectNalbuphine in pharmaceutical formulations and in biological fluids such as; gas chromatography coupled to electron-capture detection [2], mass spectrometry [3], high-performance liquid chromatography with electrochemical detection [4] and LC–MS/MS

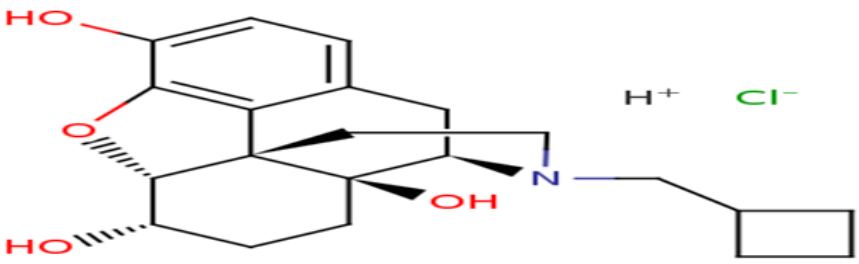

Fig. (2. 1) Structure of Nalbuphine-HCl;

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[5]. However, most of the above methods require several time consuming manipulation steps, sophisticated instruments and special training. Hence, it is of primary importance to develop an alternative method for determination of NAL with a high degree of selectivity and sensitivity. Luminescent photo probes lanthanide complexes have more advantages over the present ones; photo probe has high stability and durability. The photo probe can provide constant signal response for 2 years which is 24-fold better stability compared to the life time warranted for the chromatographic and colorimetric methods [6-14]. Photo probe is stable over all measurements which prevent the source of error in the measurement process and it gives a low standard deviation values. In this work, NAL was determined by using photo probe [Tb^{3+}-CCE] in DMF at pH 6.5 and λ_{ex} = 285 nm.

Experimental

Materials

Pure standard Nalbuphine HCl supplied by the National Organization for Drug control and Research (Giza, Egypt). Pharmaceutical preparation of Nalufin injection containing 20 mg/mL produced by Amoun Pharmaceutical Company, Egypt.

Reagents

All chemicals used are of analytical grade and pure solvents were purchased from Aldrich. A stock solution of Nalbuphine HCl; (1.0×10^{-3}mol L^{-1}) was freshly prepared by dissolving 0.2 ml from amp in 10 mL pure DMF. More diluted solution (10^{-4}mol L^{-1}) was prepared by appropriate dilution with DMF. Stock and working solutions are stored at 4 ºC when are not in use.

A Tb^{3+} ion stock solution (1.0×10^{-2} mol L^{-1}) was prepared by dissolving 0.0109g $Tb(NO_3)_3.5H_2O$ (Aldrich- 99.99%) in small amount of ethanol in 25 mL measuring flask, then dilute to the mark with absolute ethanol. A 4'carboxybenzo-18crown-6-ether (CCE) stock solution (1.0×10^{-2} mol L^{-1}) was prepared by dissolving 0.178 g CCE (Aldrich- 99.99%) in small amount of DMF in 50 mL measuring flask, then dilute to the mark with DMF. The working solution of Tb^{3+} ion of 1.0×10^{-4}mol L^{-1} was obtained by appropriate dilution with DMF.

Apparatus

All luminescence measurements were recorded with a Meslo- PN (222-263000)z Thermo Scientific Lumina fluorescence Spectrometer in the range (190 – 900 nm). The absorption of the samples was measured in the range of 220 –750 nm with Thremo UV-Visible double-beam spectrophotometer. The pH was measured using with a pHs-janway 3330 research pH meter. The separation of protein from samples was carried out by centrifuging of sample for 15 min and 3000 rpm.

General procedure

To 10 mL measuring flasks, solutions were added in the following order: 0.1 mL of $1x10^{-2}$mol L^{-1} $Tb(NO_3)_3.5H_2O$ and 0.1 ml of $1x10^{-2}$mol L^{-1} 4'carboxybenzo-18crown-6-ether solution. The above procedure was used for the subsequent measurements of absorption, emission spectra and pH and solvent effects. The luminescence intensity was measured at λex/λem =285/545nm.

Determination ofNalbuphine in serum solution

3 mL of trichloroacetic acid was added to 1.0 mL serum of a real health volunteers and the solution was centrifuged for 15 min at 4000 r/min to remove proteins, then 100 µL of the serum was added to 0.1 mL of Tb -4'carboxybenzo-18crown-6-ether on stock solution (1.0×10^{-2}mol L^{-1}) in 10 mL measuring flask and complete to the mark with DMF and. The luminescence intensity of the test solution was measured before and after addition of Tb -4'carboxybenzo-18crown-6-ether photo probe. The change in the luminescence intensity was used for determination of (NAL) in serum sample.

Result and Discussion

Absorption Spectra

The absorption spectrum of (4'carboxybenzo-18crown-6-ether) shows (Fig. 2) a band at 284 nm due to the $\pi \rightarrow \pi^*$ transition in the **CCE**. Upon addition of Tb^{3+} to **CCE** in DMF, a red shift by 8 nm was observed and the absorbance is also enhanced which indicates that **CCE** can form a complex with Tb^{3+} ion.

Effect of the Experimental Reagents

Effect of the amount of (4'carboxybenzo-18crown-6-ether) and Tb^{3+}

The ion titration revealed that the complex formed M : L (1 : 1) for Tb and (4'carboxybenzo-18crown-6-ether), which indicates that the metal .

Effect of pH

The pH of the medium has a great effect on the luminescence intensity of the Tb-(4'carboxybenzo-18crown-6-ether). The optimum pH is 6.5 at which the highest peak intensity at

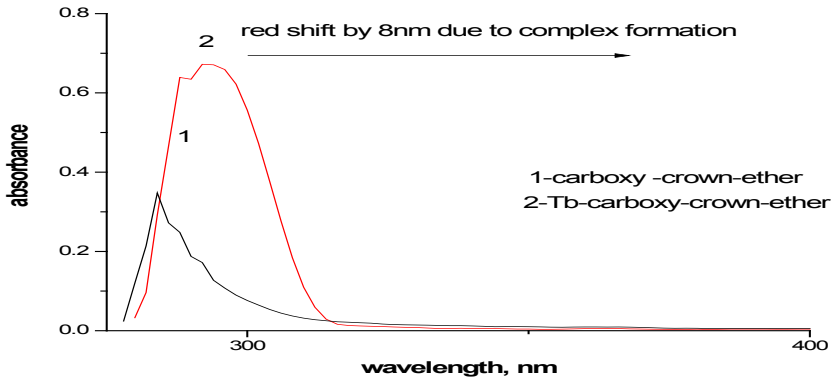

Fig. 2. Absorption spectrum of (1)-2x10^{-4}mol/L carboxy –crown-ether (2)- with 2x10^{-4}mol/LTb-carboxy-crown-ether in DMF.

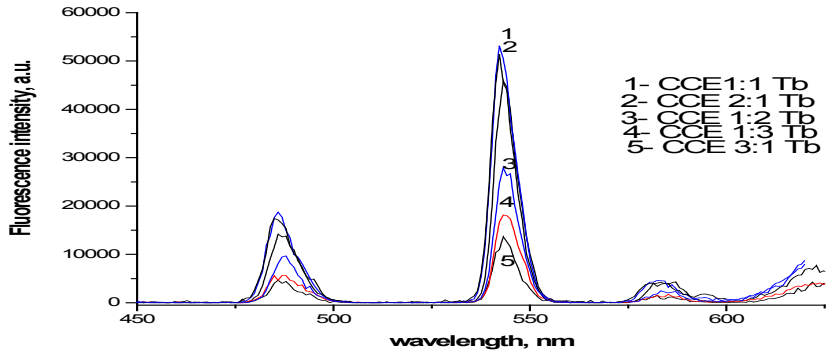

Fig. 3. Molar ratio between Tb^{3+} and 4'carboxybenzo-18crown-6-ether in DMF at λ=285.

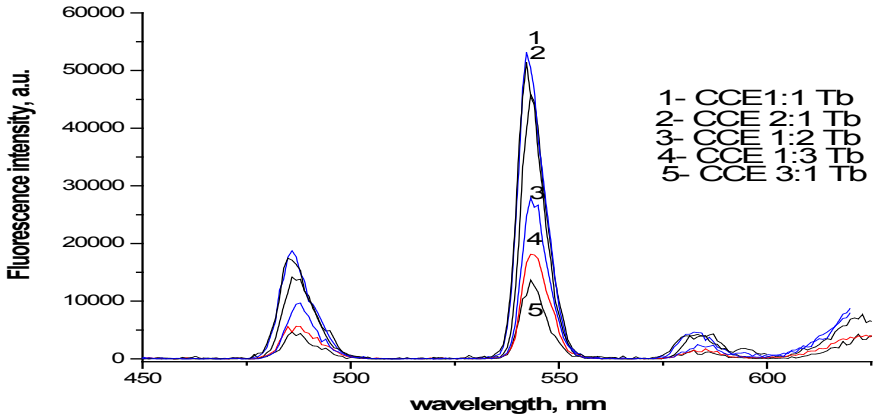

Fig. 4. Luminescence emission spectra of 1x 10^{-4}mol/L Tb^{3+} in the presence of 2x 10^{-4}mol/L of 4'carboxybenzo-18crown-6-ether in DMF at different pHs.

545 nm, (Fig. 4).

Effect of solvent

The influence of the solvents on the luminescence intensity of the solution containing 2.0 $\times 10^{-4}$mol L^{-1} of (4'carboxybenzo-18crown-6-ether) and 1.0 $\times 10^{-4}$mol $L^{-1}Tb^{3+}$ were studied under the conditions established above. The results show the high emission intensity of Tb^{3+}-(4'carboxybenzo-18crown-6-ether) in DMF and DMSO at 545 nm was obtained. This can be attributed to the formation of anhydrous solvates

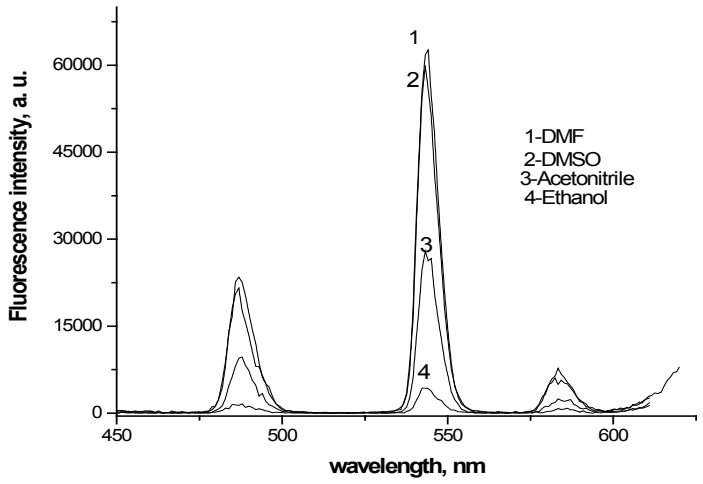

Fig. 5. Luminescence emission spectra of 1x 10^{-4}mol/L Tb^{3+} in the presence of 3x 10^{-4}mol/L of 4'carboxybenzo-18crown-6-ether at pH=6.5 in different solvents.

of Tb^{3+}-(4'carboxybenzo- 18crown-6- ether) complex introducing solvent molecules in the first coordination sphere of Tb^{3+}-(4'carboxybenzo-18crown-6-ether). This anhydrous solvates leads to the enhancement of the intensity of all emission bands ($^5D_4 \rightarrow {}^7F_6$ =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). Tb^{3+} (Fig. 5).

Also, the luminescence intensity for the complex in DMF solution is stronger than in ethanol as hydroxyl solvent. This may be due to vibrational energy transfer to the solvent molecules. It is well knowing that the excited state of the lanthanide ions is efficiently quenched by interactions 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 [15-22].

Emission spectra

The emission spectra of Tb^{3+}–(4'carboxybenzo-18crown-6-ether) complex in different concentrations of (NAL) are shown in Fig. 6. After the addition of different concentrations of (NAL) into the Tb^{3+}-4'carboxybenzo-18crown-6-ether ion in DMF, the intensity of the characteristic peak at 545 nm of Tb-4'carboxybenzo-18crown-6-ether was quenched indicating that (NAL) quenches the energy of the complex Tb^{3+}-4'carboxybenzo-18crown-6-ether. The characteristic peaks of Tb^{3+} ion appear at ($^5D_4 \rightarrow {}^7F_6$ =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) [23-40].

Analytical performance

Analytical parameters of photo probe method

A linear correlation was found between luminescence intensity of Tb-CCE complex at λem = 545 nm and concentration of NAL in the ranges given in Table 1. The six-points (103-50 n mol L^{-1}) calibration curve was obtained by plotting the peak intensity of Tb^{3+} at λ_{em} = 545 nm versus the concentration of NAL and the graph was described by the regression equation:

$$Y = a + bX$$

(Where Y = luminescence intensity of the photo probe at λ_{em} = 545 nm; a = intercept; b = slope and X = concentration in molL^{-1}). Regression

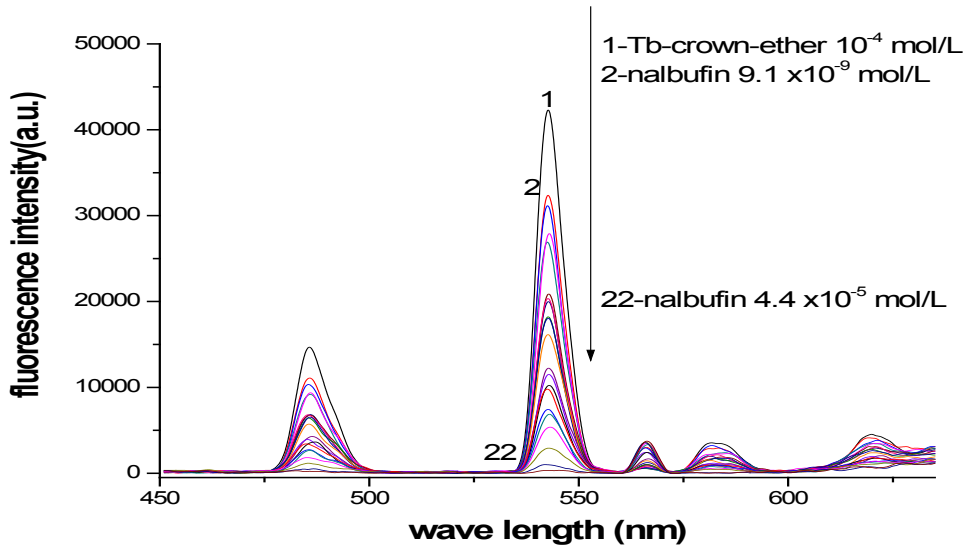

Fig. 6. Luminescence emission spectra of 1x 10^{-4}mol/L Tb^{3+} 4'carboxybenzo-18crown-6-ether in the presence of different concentrations of (NAL) in DMF.

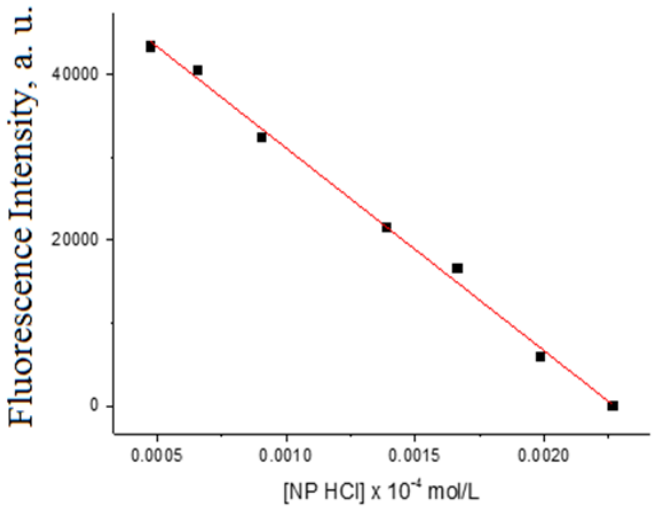

Fig. 7. linear plot between luminescence intensity of Tb(CCE) with different concentrations of NAL in DMF.

TABLE 1. Sensitivity and regression parameters for photo probe.

Parameter	NAL
λ_{em}, nm	545
Linear range,mol L^{-1}	$5x10^{-8}$ to $1.2x10^{-6}$
Limit of detection(LOD),molL^{-1}	$9.4\ x10^{-9}$
Limit of quantification(LOQ),molL^{-1}	$2.8\ x10^{-8}$
Intercept(a)	55620
Slope(b) X 10^4	2.4
Standard deviation X 10^{-5}	6.8
Regression Coefficient	0.995

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. The limit of detection (LOD) and quantitation (LOQ) calculated according to ICH guidelines [41] using the formulae: 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 [2-5].

Selectivity

The proposed method was tested for selectivity by placebo blank and synthetic mixture analysis. A placebo blank containing talc (250 mg), starch (300 mg), lactose (30 mg), calcium carbonate (50 mg), calcium dihydrogen orthophosphate (20 mg), methyl cellulose (40 mg), sodium alginate (70 mg) and magnesium stearate (100 mg) was extracted with water 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 NAL in a synthetic mixture. To the placebo blank of similar composition, different amount of NAL of pharmaceutical formulation Nalufin was added, homogenized and the solution of the synthetic mixture was prepared as done under "analysis of dosage forms". 1.0, 2.0 and 4.0 mL of the resulting solution was assayed (n=9) by proposed method which yielded a % average recovery of 100.4 ± 1.13, and 98.6 ± 0.5 for injection and serum samples, respectively. The results demonstrated the accuracy as well as the precision of the proposed method.

Application to formulations

The proposed method was applied to the determination of NAL in one representative pharmaceutical formulation 20 mg Nalufin was purchased from Amoun Pharmaceutical Company and serum sample of the health state volunteer. The results in Table 2 show that the method is successful for the determination of NAL and that the excipients in the dosage forms did not interfere. The results obtained and given in Table 2 were statistically compared with the official British Pharmacopoeia [B.P] method [42].

The average recovery and R.S.D for the injection and serum samples in proposed method were (100.4 ± 1.13, and 98.6 ± 0.5) respectively. Data obtained by B. P method average recovery 99.5% and 99.8 for the injection and serum samples respectively; and R.S.D was also presented for comparison and shows a good correlation with those obtained by the proposed method. The results obtained by the proposed

TABLE 2. Evaluation of intra-day and inter-day accuracy and precision.

Sample	Actual NAL found *	Intra-day accuracy and precision (n=3)			Inter-day accuracy and precision (n=3)		
	X 10^{-7}mol/L	NAL Average Found ±CL	%RE	%RSD	NAL average found*±CL	%RE	%RSD
NAL	5.0	4.9 ± 0.10	2.0	0.21	5.11 ± 0.12	2.22	0. 22
	4.0	3.9 ± 0.25	2.5	0.15	4.1 ± 0.24	2.50	0. 16
	3.0	3.01 ± 0.12	0.33	0.12	2.95 ± 0.14	1.66	0. 14
serum	3.0	3.05 ± 0.21	1.66	0.37	3.15 ± 0.18	5.00	0. 36
	6.0	6.01 ± 0.14	0.16	0.26	6.11 ± 0.15	1.83	0. 27
	9.0	9.06 ± 0.13	0.66	0.62	9.11 ± 0.15	1.22	0. 19

method agreed well with those of reference method and with the label claim (Table 2). Accuracy was evaluated as percentage relative error (RE) between the measured mean concentrations and the taken concentrations of NAL. Bias {bias %= [(Concentration found - known concentration) x 100 / known concentration] was calculated at each concentration and these results are also presented in Table 2. Percent relative error (% RE) values of ≤ 0.16– 5.0 % (intra-day) and ≤ 1.22– 6.89 % (inter-day) demonstrates the high accuracy of the proposed method.

Conclusion

The Tb^{3+} ion in DMF has high sensitive and characteristic peaks in the presence of (carboxy-crown-ether). The proposed method for the determination of (nalbuphine HCl) offers simple, rapid and sensitive method for the analysis of (nalbuphine HCl) in DMF and pH 6.0 with a linear range of $5x10^{-8}$ to $1.2x10^{-6}$ mol L^{-1} and detection limit of 9.4 $x10^{-9}$ mol L^{-1}. The developed photo probe is selective, accurate and attractive for routine control analysis of the drug.

References

1. Pick, C.G., Paul, D., Pastemak, G.W.,Nalbuphine, a Mixed Kappa, and Kappa3 Analgesic in Mice., *J. Pharmcol. Exp. Ther.* **262,** 1044–1049 (1992).
2. Weinstein, S.H., Alteras, M., Gaylord J., Spectrophotometric determination of some analgesic drugs in pharmaceutical formulations using N-bromosuccinimide as an oxidant, *J.Pharm. Sci.* **67** 547–548 (1978).
3. Yoo, Y.C., Chung, H.S., Kim, I.S., Jin, W.T., Kim, M.K., Evaluation of isotopically labeled internal standards and methods of derivatization for quantitative determination of cocaine and related compounds, *J. Anal. Toxicol.* **19**, 120–123. (1995)
4. Groenendaal, D., Blom-Roosemalen, M.C.M., Danhof, M., de Lange, E.C.M., Influence of biophase distribution and P-glycoprotein interaction on pharmacokinetic-pharmacodynamic modelling of the effects of morphine on the EEG, *J. Chromatogr. B* **822**, 230–237 (2005).
5. Cai, L.J., Zhang, J., Wang, X.M., Zhu, R.H., Yang, J., Zhang, Q.Z., Peng, W.X., Validated LC-MS/MS assay for the quantitative determination of Nalbuphine in human plasma and its application to a pharmacokinetic study, *Biomed. Chromatogr.* **25** 1308–1314 (2011).
6. Chapron D.J., L.B. White, Differential effects of flurbiprofen and aspirin on Nalbuphine disposition in humans, *J. Pharm. Sci.* **73**, 985–989 (1984).
7. Hartley R., M. Lucock, M. Becker, I.J. Smith, W.I. Forsythe, Solid-phase extraction of Nalbuphine from biological fluids and subsequent analysis by high-performance liquid chromatography, *J. Chromatogr.* **377,** 295–305 (1986).
8. Hernandez R.H., P.C. Falco, A.S. Cabeza, Detection and Analysis of Drugs of Forensic Interest, *J. Chromatogr.* **120,** 181–191 (1992).
9. Ichikawa N., K. Naora, H. Hirano, K. Iwamoto, Development and validation of bioanalytical method forNalbuphine from rat brain tissue, *J. Pharm. Biomed. Anal.* **17,** 1415–1421 (1998).
10. Zarghi A., A. Shafaati, Rapid determination of Nalbuphine in human plasma, *J. Pharm. Biomed. Anal.* **28**, 169–172 (2002).
11. Joseph Gal, Philip P. Ellis, Maris Rendi, Determination of Nalbuphine in biological fluids by high-performance liquid chromatography, *Current Eye Research* **1,** 361-365 (1981).
12. Hossie R.D., N. Mousseau, S. Sved, R. Brien, Quantitation of Nalbuphine in plasma by high-performance liquid chromatography, *J. Pharm. Sci.* **69,** 348–349 (1980)
13. Ihssane, B., Charrouf, M., Abourriche, A., Abboud, Y., Bouabidi, A., Bennamara, A., Saffaj, T., Monitoring and performance control of RP–HPLC method for simultaneous quantification of water-soluble vitamins during its life cycle, *Acta Chromatographica* **23**, 41-57 (2011)
14. Gomaa Z.S., Determination of Nalbuphine in dosage forms by high performance liquid chromatography, *Biomedical Chromatography,* **7,** 134-135 (1993).
15. Attia M. S., Zo-elghny H., Abdel-MottalebM. S. A., A New Nano-Optical Sensor Thin Film Cadmium sulphide Doped in Sol-Gel Matrix For Assessment of Alpha -Amylase Activity in Human Saliva, *Analyst*, **139**, 793–800 (2014) .
16. Attia M. S., Bakir E., Ayman A. Abdel-aziz, Abdel-MottalebM. S. A., Determination of melamine in different milk batches using a novel chemosensor based on the luminescence quenching of Ru(II) carbonyl complex, *Talanta* **84**, 27–33 (2011).
17. Elabd A., Zidan W., Aboaly M. M., Bakir E., Attia M. S., Uranyl ions adsorption by novel metal

hydroxides loaded Amberlite IR120, *J. Environ. Radioact.* **134,** 99-108 (2014).

18. Attia M. S., Youssef A. O., Amr A. E., 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 (2012).

19. Attia M. S., Diab M., El-Shahat M.F., Diagnosis of some diseases related to the histidine level in human serum by using the nano optical sensor Eu–Norfloxacine complex, *Sen. Actua., B* **207,** 756–763 (2015).

20. Attia M. S., Soad A. Elsaadany, Kawther A. Ahmed, Mohamed M. El-Molla, Abdel-MottalebM. S. A., Inkjet Printable Luminescent Eu^{3+}-TiO2 Doped in Sol Gel Matrix for Paper Tagging, *J. Fluoresce.*, **25**, 119–125 (2015).

21. Attia, M. S. and Abdel-Mottaleb, M. S. A. (2015) Polymer-Doped Nano- Photo probes for Pharmaceutical Analysis, in *Handbook of Polymers for Pharmaceutical Technologies: Processing and Applications,* Volume 2 (eds V. K. Thakur and M. K. Thakur), John Wiley & Sons, Inc., Hoboken, NJ, USA.

22. Attia M.S., Mekky A.E.M., Khan Z.A., Abdel-Mottaleb M.S.A. (2018) Nano- Biophoto probes for Assessment of Food Contaminants. In: Thakur V., Thakur M. (eds) *Functional Biopolymers.* Springer Series on Polymer and Composite Materials. Springer, Cham

23. Attia M. S, Al Radadi N. S., Progress of pancreatitis disease biomarker alpha amylase enzyme by new nano optical sensor, *Biosen. Bioelec.,* **86**, 413-419 (2016).

24. Attia M. S, Al Radadi N. S., Nano optical sensor binuclear Pt2pyrazinecarboxylic acid– bipyridine for enhancement of the efficiency of 3nitrotyrosine biomarker for early diagnosis of liver cirrhosis with minimal hepatic encephalopathy, *Biosen. Bioelec.,* **86,** 406-412 (2016).

25. Attia M. S., Biosen. Bioelec., Nano Optical Probe Samarium Tetracycline Complex for Early *Diagnosis of Histidinemia in New Born Children,* **94**, 81-86 (2017).

26. Amr A. E., Attia M.S., Novel application of pyronin Y fluorophore as high sensitive optical sensor of glucose in human serum, *Talanta*, **107**, 18–24 (2013).

27. Attia M. S., Spectrofluorimetric assessment of Ramipril using optical sensor Samarium–doxycycline complex doped in sol–gel matrix, *J. Pharm. Biomed. Anal.,* **51**, 7-11 (2010).

28. Attia M. S., Othman A. M., Aboaly M. M., Abdel-Mottaleb M. S. A., Novel Spectrofluorimetric Method for Measuring the Activity of the Enzyme r-L-Fucosidase Using the Nano Composite Optical Sensor Samarium(III)-Doxycycline Complex Doped in Sol-Gel Matrix, *Anal Chem.,* **82**, 6230 (2010).

29. Attia M. S., Youssef A. O., El-Sherif R. H., Durable Diagnosis of Seminal Vesicle and sexual gland diseases Using the Nano Optical Sensor thin film Sm-Doxycycline Complex, *Anal. Chim. Act.,* **835,** 56–64 (2014).

30. Attia M. S., Youssef A. O., Amr A. E., Abdel-Mottaleb M. S. A., A Highly Luminescent Complexes of Eu(III) and Tb(III) with Norfloxacin and Gatifloxacin Doped in Sol-gel Matrix: A comparable approach of using silica doped Tb(III) and Eu(III) as optical sensor, *J. Luminesc.,* **132**, 2741–2746 (2012).

31. Attia M. S., Youssef A. O., Amr A. E., Europium-Sensitized and Simultaneous pH-Assisted Spectrofluorimetric Assessment of Ciprofloxacin, Norfloxacin and Gatifloxacin in Pharmaceutical and serum Samples, *J. Photochem. Photobiol. A: Chem.,* **236**, 26–34 (2012).

32. Attia M. S., Youssef A. O., Othman A. M., El-Raghi E., Excited state interaction between Hydrochlorothiazide and europium ion in PMMA polymer and its application as optical sensor for Hydrochlorothiazide in tablet and serum samples, *J. Luminesc.,* **132**, 2049-2053 (2012).

33. Attia M. S., Ramsis M. N., Khalil L. H., Hashem S. G., A Highly Selective and Sensitive Spectrofluorimetric Method for the 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 (2012).

34. Attia M. S., Youssef A. O., Amr A. E., Mostafa M. S., 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.*, **22,** 557-564 (2012).

35. Attia M. S., Mahmoud W. H., Youssef A. O., Mostafa M. S., Cilostazol Determination by the Enhancement of the Green Emission of Tb3+

Optical Sensor, *J. Fluoresc.,* **21,** 2229-2235 (2011).

36. Attia M. S., Mahmoud W. H., Ramsis M. N., Khalil L. H., Othman A. M., Mostafa M. S., Hashem S. G., Spectrofluorimetric Assessment of Doxycycline Hydrochloride in Pharmaceutical Tablets and Serum Sample Based on the Enhancement of the Luminescence Intensity of the Optical Sensor Sm3+Ion, *J. Fluoresc.,* **21**, 1739-1748 (2011).

37. Attia M. S., Othman A. M., Elraghi E., Hassan Y. Aboul-Enein, Spectrofluorimetric Assessment of Metoclopramide Hydrochloride Using Terbium Doped in PMMA Matrix Optical Sensor, *J. Fluoresc.,* **21**, 739-745 (2011).

38. Attia M. S., Aboaly M. M., Highly sensitive and selective spectrofluorimetric determination of metoclopramide hydrochloride in pharmaceutical tablets and serum samples using Eu^{3+} ion doped in sol–gel matrix, *Talanta*, **82,** 76-82 (2010).

39. Attia M. S., Spectrofluorimetric quantification of bromazepam using a highly selective optical probe based on Eu^{3+}–bromazepam complex in pharmaceutical and serum samples, *Spectrochim. Acta Part A,* **74,** 972–976 (2009).

40. Attia M. S., Khalil M. M. H., Abdel-Mottaleb M. S. A., Lukyanova M. B., Yu. A. Alekseenko, Boris Lukyanov. 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, *Intern. J. Photoenergy,* 1–9 (2006).

41. ICH: International Conference on Hormonisation of Technical Requirements for Registration of Pharmaceuticals for Human Use, ICH Harmonised Tripartite Guideline, Validation of Analytical Procedures: Text and Methodology Q2(R 1), Complementary Guideline on Methodology dated 06 November 1996, incorporated in November 2005, London.

42. British Pharmacopoeia, Vol. II, Her Majesty's Stationary Office, London, 2505 (1999)

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مجس ضوئي من التربيم-١٨-كرون-٦-ايثير لتعيين النلبيوفين في عينات دوائية و دم مختلفة

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تم اختبار كفاءة الحالة المثارة بين عنصر التربيم و مركب ١٨-كرون-٦-ايثيرر عند اس هيدروجيني مختلف و في مذبيات عضوية مختلفة. و قد تم الحصول علي الحزم الضوئية الخاصة بعنصر التربيم و خاصة عند طول موجي ٥٤٥ نانومتر و تم اثبات انتقال الطاقة من مركب ١٨-كرون-٦-ايثير الي عنصر التربيم عن طريق ظهور الحزم الضوئية الخاصة به. تم استخدام متراكب التربيم مع مركب الكرون ايتير لتعيين دواء النلبيوفين في عينات دوائية و عينات دم لمتبرعين اصحاء.

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