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Examine the Presence of Chemical Constituents in *Tecomella undulata* and their Interaction with Lipids

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ABSTRACT

During pre-formulation studies common methods like UV-Spectrophotometric methods, FTIR are used for the study of compatibility. In the present investigation drug-lipid compatibility study was conducted for *Tecomella undulata* with lipid mixture by using equal ratio of drug: lipid. Objective of this research work is to examine the chemical constituents present in water soluble fraction of *Tecomella undulata* bark and check its lipid compatibility in various ratios for preparation of a novel formulation in future prospectus. Aqueous extract of powder drug was prepared by heating it with sufficient distilled water for 1 hour. Prepared extract was used for detection of various chemical constituents and their interaction with lipid substances with help of UV-Visible and Fourier transfer infrared-red spectroscopy. The drug and lipid mixtures were stored at 40°C and 75% relative humidity for predetermined period. The samples were then characterized using UV Spectrophotometric method and FTIR spectroscopy. FTIR spectrum of extract suggests the presence of various phyto-chemicals in extract. FTIR spectrum of mixture of plant extract and lipid constituents showed no overlapping of peaks and no additional peaks after 30 days storage under conditions mentioned in ICH guidelines. The results show that Phytoconstituents of drug were compatible with drug.

KEY-WORDS: FTIR, *tecomella undulata*, compatibility

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INTRODUCTION

The drug consists of heartwood, stem bark, leaves and seeds of *Tecomella undulata* of family bignoniaceae. It is commonly known as Rohida and is a well known plant in the ayurvedic system of medicine.¹⁻³ Bark of *Tecomella undulata* is strongly astringent and specified for diseases of liver and spleen, internal tumors and diseases of abdomen incl. ascitis. Charka prescribed powdered bark, its decoction and extract in clarified butter in jaundice, enlarged spleen, anemia, intestinal worms and urinary disorders.⁴⁻⁵ The various chemical constituents isolated from the plant are belonging from glycosides, saponins, tannins and phytosterols.

Drug excipient compatibility is one of the important parameter to be considered during Preformulation studies, which can alter the physicochemical properties and bioavailability of the drugs. To develop effective, safe and stable formulation drug excipient compatibility is an important process and it helps in the selection of right excipient. Despite of the importance of the drug excipient compatibility tests, there is no universally accepted protocol for this purpose. Infrared spectroscopy is a technique based on the vibrations of the atoms of a molecule.

In the present study, the drug lipid compatibility of the *Tecomella undulata* with mixture of soya lecithin and cholesterol was determined by as a part of an ongoing project on the preparation of Phytosomal syrup of *Tecomella undulata*. FTIR and UV Spectrophotometric methods were used for the characterization study.

MATERIAL AND METHODS

MATERIAL

The bark of *Tecomella undulata* was collected from the fields of Nohar, Hanumangarh (Rajasthan), in the month of November 2009 at morning time. Lecithin soya 30% was purchased from Vinayak Ingredients (India) Private Limited, Mumbai, cholesterol was purchased from S.D. Fine Chem., Mumbai and all other chemicals are of analytical grade.

METHODS

a) Preparation of aqueous extract of *Tecomella undulata*

Bark of *Tecomella undulata* was air dried and then cut into small pieces. All pieces were ground in wiley mill. The material then placed in sieve shaker machine. The material that passed through a No. 40 mesh sieve (425 m) yet retained on a No. 60 mesh sieve (250- m) was collected. The resulting material was placed in glass jars and labeled. Powder of bark (500 g) was decocted with distilled water for 1 hour and Extract was filtered using Whatman filter paper (size no.1). Then, all of the extracts were collected, dried under a rotary evaporator, lyophilized in air freeze drier, and kept in the dark at 4°C until testing. Solvent was evaporated in water bath and aqueous extract was concentrated.⁶

b) Ultra Violet absorption Maxima

A double-beam spectrophotometer (Cyberlab) was utilizes to record the absorption differences between the blank and test solutions to give the spectrum of the chemical being tested. To ensure that the instrument is performing satisfactorily, spectra for test solutions of $K_2Cr_2O_7$ (for absorbance accuracy) and holmium glass (for wavelength accuracy) was run for testing the reproducibility and sensitivity of instrument.

Dabble distilled purified water was used for base line correction. The sample cell should then be rinsed and filled with aqueous extracts of *Tecomella undulata* and the scanning repeated, on the same spectrum chart, to display the baseline. The test should be carried out at 25°C.

c) Infrared Spectroscopy Study

IR spectrum of aqueous extract of stem bark of *Tecomella undulata* was obtained using FTIR (Thermolab). FTIR spectrometer was calibrated using an internal fixed-spectrum source. The sample was scanned at $4000\text{ cm}^{-1} - 400\text{ cm}^{-1}$

d) Plant lipid interaction study

This study was designed to ensure the compatibility and stability of plant phytoconstituents-lipid mixture. The physical mixture of plant phytoconstituent and lipid in ratio of 1:1 were placed in glass vials, sealed and stored at 40°C and 75% relative humidity. The samples were drawn at predetermined time interval of 7, 15, 21 and 30 days and examined for physical and chemical integrity of plant phytoconstituent and lipid. Parameters such as colour change, odour or gas formation, caking were examined.⁷⁻¹⁰

After 30 days physical mixture was examined by FTIR spectra and examined the compatibility of lipid material with plant phytoconstituents.

RESULT AND DISCUSSION

The primary environmental purpose in determining the ultraviolet-visible (UV-VIS) absorption spectrum of a chemical compound is to have some indication of the wavelengths at which the compounds may be susceptible to photochemical degradation. Since photochemical degradation is likely to occur in both the atmosphere and the aquatic environment, spectra appropriate to these media will be informative concerning the need for further persistence testing. Degradation will depend upon the total energy absorbed in specific wavelength regions. Such energy absorption is characterised by both molar absorption coefficient (molar extinction coefficient) and band width. However, the absence of measurable absorption does not preclude the possibility of photo-degradation.

Two λ_{\max} (220 and 250) of aqueous extract of *Tecomella undulata* were determined and no changes in absorption maxima were determined after lipid interaction.

The characteristic band peaks acquired were taken from the prepared drug extract and drug-lipid mixtures. The interaction study between drug and polymer was evaluated. IR spectrum of aqueous extract of *Tecomella undulata* was shown the characteristic peaks with respect to their phytochemicals.

IR spectrum was shown the characteristics peak with specific intensity which suggests the various phytoconstitutes present in extract. Majority of peaks were present in 1200-2000 cm^{-1} and 2900-3100 cm^{-1} which suggests the presence of various glycosidic phytoconstituents in extract.

The plant constituents-lipid was compatible on the standard ICH conditions (40°C and 75% RH) and it confirm by FTIR. No additional peaks were found after 30 days. Peaks were almost same as FTIR spectrum of *Tecomella undulata* extract in standard conditions, with comparison of initial physical mixture of plant constituents-lipid(1:1). Parameters such as color, odor were not changed and no cake formation were observed in sample after 30 days.

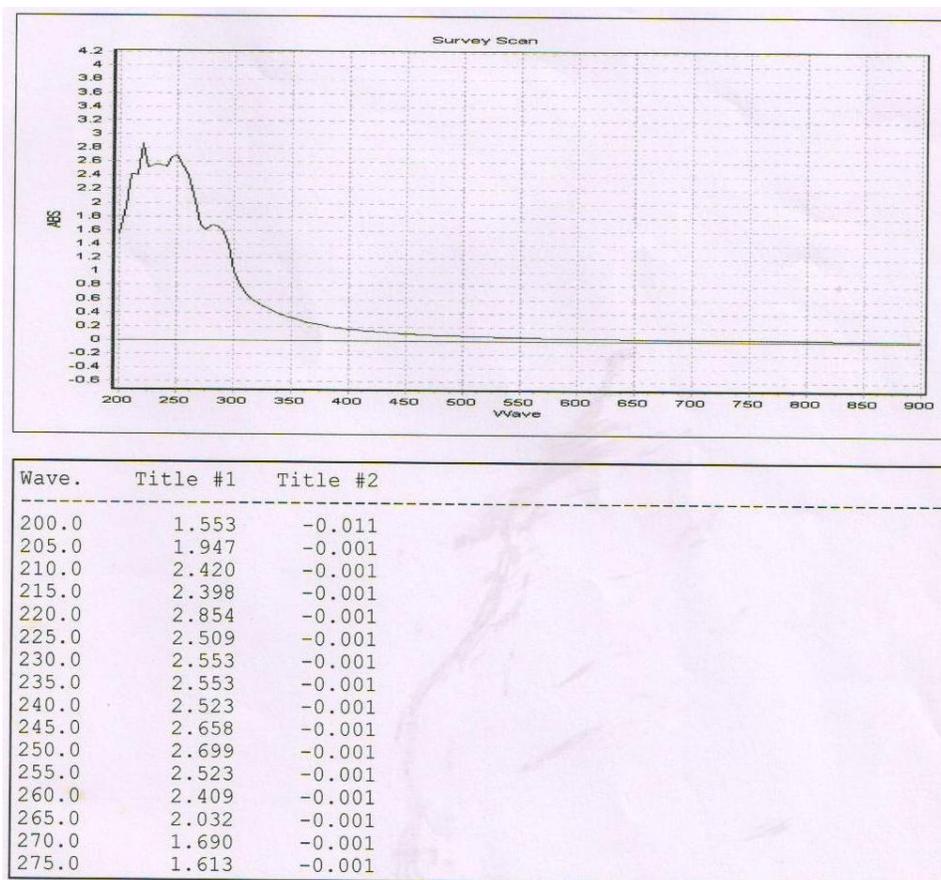


Figure 1: UV spectroscopy study of *Tecomella undulata* extract for detection of λ_{max}

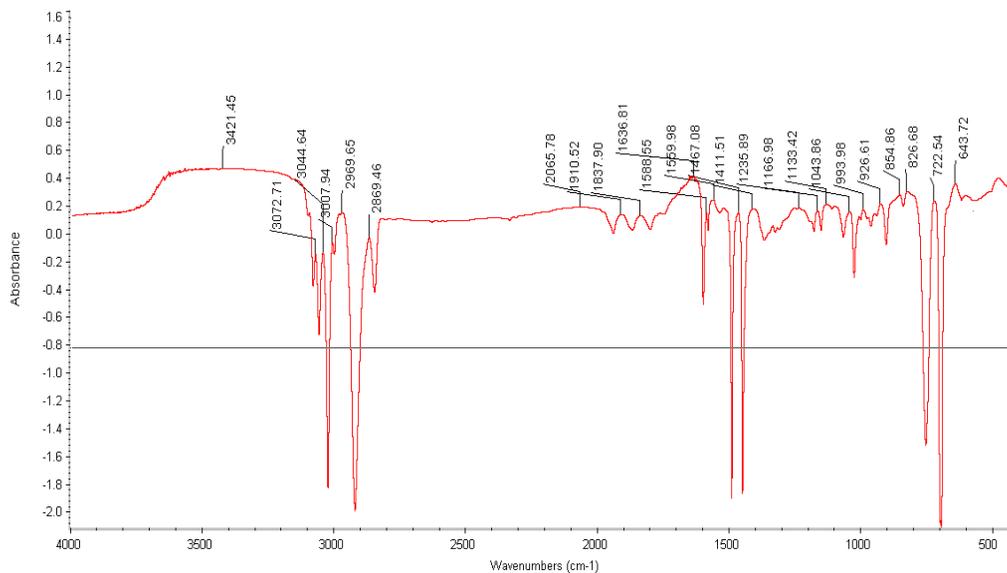


Figure 2: FTIR spectra of aqueous extract of *Tecomella undulata*

Table 1: FTIR spectrum peaks of aqueous extract of *Tecomella undulata*

S.N.	Position (cm ⁻¹)	Bond	Mode	Relative stretch	Corresponding to various Phytoconstituents wavelength (cm ⁻¹)
1	643-722	C-H	Rocking	w	Correspond to glycosides
2	722-826	N-H	Rocking	sm	Corresponds to saponin glycoside
3	993-1043	C-O	Stretch	ms	Alcohol, ether, carboxylic acids corresponds to glycosides
4	1411-1467	O-H	Bending	mw	Correspond to phenolic cpd. and tanins
5	1588-1636	C=N	Stretch	ms	Correspond to phytosterols
6	2869-2969	C-H	Stretch	s	Correspond to sterols
7	3007-3044	N-H	Stretch	m	Phenyl ring indicative of glycoside
8	3044-3072	O-H	Stretch	s	Correspond to phenolic cpd.

Table 2: FTIR spectrum peaks of soya lecithin + cholesterol + bark extract of *Tecomella undulata*

S.N.	Position (cm ⁻¹)	Bond	Mode	Relative stretch	Corresponding to various Phytoconstituents wavelength (cm ⁻¹)
1	481-643	C-H	Rocking	w	Corresponds to lipid
2	643-721	C-H	Rocking	w	Correspond to glycosides
3	721-827	N-H	Rocking	sm	Corresponds to saponin glycoside
4	993-1043	C-O	Stretch	ms	Alcohol, ether, carboxylic acids corresponds to glycosides
5	1411-1467	O-H	Bending	mw	Correspond to phenolic cpd. and tanins
6	1588-1647	C=N	Stretch	ms	Correspond to phytosterols
7	2869-2970	C-H	Stretch	s	Correspond to sterols
8	3007-3044	N-H	Stretch	m	Phenyl ring indicative of glycoside
9	3044-3072	O-H	Stretch	s	Correspond to phenolic cpd. or lipids

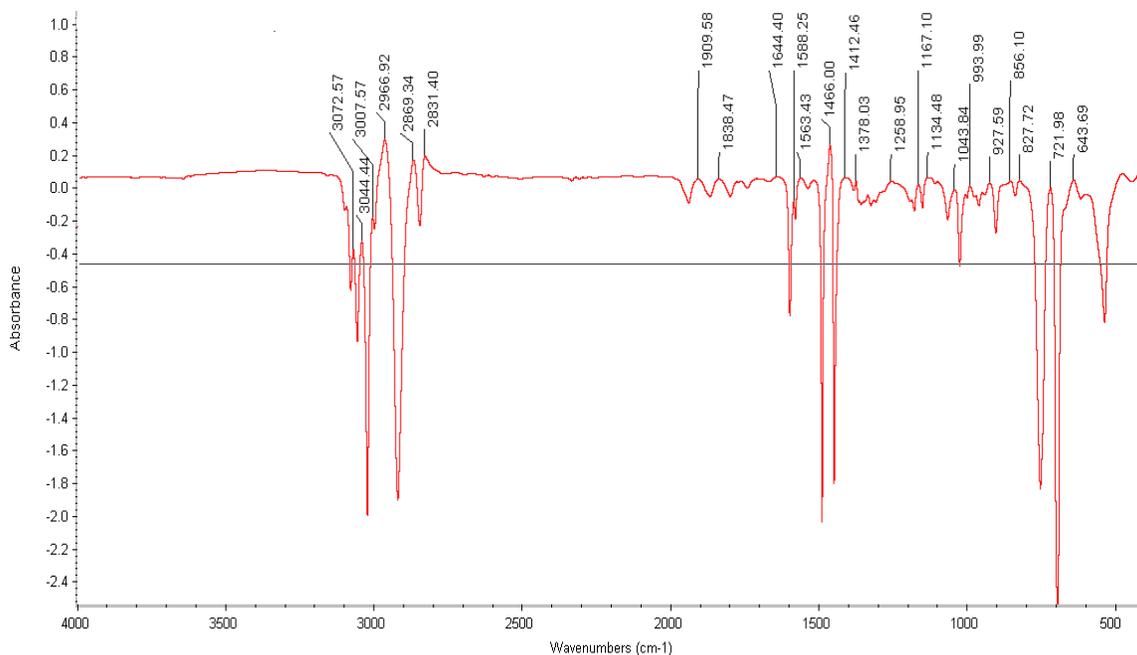


Figure 3: FTIR spectra of aqueous extract of bark of *Tecomella undulata* + soya lecithin + cholesterol

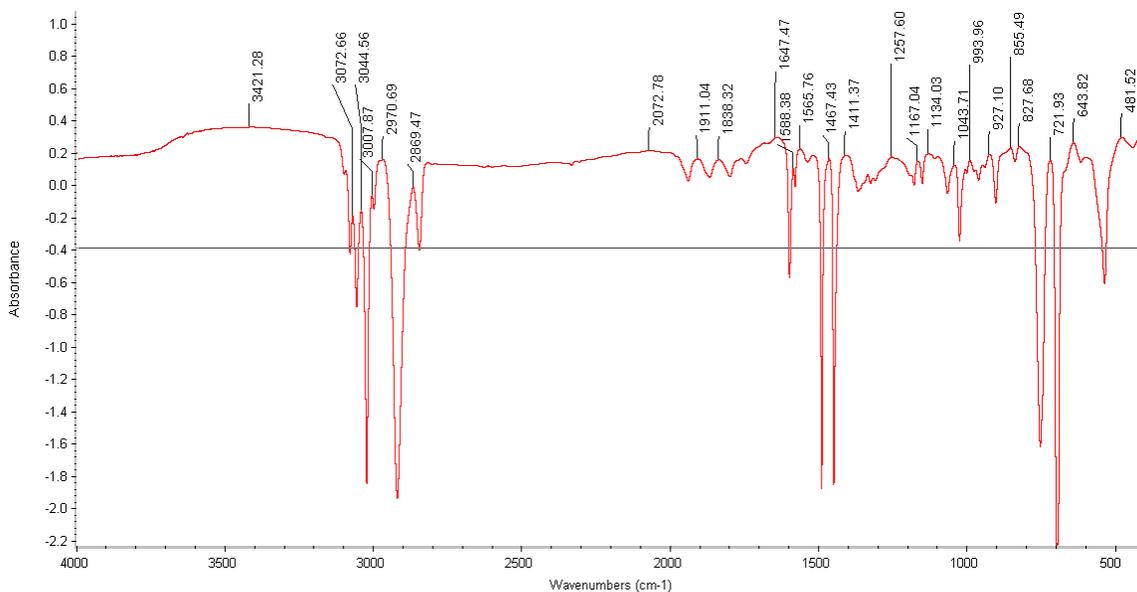


Figure 4: FTIR spectra of aqueous extract of bark of *Tecomella undulata* + soya lecithin + cholesterol (examined after 30 days of storage on 40°C and 75% RH)

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