The Dissolution Study For Sodium Selenite Tablets Using Atomic Absorption Spectrophotometer

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Abstract:

The development of a meaningful dissolution procedure for drug products with limited water solubility has been a challenge to both the pharmaceutical industry and the agencies that regulate them. Natural surfactants aid in the dissolution and subsequent absorption of drugs with limited aqueous solubility. In vitro, various techniques have been used to achieve adequate dissolution of the sparingly water – soluble or water insoluble drug products such as the use of mechanical methods (i.e., increased agitation and the disintegration method) or hydro alcoholic medium or large volumes of medium. The necessity of assuring the quality of drugs , especially those with low aqueous solubility and in vivo absorption , has led to the development and evaluation of new techniques that can reduce the time and cost of analysis. This study has been examines the efficiency and accuracy of an automated dissolution system, fitted with a simple, integrated, for analysis of generic drugs. Sodium Selenite 200 µg tablets was chosen as model drugs for this study and comparison was made with a conventional analysis based on flameless atomic absorption spectrophotometer (AAS). The analytical system under study gave reproducible and accurate results. Low instrumentation cost was demonstrated which is provide satisfactory elemental drugs analysis to a standard at least as good as that achieved using AAS.

Key words: Dissolution, Sodium Selenite, Atomic Absorption, Spectrophotometer

Introduction:

The amount of Selenium in food is a function of the selenium content of the soil. Selenium enters the food chain through incorporation into plant proteins as the amino acids L-selenocysteine and L-selenomethionine. Selenium, like most trace elements and minerals, is not evenly distributed in the world's soil. Because of the uneven global distribution of selenium, disorders of both selenium deficiency and selenium excess are known. China has regions with both the lowest and highest selenium – containing soils in the world.In recent decades, the development of new formulations has become a key function in pharmaceutical companies, principally because of the need to improve drug efficacy and minimize unwanted side – effects. An important feature of drug production is the necessity to ensure appropriate quality control and this requires accurate , often sophisticated but where possible fast , cost effective analysis . The complexities of drug analysis are clearly increased when the number of drugs or excipients in the formulation increases. Thus the case of analysis is especially important for dosage forms containing more than one drug. Where drugs have poor absorption characteristics in vivo, or more especially have poor dissolution characteristics from their chosen

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dosage formulation, regulations require drug formulations to be subject to dissolution analysis, conventionally. High pressure liquid chromatography (HPLC) has been chosen for monitoring drug release from such formulations because of the generally excellent resolution and sensitivity of the technique. However, analysis of multiple drug components in a mixture has also been demonstrated using first and second derivative spectrophotometer [1, 2]. More recently, this type of approach has been incorporated in the development of UV – Visible Multicomponents Automated Dissolution Systems (ADS). The main condition to be met is that the number of monitoring wavelengths must be similar to the number of components present in the solution [3, 4]. An alternative approach is to employ the more complicated but also more powerful principal component regression (PCR). In which case spectra from a selected wavelength range are resolved using an appropriate algorithm [5].The term surfactant is a convenient contraction for surface active agent [6]. Surfactants play a major role in the absorption of drugs in the body [7]. There are four major classifications of surfactants: anionic, cationic, nonionic, and amphoteric. The nonionic surfactant remains whole, has no charge in aqueous solutions, and does not dissociate into positive and negative ions. Because the nonionic surfactant does not dissociate in water, it can be used in combination with anionic or cationic surfactants. Anionic surfactants are water soluble, have a negative charge and dissociate into positive and negative ions when placed in water. The negative charge lowers the surface tension of water and acts as the surface – active agent. Cationic surfactants have a positive charge, and also dissociate into positive and negative ions when placed in water. In this case, the positive ions lower the surface tension of the water and act as the surfactant. The amphoteric surfactant assumes a positive charge in acidic solutions and performs as a cationic surfactant, or it assumes a negative charge in an alkaline solution and acts as an anionic surfactant. Because of the unique characteristics of surfactants, small concentrations added to water will immediately form a stable mono – layer. As more surfactant is added, a bilayer is formed. If the concentration of surfactant is increased sufficiently, the bilayer becomes unstable and micelles are formed. The micelle consists of a hydrophilic shell and a hydrophobic core. In vivo [8-10], surfactants (anionic, nonionic or cationic) are available to solubilize drugs. Parameters such as temperature, environment, and pH will also influence the solubility of a drug inside the micelle [11- 15].

Materials and Methods

Atomic Absorption Spectrophotometer Analysis

Routine checks on the response factors were made by daily analysis of a standard solution containing 300 ug / ml sodium selenite. Analysis of this drug involved dissolving tablets containing 200 ug of sodium selenite ($Na_2SeO_3.3H_2O$) in 900 ml of 0.10 M HCl using the DTD6 Erweka – Apparatebu GMBH. The conditions were specified by the USP XXII pharmacopoeia for this product (USP apparatus 2, 100 rpm for 60 minutes, 37^oC). After 5 minutes, 1.0 ml was removed into test tube. The diluted samples were filtered and analyzed by Flameless Atomic Absorption Spectrophotometer (AAS 6800, Shimadzu, Japan). This is equipped with nitrous oxide acetylene burner head, hollow cathode lamps were used for Se, the wave length is 196 nm, lamp current (mA) 16 , volume sample

10 ul , sheathing gas argon , drying time 30 second , ashing temp 1000 ^{0}C , atomization temp , 2000 ^{0}C , atomization time 3 sec. sing graphite furnace method.

Dissolution System

The instrument was fitted with a model DTD6 Erweka – Apparatebu – GMBH. Germany, Dissolutor, 6 channel peristaltic pump, with six vessels. Dissolution conditions were identical to those described above. The analytical instrumentation was checked for wavelength accuracy and reprezability. The dissolution apparatus was set up. Calibrated and operated in compliance with the USP compendia using the recommended 200 ug sodium selenite izolets .Calibration curves for the individual drug standards were obtained by measuring the absorbance of each sample and then the concentration of selenium. Standards were prepared in 0.10 M HCl in the concentration range 0 – 200 ug ml for sodium selenium.

Results and Discussion

The most widely used in vitro test available to determine the release rare of drug products is the in vitro dissolution test. Dissolution testing is used widely by both the pinarmaceurica industry and regulatory genitors to assure the quality of drug products. This paper provides a step wise procedure for developing a meaningful description test for springy water solute and water insurable drug substances.The chromatogram in figure 1 shows the peeks releasing to the drug of interest. Results of the drug assays for twenty tablet homogenates of the different brands are summarized in Table 1. The dissolution time for selenium tablet was about 10.5 minutes and all samples were taken after that time and analyzed. The results were nearly the same (Fig. 1).It is clear that all the batches were within the assay limits established for this product by the USP XXII 19 – 103 %, when using the instrument analysis. The AAS analysis gave a broadly similar result, however the 200 ug sodium selenite (except medical value 600µg) tablet assays were slightly higher than expected in all three runs. This may reflect the fact that the AAS method could be further optimized. The variation coefficient was less than 3% for the AAS system, the analysis indicating that the method is highly reproducible.In the present study a low cost, relatively unsophisticated AAS is able to deliver the dissolution profile of all metals drugs simultaneously in a short space of time.

Table-1- Dissolution of prepared selenium tablet with tablet of standard

Time/min.	Concentration µg/ml of tablet (experiment)	Concentratic µg/mltablet (standard)
2.5	38	45
5.0	50	54
7.5	100	130
10.0	200	196
12.5	194	195
15.00	201	201
17.5	202	202
20.0	201	201

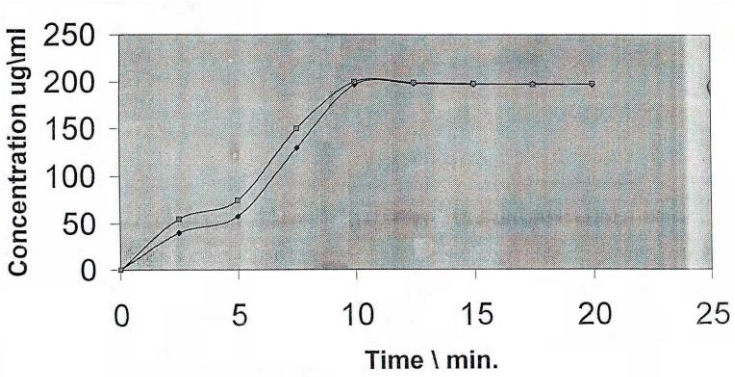

Fig. 1 Dissolution of Selenium.

Conclusions

We have demonstrated the utility of the dissolution system and flameless AAS analysis for routine analysis of tabulated pharmaceuticals, especially metal drugs. This system when used to its full potential is capable of giving a complete profile of the drugs release. Particular attention should be focused on the filtration process, particularly for those runs where the excipients interfere with the measured absorbance. This can occur when the particle size is small enough to pass through the pores of the filter causing light scattering effects.We expect the technique to become increasingly important, particularly in the analysis of elements drug and other drugs formulations where there are likely to be considerable time and cost benefits.

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دراسة ذوبانية لملح حبوب سلينات الصوديوم بأستخدام تقنية المطاييف الذرية

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الخلاصة:

تم تطوير طريقة لأذابة لمنتجات الدوائيه شحيحة الذوبان في الماء كانت أحدى عوامل التحدي للصناعات الدوائية والوكالات المنظمه لها. عوامل تغير الشد السطحي الطبيعيه من العوامل الأساسيه لزيادة أذابة أمتصاص الدواء ذات ألأذابه المحدوده. تم أستخدام عدة تقنيات خارج الجسم لزيادة ذوبانية الدواء قليل أو عديم الذوبان بالماء، مثال على ذلك الطريقة الميكانيكية (رج أو أضافة الكحول الى الوسط المائي). ولضرورة جودةالدواء بصوره خاصه الدواء قليل الذوبان في المحاليل والأمتصاص داخل الجسم، أدت الى أستخدام وتقييم تقنيات حديثه أدت الى تقليل الكلفه وأختصار الزمن. في هذة الدراسة تم فحص كفاءة ودرجة أستخدام جهاز للأذابة ألأوتوماتيكي، مرتبط مع حاسبه لتحليل نتائج الذوبانية. في هذه الدراسه تم أختيار حبوب سلينات الصوديوم 200µg كموديل لدراسة ذوبانية الدواء ومقارنة النتائج مع الطريقة الملائمة بأستخدام جهاز ألأمتصاص الذري غير اللهبي (AAS). هذة التقنية أعطت نتائج دقيقة وذات تكرارية عالية. ثم توضيح أنخفاض كلفة التحاليل بهذة التقنية مع الحصول على نتائج مرضية لتحاليل العناصر الدوائية وخلال وقت قصير بأستخدام تقنية الأمتصاص الذري غير اللهبي.