Publications Template

#	Research Title	Field	Abstract	Year of Publication Publishing	Publishing Link "URL"
1	Green Chemistry: Analytical and Chromatography	Pharmaceutical Analytical Chemistry	Nowadays, the environment protection and the personal health and safety are given more consideration in the field of chemistry, thus resulting in an increased number of published research about how to work according to green instructions, to follow up the recommendations of environmental agencies and to obtain better clean handling of chemistry. In this review, green chemistry definition, importance, principles, and some recent applications in the field of green chemistry were discussed. In addition, the review summarizes the evolution of green analytical chemistry (GAC) with its specific principles and how to make the analytical process more environmentally benign with special emphasis on recent applications of GAC. Moreover, the green chromatography, its methods, and some of its applications were outlined. Finally, different techniques available up till now for the assessment of greening of the methods were also presented.	Mohamed A. Korany, Hoda Mahgoub, **Rim S. Haggag**, Marwa A. A. Ragab & Osama A. Elmallah J. Liq.Chromatogr.&Rel.Technol., 40(16), 839-852, (2017).	https://doi.org/10.1080/10826076.2017.1373672

2	Development of a green stability-indicating HPLC–DAD method for the determination of donepezil hydrochloride in presence of its related substance and degradation products	Pharmaceutical Analytical Chemistry	A simple, eco-friendly, stability-indicating HPLC method was developed for the determination of donepezil hydrochloride (DH) in tablet dosage form in the presence of its pharmacopoeia-related compound (donepezil-related compound A) and its different degradation products. The chromatographic conditions were optimized to achieve the highest performance parameters using Zorbax Eclipse Plus C18 rapid resolution column (4.6 x 100 mm, 3.5 µm), with a mobile phase composed of 72.5% acetate buffer pH 5.5 and 27.5% ethanol, flowing at 1 mL min^{-1}. The diode array detector (DAD) was set at 315 nm and the column oven was adjusted at 45°C. Linear response (r = 0.9999) was observed over the range of 2–28 µg mL^{-1} of donepezil, with detection and quantitation limits of 0.031 and 0.103 µg mL^{-1}, respectively. Forced degradation studies were performed on standard DH and test Demepezil® 5-mg tablets under various conditions and the method was found to be stability indicating. The purity of DH peak was confirmed using the DAD. In the developed method, two principles of green chromatography were adopted (reduce and replace) by reducing solvent consumption through the utilization of a short	Mohamed A. Korany, Hoda Mahgoub, **Rim S. Haggag**, Marwa A. A. Ragab & Osama A. Elmallah J. Liq.Chromatogr.&Rel.Technol., 40(18), 930–942, (2017).	https://doi.org/10.1080/10826076.2017.1386672

			column (10 cm) with a smaller particle size (3.5 µm) instead of a normal 25 cm with a 5 µm particle size and by replacing hazardous solvents of the official United States Pharmacopoeia method as acetonitrile with ethanol. Furthermore, the greenness of the method was assessed using three assessment tools.		
3	Green gas chromatographic stability-indicating method for the determination of Lacosamide in tablets. Application to in-vivo human urine profiling	Pharmaceutical Analytical Chemistry	A direct, eco-friendly, stability-indicating GC method was developed for the determination of Lacosamide (LCM) in tablet dosage forms in presence of its degradation products as well as in human urine in presence of the coadministered drug Zonisamide (ZON). The assay method in tablets was validated according to the ICH guidelines, while the method for determination of LCM in urine was validated according to FDA; Bioanalytical Method Validation guidance. Linear response (r=0.9998) was observed over the range of 20–280 µg/mL of LCM, with detection and quantitation limits of 5.871 and 19.57 µg/mL, respectively for the tablet assay method. While (r=0.9999) was observed over the range of 0.5–20 µg/mL of LCM, with detection and quantitation limits of 67 and 233 ng mL−1, respectively for the urine analysis method. Under various stress conditions, the investigation of LCM forced degradation behaviour was carried out. Furthermore, monitoring of	Mohamed A. Korany, Hoda Mahgoub, **Rim S. Haggag**, Marwa A.A. Ragab & Osama A. Elmallah Journal of Chromatography B: Analytical Technologies in the Biomedical and Life Sciences, 1083, 75–85, (2018).	https://doi.org/10.1016/j.jchromb.2018.02.033

			the drug in urine followed by construction of its urine profile was done after the administration of 50 mg tablet of LCM to three healthy volunteers so as to prove the ability of the method to be applied in assaying LCM in human urine. The method showed also successful separation of LCM and the co-administered drug ZON in urine. Finally, the greenness of the method was assessed using National Environmental Methods Index label and Eco scale methods.		
4	Chemometrics - Assisted Spectrophotometric Green Method for Correcting Interferences in Biowaiver Studies: Application to Assay and Dissolution Profiling Study of Donepezil Hydrochloride Tablets	Pharmaceutical Analytical Chemistry	A green, simple and cost effective chemometric UV–Vis spectrophotometric method has been developed and validated for correcting interferences that arise during conducting biowaiver studies. Chemometric manipulation has been done for enhancing the results of direct absorbance, resulting from very low concentrations (high incidence of background noise interference) of earlier points in the dissolution timing in case of dissolution profile using first and second derivative (D1 & D2) methods and their corresponding Fourier function convoluted methods (D1/FF& D2/FF). The method applied for biowaiver study of Donepezil Hydrochloride (DH) as a representative model was done by comparing two different dosage forms containing 5 mg DH per tablet as an application of a	Mohamed A. Korany, Hoda Mahgoub, **Rim S. Haggag**, Marwa A. A. Ragab & Osama A. Elmallah Spectrochimica Acta Part A: Molecular and Biomolecular Spectroscopy, 199, 328–339(2018).	https://doi.org/10.1016/j.saa.2018.03.059

			developed chemometric method for correcting interferences as well as for the assay and dissolution testing in its tablet dosage form. The results showed that first derivative technique can be used for enhancement of the data in case of low concentration range of DH (1–8 μg mL^{-1}) in the three different pH dissolution media which were used to estimate the low drug concentrations dissolved at the early points in the biowaiver study. Furthermore, the results showed similarity in phosphate buffer pH 6.8 and dissimilarity in the other 2 pH media. The method was validated according to ICH guidelines and USP monograph for both assays (HCl of pH 1.2) and dissolution study in 3 pH media (HCl of pH 1.2, acetate buffer of pH 4.5 and phosphate buffer of pH 6.8). Finally, the assessment of the method greenness was done using two different assessment techniques: National Environmental Method Index label and Eco scale methods. Both techniques ascertained the greenness of the proposed method.		
5	A validated stability-indicating HPLC method for	Pharmaceutical Analytical Chemistry	A new, reliable, sensitive and stability-indicating gradient HPLC method was introduced for the simultaneous determination of two anti-hepatotoxic polyphenolic drugs	Mohamed A. Korany, **Rim S. Haggag**, Marwa A.A. Ragab, and Osama A. Elmallah Arabian Journal of Chemistry, 10,	doi.org/10.1016/j.arabjc.2013.06.021

	simultaneous determination of Silymarin and Curcumin in various dosage forms.		(Silymarin and Curcumin). The method was adapted to analyze both drugs in their dosage forms (tablets and capsules) with no interference from common excipients. The photo diode array detector was used as a tool for peak identification and purity confirmation especially that both drugs have several reported peaks. In order to assess the stability-indicating power of the assay procedure, SIL and CUR were subjected to different forced degradation studies: acidic, alkaline and neutral hydrolysis, photo-degradation, oxidative degradation and dry heat. The developed method could efficiently separate the parent drug peak from the degradation products peaks. The method was validated according to the ICH guidelines with respect to linearity, detection and quantitation limits, accuracy, precision, specificity, and robustness. Finally, the results of the proposed method for determination of SIL were statistically compared to the official BP method and no significant difference was found between them.	S1711-S1725, (2017).	
6	Spectrofluorimetric estimation of some sulfhydryl – containing drugs by demasking	Pharmaceutical Analytical Chemistry	A simple and sensitive spectrofluorimetric method has been developed for the determination of some selected sulfhydryl–containing drugs namely acetylcysteine (ACS), captopril (CAP) and	**Rim S. Haggag**, Saied F. Belal, Ismail I. Hewala and Ola A. ElRouby Pharm Anal Acta, , 8(1),1- 10, (2017).	DOI: 10.4172/2153-2435.1000532

	reaction of the palladium chelate of 8-Hydroxyquinoline -5- sulfonic acid		mesna (MSN). The method is based on the interaction of the drugs with potassium (5-sulfoxino) palladium II in alkaline medium in presence of magnesium ions, where the sulfhydryl group combines with palladium from the non-fluorescent potassium bis (5- sulfoxino) palladium II. The resulting 8-hydroxy-5-quinoline sulfonic acid coordinates with magnesium to form the fluorescent chelate that is a measure of the amount of sulfhydrl containing drug analyzed. The fluorescence intensity was measured at an emission wavelength of 485 nm, by excitation at 345 nm. All the experimental parameters affecting the reaction were studied and optimized. The proposed method was applicable over the concentration range of 0.04-0.44 µg/mL for the three drugs and was applied for their determination in bulk form and in pharmaceutical preparations without interference from ommon excipients. The assay results were statistically compared with those obtained from previously reported methods where no significant difference was found between them. The selectivity and the stability-indicating aspect of the proposed method were confirmed by preparing the disulphides of the studied drugs and applying the reaction to the parent drugs in presence		

			of their disulphides where no interference was detected from these related substances. By virtue of its high sensitivity, the proposed method was also extended to analyze the drugs in spiked human plasma and urine.		
7	Spectrophotometric and spectrofluorimetric determination of mesna, acetylcysteine and timonacic acid through the reaction with acetoxymercuri fluorescein	Pharmaceutical Analytical Chemistry	Simple, sensitive and specific spectrophotometric (Method I) and spectrofluorimetric (Method II) methods were developed for the determination of three sulfur-containing drugs: Mesna (MSN), Acetylcysteine (ACT) and Timonacic acid (TMN). The methods are based on the suppressive effect of the drugs on the absorbance and the fluorescence intensity of 2',7'-bis (acetoxymercuri) fluorescein (AMF) in 0.05 M borate buffer. In Method I the decrease in AMF absorbance was measured at 497 nm, while in Method II the fluorescence quenching of the reagent was measured at λem 520 nm (λex 497 nm). All the experimental parameters affecting this reaction were studied and optimized. The selectivity and the stability-indicating aspect of the methods were confirmed and no interference was detected from the oxidation products of the quantified drugs or from other co-administered drugs. Method I was applicable over the concentration ranges 0.5 – 3, 0.5 – 2.75 and 0.25 – 2.75 µg/mL for MSN, ACT and	**Rim S. Haggag**, Dina A. Gawad, Saeid F. Belal and Hadil M. Elbardisy Analytical Methods, 8, 2479-2493, (2016).	DOI: 10.1039/c5ay02279g

			TMN, respectively. The reaction sensitivity was enhanced by method II where the linearity ranges were found to be 0.6 – 7.2, 0.7 – 7 and 0.8 – 10.4 ng/mL for MSN, ACT and TMN, respectively. Both methods were applied for the determination of the three drugs in bulk form and in their pharmaceutical preparations without interference from common excipients. The percentage recoveries were satisfactory and they were statistically compared with those obtained from previously reported methods. Moreover, method II was extended to analyze the drugs in spiked human plasma, by virtue of its high sensitivity.		
8	Spectrophotometric determination of the sulfhydryl containing drug mesna.	Pharmaceutical Analytical Chemistry	Four simple and sensitive spectrophotometric methods were developed for the determination of the sulfhydryl containing drug mesna (MSN). Methods I and II rely on nucleophilic aromatic substitution reactions using two UV tagging reagents namely: 4-chloro-7-nitrobenzo-2-oxa-1,3-diazole (NBD-Cl) for method I and 2,4-dinitrofluorobenzene (DNFB) for method II. Both reactions took place in alkaline buffered medium and the obtained yellowish products were measured at 414 and 332 nm for methods I and II, respectively. Methods III and IV are indirect spectrophotometric methods based on the suppressive effect	**Rim S. Haggag** , Dina A. Gawad , Saeid F. Belal , Hadil M. Elbardisy Bull. Fac. Pharm., Cairo University, 54, 21-32, (2016).	http://dx.doi.org/10.1016/j.bfopcu.2015.12.002

			of MSN on the absorption of two ternary complex systems which are composed of 1,10-phenanthroline, silver and eosin for method III and 1,10-phenanthroline, silver and bromopyrogallol red for method IV. The decrease in absorbance of the ternary complexes was measured at 547 and 635 nm for methods III and IV, respectively. All the experimental parameters affecting these reactions were carefully studied and optimized. The methods were validated as per the ICH guidelines. The methods were applicable in the linearity ranges 4–18 lg/mL for method I, 4–16 lg/mL for method II, 0.25–2.25 lg/mL for method III and 0.25–1.75 lg/mL for method IV. The proposed methods were successfully applied for the analysis of MSN in its commercial ampoules and no interference was encountered from the present excipients as indicated by the satisfactory percentage recoveries. The results obtained were in a good agreement with those obtained from a previously published method of the investigated drug.		
9	Kinetic Investigation of Pentoxifylline Based on Non-Parametric Linear Regression of	Pharmaceutical Analytical Chemistry	A novel application of chemometrics to the chromatographic peak responses in the kinetic investigation of Pentoxiphylline was introduced using nonparametric linear regression method as the statistical method of analysis. The	Mohamed A. Korany, **Rim S. Haggag**, Marwa A.A. Ragab, Osama A. Elmallah J. Liq.Chromatogr.&Rel. Technol. 37(4), 475-497, (2014).	doi:10.1080/10826076.2012.745151.

	Derivative and Convoluted Derivative Chromatographic and Spectrophotometric Responses.		kinetic study of Pentoxiphylline was conducted under two different stress conditions using DAD-HPLC. The chemometric methods were applied to the HPLC and spectrophotometric data of the kinetic study of Pentoxiphylline. First and second derivative treatment of chromatographic and spectrophotometric response data were followed by convolution of the resulting derivative curves using 8-points sin xi polynomials (discrete Fourier functions). The study also presents a comparison between parametric and non-parametric regression methods of analysis. Moreover, application of Arrhenius equation to the determination of the half life of Pentoxiphylline in alkaline condition was studied before and after the chemometric treatment of the data. The results obtained indicated that chemometric treatment of data with the application of non-parametric method enhances the linearity parameters obtained during the kinetic investigation. These linearity parameters were further used to estimate the degradation rate constant (K) and half life of the drug at room temperature which is very important for the estimation of the stability of the drug on shelf with accuracy and with minimum experimental work and errors.		

10	Liquid Chromatographic Determination of Amikacin sulphate after Pre-column Derivatization.	Pharmaceutical Analytical Chemistry	A novel high performance liquid chromatographic (HPLC) method with a pre-column derivatization reaction has been developed and validated. The method was used for the determination of the aminoglycoside antibiotic amikacin sulphate (AMK) in the presence of its synthetic precursor kanamycin sulphate in pure form and in different pharmaceutical preparations. The pre-column derivatization was based on Hantzsch condensation reaction and the obtained coloured products were separated using an isocratic reversed-phase high performance liquid chromatographic method. The separation was achieved on a Spherisorb C18 ODS2 (250 3 4.6 mm, 5 mm) column using a mobile phase composed of acetonitrile–0.1 M sodium acetate buffer (pH 5.0; 25:75, v/v). The column temperature was adjusted at 358C and the flow rate at 2 mL min21. The detection was carried out at 330 nm by using photo-diode array detector. Different conditions for the optimization of the derivatization reaction as well as for the HPLC measurement were studied. Moreover, AMK was subjected to forced degradation by oxidation, hydrolysis, photolysis and dry heat. Degradation products did not interfere with the assay, which can thus be considered selective and specific. The proposed method was validated for	Mohamed A. Korany, **Rim S. Haggag**, Marwa A. A. Ragab and Osama A. Elmallah J. Chromatogr. Science, 52(8), 837-847, (2014).	doi:10.1093/chromsci/bmt126

			linearity, precision, accuracy, specificity and robustness. Also, it was used to check the purity of AMK in the presence of KAN (related impurity) at the pharmacopoeial limit (0.5%).		
11	Simultaneous Determination of Hyoscine, Ketoprofen and Ibuprofen in Pharmaceutical Formulations by HPLC – DAD.	Pharmaceutical Analytical Chemistry	The objective of the work was to establish a new, rapid and sensitive HPLC–DAD method for simultaneous determination of three most commonly prescribed drugs; hyoscine, ketoprofen, and ibuprofen. The HPLC separation of the analytes was performed on a hypersil - Gold C18 (150 mm × 4.6 mm, 8 µm) column, using gradient elution of the mobile phase composed of 0.01 M potassium phosphate dibasic containing 2 g/L heptane sulphonic acid sodium salt maintained at pH 3.5 (Pump A) and acetonitrile 80% v/v (pump B) with a flow rate of 2 mL/min. The multiple wavelength detector was set at 210 nm for measurement of all compounds. Quantification was based on measuring the peak areas. The three compounds were resolved with retention times 6.42 ± 0.009, 10.63 ± 0.006 and 16.43 ± 0.008 min for hyoscine, ketoprofen and ibuprofen, respectively.The calibration curves were linear in the range of 0.64 – 96, 0.64 – 400 and 1.28 – 640 µg/mL for hyoscine, ketoprofen and ibuprofen, respectively, all of them with coefficients	Rasha A. Shaalan, **Rim S. Haggag**, Saeid F. Belal and Mahmoud Agami Journal of Applied Pharmaceutical Science, 3(07), 038-047, (2013).	doi: 10.7324/JAPS.2013.3708

			of determination above 0.9995. The methodology recoveries were higher than 95.0%. The limits of detection (LODs) were 0.11, 0.17 and 0.17 µg/mL for hyoscine, ketoprofen, and ibuprofen, respectively. The intra- and inter-day coefficients of variation were less than 2%. The method is accurate, sensitive and simple for quality control as well as for stability indicating purposes.		
12	Stability-Indicating HPLC-DAD Determination of Ribavirin in Capsules and Plasma.	Pharmaceutical and biomedical analysis	A simple, selective and stability-indicating high-pressure liquid chromatographic method was developed for the analysis of ribavirin. Chromatographic separation was achieved by using a CPS Hypersil cyano column (4.6 3 250 mm, 5 mm particle size) with isocratic elution of the mobile phase, which was composed of 50 mM phosphate buffer, adjusted at pH 4 with phosphoric acid. The mobile phase was pumped at a flow rate of 0.8 mL/min. The detector was set at 240 nm and quantification of the analyte was based on peak area measurement. The method was validated with respect to linearity, range, precision, accuracy, selectivity, robustness, limit of detection and limit of quantitation. The calibration curve was linear in the range of 5–200 mg/mL with correlation coefficient > 0.999. Ribavirin was subjected to forced degradation studies under two conditions: mild and extensive stress testing. These	**Rim. S. Haggag**, Saied F. Belal, Ismail I. Hewala, and Ola. A. El Rouby J. Chromatogr. Science, 52(5), 493-500 (2014).	doi:10.1093/chromsci/bmt067

			studies included the effects of hydrolysis (neutral, acidic and alkaline) and oxidation, photolysis and dry heat). The proposed method was proved to be stability-indicating by the resolution of the drug from its forced degradation products, making use of the diode array detector as a tool for confirmation of peak identity and purity. Moreover, the kinetics of alkaline degradation of ribavirin were investigated, an Arrhenius plot was constructed and the activation energy was calculated. The developed method was also extended to analyze ribavirin in capsules and in human plasma with good recovery values.		
13	A validated stability-indicating DAD-HPLC method for determination of pentoxifylline in presence of its pharmacopeial related substances.	Pharmaceutical Analytical Chemistry	A validated, simple and sensitive stability-indicating HPLC method was introduced for the analysis of Pentoxifylline in the presence of its pharmacopeial related substances, Caffeine anhydrous and Theophylline anhydrous, in the presence of its forced degradation products. This was achieved using a gradient DAD–HPLC method in order to achieve a good separation between the related substance peaks, complying with the pharmacopeial requirement, and an adequate retention time for the Pentoxifylline peak. The method was validated according to the ICH guidelines and different HPLC parameters were optimized for the determination of	Mohamed A. Korany, **Rim S. Haggag**, Marwa A.A. Ragab, and Osama A. Elmallah Bull. Fac. Pharm., Cairo University, 51, 211–219, (2013).	http://dx.doi.org/10.1016/j.bfopcu.2013.06.001

			Pentoxifylline in its dosage form (sustained release tablets). Furthermore, the study of forced degradation of Pentoxifylline was done under various conditions including; hydrolysis (acid, alkaline and neutral), oxidation, dry heat and photo-decomposition. The proposed method could separate Pentoxifylline peak from those of the different forced degradation product peaks and the purity of the Pentoxifylline peak was confirmed using the photo-diode array detector.		
14	Gradient HPLC-DAD Determination of Two Pharmaceutical Mixtures Containing the Antihistaminic Drug Ebastine.	Pharmaceutical Analytical Chemistry	This work describes the development, validation and application of a simple and reliable high-performance liquid chromatography–diode array detection (HPLC–DAD) procedure for the analysis of two pharmaceutical mixtures. The first mixture contains the antihistaminic drug ebastine (EBS) and the famous sympathomimetic drug pseudoephedrine hydrochloride (PSD), and the second mixture is composed of EBS and another sympathomimetic agent, phenylephrine hydrochloride (PHR). Effective chromatographic separation of EBS, PSD and PHR was achieved using a Zorbax SB-C8 (4.6 X 250 mm, 5 mm) column with gradient elution of the mobile phase composed of 0.05M phosphoric acid and acetonitrile. The gradient elution started with 20% (by volume) acetonitrile,	**Rim S. Haggag** and Tarek S. Belal J. Chromatogr. Science, 50(10), 862 – 868 (2012).	doi: 10.1093/chromsci/bms082

			ramped up linearly to 90% in 5 min, then kept constant until the end of the run. The mobile phase was pumped at a flow rate of 1 mL/min. The multiple wavelength detector was set at 254 (for EBS and PSD) and 274 nm (for PHR) and quantification of the analytes was based on measuring their peak areas. The retention times for PHR, PSD and EBS were approximately 2.5, 2.9 and 7.1 min, respectively. The reliability and analytical performance of the proposed HPLC procedure were statistically validated with respect to linearity, ranges, precision, accuracy, selectivity, robustness and detection and quantification limits. Calibration curves were linear in the ranges 5–100, 100–1,000 and 10–200 mg/mL for EBS, PSD and PHR, respectively, with correlation coefficients > 0.9996. The validated HPLC method was applied to the analysis of the two pharmaceutical mixtures in laboratory-made tablets in which the analytes were successfully quantified with good recovery values and no interfering peaks were encountered from the inactive ingredients. Finally, the proposed method made use of DAD as a tool for peak identity and purity confirmation.		
15	Gradient HPLC-DAD stability	Pharmaceutical	The pharmaceutical combination of miconazole nitrate (MZ) and lidocaine	Tarek S. Belal and **Rim S. Haggag** J. Chromatogr. Science, 50(5), 401-	doi:10.1093/chromsci/bms019

	indicating determination of Miconazole nitrate and Lidocaine Hydrochloride in their combined oral gel dosage form.	Analytical Chemistry	hydrochloride (LD) is used in the curative and prophylactic therapy of the oral and gastro-intestinal infections caused by Candida albicans. To the best of our knowledge, no attempts have yet been made to assay this combination by any analytical method. A simple and selective high-performance liquid chromatography– diode array detection (HPLC–DAD) stability-indicating method was developed for the simultaneous determination of MZ and LD in their combined formulation. Effective chromatographic separation was achieved using a Zorbax SB-C8 column with gradient elution of the mobile phase composed of 0.05M phosphoric acid and acetonitrile. The gradient elution started with 25% (by volume) acetonitrile, ramped up linearly to 65% in 6 min, then kept constant until the end of the run. The mobile phase was pumped at a flow rate of 1 mL/min. The multiple wavelength detector was set at 215 nm and analytes were quantified by measuring their peak areas. The retention times for LD and MZ were approximately 4.1 and 8.4 min, respectively. The reliability and analytical performance of the proposed HPLC procedure were statistically validated with respect to linearity, ranges, precision, accuracy, selectivity, robustness, detection and quantification limits. Calibration	409 (2012).	

			curves were linear in the ranges of 5–100 mg/ml for both drugs with correlation coefficients > 0.999. Both drugs were subjected to stress conditions of hydrolysis, oxidation, photolysis and thermal degradation. The proposed method proved to be stability-indicating by the resolution of the two analytes from the related substance and potential impurity (2,6-dimethylaniline) and from the forced-degradation products. The validated HPLC method was applied to the analysis of MZ and LD in the combined oral gel preparation, in which the two analytes were successfully quantified and resolved from the pharmaceutical additives. The proposed method made use of DAD as a tool for peak identity and purity confirmation.		
16	Selective Stability-Indicating Methods for the Determination of Clonidine Hydrochloride and/or its Related Substance, 2,6-Dichloroaniline.	Pharmaceutical Analytical Chemistry	Three rapid, sensitive and selective analytical methods were developed for the determination of clonidine hydrochloride and its related substance: 2,6-dichloroaniline in a mixture of both. The first method depends on derivative-ratio spectrophotometry where the first derivative signals of the ratio spectra at 228.4 nm (Δλ = 2 nm) were selected for the determination of clonidine hydrochloride. The second method is based on measuring the first derivative response of 2,6-dichloroaniline at 300.8 nm with no interference from intact	**Rim Said Haggag,** Saied Fathalla Belal and Rasha Abdel-aziz Shaalan J. Food and Drug Analysis, 19(2), 174-182 (2011).	

			clonidine hydrochloride. In the third method, 2,6-dichloroaniline was determined via diazotization and coupling with N-(1-naphthyl) ethylenediamine to yield a colored azodye which was measured at 498 nm. The different parameters affecting each method were studied and optimized. The proposed methods were validated according to USP guidelines concerning linearity, ranges, accuracy, precision, detection and quantification limits. The derivative-ratio spectrophotometric method was applied for the analysis of clonidine hydrochloride in tablets and the results were found to be in good agreement with those of the USP XXX HPLC procedure, while both the second and the third methods permitted the selective analysis of 2,6-dichloroaniline in clonidine hydrochloride raw material.		
17	Gradient HPLC-DAD stability indicating determination of lidocaine hydrochloride and cetylpyridinium chloride in two combined oral gel dosage forms.	Pharmaceutical Analytical Chemistry	A simple, rapid, and selective HPLC-diode array detector method was developed for the simultaneous determination of lidocaine hydrochloride (LD) and cetylpyridinium chloride (CPC) in two combined pharmaceutical formulations. Effective chromatographic separation was achieved on a Zorbax SB-C8 (4.6 X 250 mm, 5 µm particle size) column with gradient elution using a mobile phase composed of 0.05 M phosphoric acid and acetonitrile. The gradient elution started	Tarek S. Belal, Rasha A. Shaalan and **Rim S. Haggag** J. AOAC International, 94(2), 503-512 (2011).	

			with 25% (v/v) acetonitrile, ramped up linearly to 85% in 5 min, and then was constant until the end of the run. The mobile phase was pumped at a flow rate of 1.2 mL/min. The multiple wavelength detector was set at 214 and 258 nm, and quantification of the analytes was based on measuring their peak areas. The retention times for LD and CPC were about 3.4 and 7.3 min, respectively. The reliability and analytical performance of the proposed HPLC procedure were statistically validated with respect to linearity, range, precision, accuracy, selectivity, robustness, LOD, and LOQ. Calibration curves were linear in the range of 5–200 and 10–400 µg/mL for LD and CPC, respectively, with correlation coefficients >0.999. The proposed method was proven to be stability-indicating by the resolution of the two analytes from the related substance and potential impurity (2,6-dimethylaniline) as well as from forced-degradation products. The validated HPLC method was extended to the analysis of LD and CPC in two combined oral gel preparations for which the two analytes were successfully resolved from the pharmaceutical adjuvants and quantified with recoveries not less than 97.9%.		
18	Validated HPLC determination of	Pharmaceutical	Simple, rapid, and selective RP-HPLC methods with UV detection were	**Rim S. Haggag**, Rasha A. Shaalan, and Tarek S. Belal	

	the two fixed dose combinations (Chlordiazepoxide Hydrochloride and Mebeverine Hydrochloride; Carvedilol and Hydrochlorothiazide) in their Tablets.	Analytical Chemistry	developed for simultaneous determination of chlordiazepoxide hydrochloride and mebeverine hydrochloride (Mixture I) and carvedilol and hydrochlorothiazide (Mixture II). The chromatographic separation in both mixtures was achieved by using an RP-C8 (octylsilyl) analytical column. For Mixture I, a mobile phase composed of acetonitrile–0.05 M disodium hydrogen phosphate–triethylamine (50 + 50 + 0.2, v/v/v), pH 2.5, was used; the detector wavelength was 247 nm. For Mixture II, the mobile phase consisted of acetonitrile–0.05 M disodium hydrogen phosphate (50 + 50, v/v), pH 4.0, and the detector was set at 220 nm. Quantification of the analytes was based on measuring their peak areas. Both mixtures were resolved in less than 6 min. The reliability and analytical performance of the proposed HPLC procedures were statistically validated with respect to linearity, range, precision, accuracy, selectivity, robustness, LOD, and LOQ. The linear dynamic ranges were 2.5–150 and 2.5–500 µg/mL for chlordiazepoxide HCl and mebeverine HCl, respectively, and 0.25–200 and 0.25–150 µg/mL for carvedilol and hydrochlorothiazide, respectively. The validated HPLC methods were successfully applied to the analysis of their commercial tablet dosage forms,	J. AOAC International, 93(4), 1192-1200 (2010).	

			for which no interfering peaks were encountered from common pharmaceutical adjuvants.		
19	The use of 4-Chloro-7-nitro-2,1,3-benzoxdiazole for the determination of amlodipine besylate and heptaminol hydrochloride in dosage forms.	Pharmaceutical Analytical Chemistry	Two simple, sensitive and specific methods were developed for the determination of two amino compounds namely amlodipine besylate (AB) and heptaminol hydrochloride (HH) in their pharmaceutical preparations. The methods are based on reacting the drugs with 4-Chloro-7-nitro-2,1,3-benzoxdiazole in absolute methanol. The yellow colored products obtained were measured spectrofluorimetrically at λem 550 nm (λex 462 nm) and spectrophotometrically at 465 and 475 nm ,respectively, for the two drugs. The different experimental parameters were studied and optimized spectrophotometrically. Under the described optimum conditions, the proposed spectrofluorimetric method was applicable over the concentration ranges of 0.03-0.135 µg mL-1 for (AB) and 0.048-0.144 µg mL-1 for (HH). For the spectrophotometric method the linearity ranges were 6-27 µg mL-1 for (AB) and 4.8-14.4 µg mL-1 for (HH). The proposed methods were statistically validated according to USP guidelines concerning linearity, ranges, accuracy, precision, detection and quantitation limits and specificity. Both methods were applied for the determination of the studied	**Rim S. Haggag**, Saied F. Belal and Rasha A. Shaalan Mansoura J. Pharm. Sci., 25(1), 22-30 (2009).	

			drugs in their pharmaceutical preparations. The results were statistically analyzed and compared to those of reference published methods.		
20	Kinetic spectrophotometric determination of atenolol, meteprolol tartarate & timolol maleate in pharmaceutical preparations.	Pharmaceutical Analytical Chemistry		Saied F. Belal, **Reem S. Haggag**, Ekram M. Hassan and Rasha A. Shaalan Bull. Fac. Pharm. Cairo Univ., 42(2), 359-370 (2004).	
21	Differential pulse polarographic determination of clonidine hydrochloride and fosinopril sodium in pharmaceutical preparations through labeling using nitro derivatives.	Pharmaceutical Analytical Chemistry	A sensitive differential pulse polarographic method has been developed for the determination of two antihypertensive drugs: clonidine hydrochloride and fosinopril sodium. The method is based on the formation of their nitro-derivatives which exhibit well defined cathodic differential pulse polarographic peaks in Britton-Robinson buffer in the range of -36 to -60 mV and -84 to -120 mV (vs.Ag/AgCl reference electrode) for the two cited drugs, respectively. The limits of detection were found to be 30 and 20 ng ml^{-1} for clonidine hydrochloride and fosinopril sodium, respectively. The Janovsky reaction was investigated by the addition of sodium hydroxide and acetone to the formed nitro-derivatives. Only clonidine hydrochloride gave a yellow colored	**Rim S. Haggag**, Saied F. Belal and Rasha A. Shaalan Bull. Fac. Pharm. Cairo Univ., 46(1), 271-282 (2008) (Special Issue).	

			Meisenheimer complex which was measured spectrophotometrically at 448 nm and the reaction was utilized to analyze the drug in bulk powders.		
22	The use of an aromatic substitution reaction in the spectrophotometric determination of selected amino or thiol containing drugs.	Pharmaceutical Analytical Chemistry	A simple spectrophotometric method is described for the determination of acetylcysteine (I) and captopril (II) as representative examples of thiols , as well as amlodipine besylate (III) and heptaminol hydrochloride (IV) as amine examples. The method is based on the reaction of these drugs with the activated halide 2,4-dinitrofluorobenzene (DNFB) in aqueous borate buffer to yield yellow colored products. Beer's law was obeyed over the concentration ranges of 4-12, 2.4-16.8, 8-28 and 5-25 µg mL-1 for (I), (II), (III), and (IV), respectively. The different experimental parameters were studied and optimized. The proposed method was validated according to the USP 27 criteria and was found suitable for the quantitation of the cited compounds in their pharmaceutical preparations without interference from common excipients.	Saied F. Belal, **Rim S. Haggag** and Rasha A. Shaalan J. Food and Drug Analysis, 16(1), 26-33 (2008).	
23	Derivatization with 4-Chloro-7-nitro-2,1,3-benzoxdiazole for the spectrophotomet	Pharmaceutical Analytical Chemistry	Sensitive methods were developed for the determination of two sulfhydryl containing drugs namely acetylcysteine (I) and captopril (II). The methods were based on reacting the drugs with 4-chloro-7-nitro-2,1,3-benzoxadiazole	**Rim S. Haggag**, Saied F. Belal, and Rasha A. Shaalan Sci. Pharmaceutica, 76, 33-48 (2008).	doi:10.3797/scipharm.0711-02

	ric and differential pulse polarographic determination of acetylcysteine and captopril.		(NBD-Cl) in the presence of sodium tetraborate in absolute methanol. The yellow colored products obtained were measured spectrophotometrically at 417 and 420 nm for (I) and (II), respectively and by differential pulse polarography at -872 and -1007 mV (vs. Ag/AgCl electrode) for compounds (I) and (II) after getting rid of excess unused reagent by extraction with ether. The different experimental parameters were studied and optimized spectrophotometrically. The proposed methods were validated and applied to the determination of the cited drugs in their pharmaceutical preparations. The results were statistically analyzed and compared to those of a reference HPLC method.		
24	Selective and stability-indicating methods for the simultaneous determination of mexiletine hydrochloride and/or its related substance: 2,6-dimethylphenol	Pharmaceutical Analytical Chemistry	Four simple, rapid, sensitive, and selective analytical procedures were developed for determination of mexiletine hydrochloride (MX) and/or its related substance: 2,6-dimethylphenol (DMP). The latter is a synthetic impurity for which a maximum pharmacopeial limit is defined. The first method depends on derivative-ratio spectrophotometry, for which the first-derivative signals of the ratio spectra at 259 nm ($\Delta\lambda$ = 3 nm) are selected for the determination of MX. The second method is based on the spectrofluorometric measurement of	Tarek S. Belal, **Rim S. Haggag**, and Rasha A. Shaalan J. AOAC International, 91(4), 720-730 (2008).	

			MX in alkaline solution in the presence of 15 mM sodium dodecyl sulfate micellar medium at 292 nm (λ_{Ex} 260 nm). The third method is based on liquid chromatographic (LC) separation of MX and DMP on an RP-C8 column with a mobile phase consisting of 50 mM Na_2HPO_4–acetonitrile (60 + 40, adjusted to pH 2.4), and quantification of the analytes is achieved with UV detection at 212 nm based on peak area. The fourth method uses the coupling reaction of DMP with 2,6-dibromoquinone-4-chlorimide (DBQC) in borate buffer to form an intensely colored product that was spectrophotometrically measured using first-derivative amplitudes at 670 nm ($\Delta\lambda$ = 6 nm) for the determination of DMP. Different variables affecting each method were carefully investigated and optimized. The reliability and analytical performance of the proposed methods, including linearity, range, precision, accuracy, and detection and quantitation limits, were statistically validated. The first 3 methods were successfully applied for the stability-indicating determination of MX in laboratory-prepared mixtures with DMP, as well as for the determination of MX in capsules. Also, the LC and the DBQC spectrophotometric methods permitted the selective determination of DMP in the presence of a large excess of the parent		

			drug at or near the pharmacopeial limit (0.1–1%).		
25	Application of cathodic square wave polarography and spectrophotometry to the determination of the cytoprotective agent amifostine (WR-2721) in vials and spiked human plasma after complexation with copper(II)phosphate.	Pharmaceutical Analytical Chemistry	Two sensitive methods are described for the determination of the cytoprotective agent amifostine (WR-2721).The procedures are based on the formation of drug- copper (II) complex when shaking with copper (II) phosphate suspension. The resulting complex was measured both spectrophotometrically at 432 nm after the addition of sodium diethyldithiocarbamate and by cathodic square wave polarography at -108 mV (vs. Ag/AgCl reference electrode).The different experimental parameters were studied and optimized. The reliability and analytical performance of the proposed methods including linearity, ranges, accuracy, precision, selectivity, robustness, detection and quantitation limits were statistically validated according to USP guidelines. Both methods were successfully applied for the determination of amifostine in vials. Due to its high sensitivity, the cathodic square wave polarographic method was also extended to the analysis of the drug in spiked human plasma after deproteination with methanol.	**Rim S. Haggag** Bull. Fac. Pharm. Cairo Univ., 47(1), 201-209 (2009).	

26	Polarographic determination of fenofibrate and bezafibrate in pharmaceutical preparations and their bioactive forms in plasma.	Pharmaceutical Analytical Chemistry		Omaima A. Razak, Saied F. Belal, Mona M. Bedair and **Rim S. Haggag** Bull. Fac. Pharm. Cairo Univ., 42(1), 251-257 (2004).	
27	Spectrophotometric stability-indicating assay of enalapril and study of its degradation.	Pharmaceutical Analytical Chemistry		Omaima A. Razak, Saied F. Belal, Mona M. Bedair, Nahla S. Barakat and **Rim S. Haggag** Bull. Fac. Pharm. Cairo Univ., 42(1), 243-249 (2004).	
28	The utilization of copper(II)phosphate for the anodic stripping voltammetric assay of alendronate sodium, desferrioxamine mesylate and lisinopril.	Pharmaceutical Analytical Chemistry	A sensitive differential pulse anodic stripping voltammetric method is described for the determination of alendronate sodium, desferrioxamine mesylate and lisinopril. The procedure is based on the formation of labile drug-copper(II) complex when shaking with copper(II) phosphate suspension. The voltammetric peaks, which correspond to the reduction of the copper(II) moiety of the formed complexes are obtained at -153, -74 and -111 mV, respectively. The different experimental parameters have been carefully studied. The method has been fully validated. The limit of detection was as low as 8.6 ng ml(-1). The method has been applied successfully for the determination of the drugs in plasma and in their pharmaceutical preparations.	Omaima A. Razak, Saied F. Belal, Mona M. Bedair and **Rim S. Haggag** Talanta , 59, 1061-1069 (2003).	doi: 10.1016/S0039-9140(03)00013-4.

			The obtained results were compared statistically with those obtained from a published method, in case of AS, or the official USP methods, for the other two drugs.		
29	Spectrophotometric and polarographic determination of enalapril and lisinopril using 2,4-dinitrofluorobenzene.	Pharmaceutical Analytical Chemistry	The reaction of enalapril maleate and lisinopril with 2,4-dinitrofluorobenzene has been used to form colored products and polarographically active derivatives. The different experimental conditions have been optimized. The proposed methods have been validated and applied to the determination of both drugs in their commercial tablets. The results have been statistically compared with those obtained using the official HPLC methods.	Omaima A. Razak, Saied F. Belal, Mona M. Bedair, Nahla, S. Barakat and **Rim S. Haggag** J. Pharm. Biomed. Anal., 31, 701-711 (2003).	doi: 10.1016/s0731-7085(02)00654-4.
30	Kinetic study of alkaline degradation of indapamide and its assay in tablets fluorimetrically.	Pharmaceutical Analytical Chemistry		Omaima A. Razak, Mohamed A. Korany, Mona M. Bedair and **Rim S. Haggag**. Arab Journal of Pharmaceutical Sciences, 1(6), 73-86 (2000).	
31	Extraction–spectrophotometric determination of phenytoin in capsules and plasma using potassium permanganate/	Pharmaceutical Analytical Chemistry	An extraction-spectrophotometric method for the determination of phenytoin in capsules and plasma is presented. The method is based upon oxidation of phenytoin using alkaline potassium permanganate solubilized in chloroform/cyclohexane (1:1) after crowning with dicyclohexano-24-crown-8	Mohamed A. Korany, Mona M. Bedair and **Rim S. Haggag**. Talanta, 46, 9-14 (1998).	https://doi.org/10.1016/S0039-9140(97)00241-5

	dicyclohexano-24-crown – 8.		(DC-24-C-8). The formed benzophenone being soluble in the oxidation reaction medium was directly measured at 238 nm. The optimum conditions for the reaction were studied and the detection limit was found to equal 1.2 mg/100 ml. The developed method was applied to the determination of the drug in capsules and plasma. The method is simple, accurate and avoids laborious multistep extraction procedures.		
32	The Use of Fourier Descriptors for the spectrophotometric identification of some benzenoid compounds.	Pharmaceutical Analytical Chemistry	Fourier descriptor (FD) values computed from spectrophotometric measurements were used to compute a purity index. The Fourier Descriptors calculated for a set of absorbencies are independent of concentration and is sensitive to the presence of interferents. Such condition was proven by calculating the FD for pure and degraded benyzylpenicillin. Absorbance data were measured and recorded for twelve different benzenoid compounds. The calculated FD values for these compounds showed significant discrimination between them. Also the reproducibility of FDs was tested by measurement over several successive days and the relative standard deviation obtained was less than 2 %.	Mohamed A. Korany, Ezzat A. Korany, Mona M. Bedair, Ismail I. Hewala and **Rim S. Haggag** Anal. Letters, 31(8), 1387-1406 (1998).	https://doi.org/10.1080/00032719808002874