



Original research article

Spectroscopic insight into the characteristic of the minor bupleurum decoction

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ABSTRACT

Minor bupleurum decoction is a famous prescription of traditional chinese medicine and has been used to treat the fever and noncausal periodic fever due to its wide clinical application. The characteristics of the minor bupleurum decoction were studied by spectroscopic methods in this paper. Result shows that minor bupleurum decoction could emit fluorescence after absorbing the exciting light. The fluorescence peak wavelength is about 440 nm and has a little red shift with the increasing excitation wavelength. The maximum absorption wavelength is about 273 nm, and there is a good linear relationship between the fluorescence intensity and minor bupleurum decoction concentration. On the other hand, the mechanism of absorption and fluorescence spectroscopy of minor bupleurum decoction is also discussed.

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1. Introduction

Minor bupleurum decoction is a classical prescription in traditional chinese medicine, originated from 'treatise on febrile and miscellaneous diseases' written by Eastern Han Dynasty's Zhang Zhong-jing. It composed of bupleurum, scutellaria, pinellia ternate, glycyrrhiza, ginseng, ginger, jujube and so on [1,2]. Minor bupleurum decoction has the effect of reconciling Shaoyang, dredging liver and cholagogic, strengthening spleen and stomach, recanalizing body fluid et al. It has been commonly used in the clinical field, gone by the name of progenitor of wagata [3–5].

Due to its good medicinal value, a large number of clinical and experimental studies have been carried out to investigate on its chemical, physical and pharmacological analysis of minor bupleurum decoction. Li XF et al. studied the effect of proliferation inhibition and apoptosis of esophageal cancer cell strain Eca-109 cell caused by the minor bupleurum decoction through a MTT (Methyl Thiazolyl Tetrazolium) method. The result shows that minor bupleurum decoction may have an importance of inhibiting esophageal cancer cell strain Eca-109 cell proliferation [6]. Wang YZ obtained that minor bupleurum decoction has an effective action for preventing cancer emerging and inhibiting the development of hepatic fibrosis etc. [7]. Li GC et al. show that the immune function of the patients may recover earlier when are treated interleukin-2 and minor bupleurum decoction after AHSCT [8]. In another study it is reported that the effects of effects of minor bupleurum decoction on the activation of T cell subsets and the production of interleukin 2(IL-2) and tumor necrosis factor α (TNF α) in myocarditis model [9]. However, the detailed investigations on the spectroscopic characteristics of minor bupleurum decoction are

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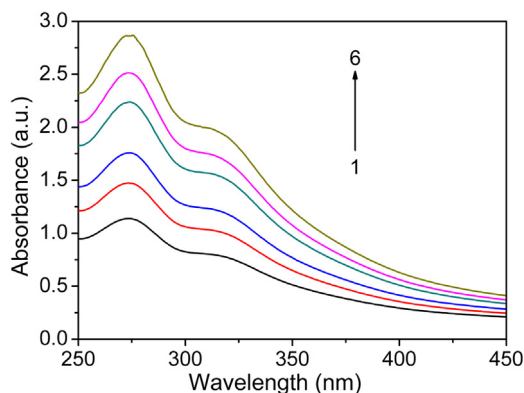


Fig. 1. The absorption spectrum of minor bupleurum decoction; From curve 1- 6, Minor bupleurum decoction concentrations: 15%, 25%, 35%, 45%, 55%, 65%, respectively.

lacking, which may provide useful information for understanding the drug's effects of minor bupleurum decoction and exploring its clinical application. So it is necessary to further study the characteristics of minor bupleurum decoction by a variety methods.

Recently, many optical techniques have been carried out to study the characteristics of biomedical medicine because of its high degree of accuracy and relatively easy to use [10–12]. Of these methods, fluorescence spectroscopy and absorption spectroscopy is an effective method to investigate the reactivity of biological and chemical systems due to its non-intrusive measurement for substances in low concentration [13,14]. This work aimed to investigate the characteristic of the fluorescence and absorption spectroscopy of minor bupleurum decoction. We hope this research may could provide some information for understanding the pharmacology active of the minor bupleurum decoction.

2. Experimental

2.1. Materials and apparatus

The bupleurum, scutellaria, ginseng, pinellia ternate, glycyrrhiza, ginger and jujube were purchased from Nanjing Chinese Medicine Co. Ltd. (Nanjing, China). The fluorescence spectra were recorded by RF-5301PC spectrofluorophotometer (Shimadzu, Japan). The absorption spectra were measured by UV-3600PC spectrofluorophotometer (Shimadzu, Japan). The double distilled water was used throughout and other chemicals were of analytical reagent grade.

2.2. Procedures

Minor bupleurum decoction stock solution: Weighed accurately bupleurum (13 g), scutellaria slice (9 g), ginseng slice (6 g), pinellia ternate slice (9 g), glycyrrhiza slice (5 g), ginger slice (9 g) and jujube slice (4 g), then placed them into the beaker containing 200 ml double distilled water and soaked 6 h at room temperature, filtered and take the upper clear liquid. And the minor bupleurum decoction stock solution was diluted with 6 times volume using double distilled water as a standard sample of minor bupleurum decoction.

3. Results and discussion

3.1. Characteristics of absorption spectra of minor bupleurum decoction

Fig. 1 shows the absorption spectra of the different concentration of minor bupleurum decoction. As shown in Fig. 1, it can be seen that the maximum absorption spectrum of minor bupleurum decoction is 273 nm. And at the maximum absorption wavelength, the absorbance increases with the volume fraction of minor bupleurum decoction solution.

The minor bupleurum decoction is an organic mixture of bupleurum, scutellaria and other five drugs. Based on reference [15,16], the ultraviolet absorption spectrum of organic compound depends on its molecular structure. And the energy level transition of valence electrons and the charge transfer play the main role. In the molecular orbital theory, the valence electrons in the molecules of organic compounds include single-bond σ electrons, double-bond π electrons and non-bond n electrons. When the molecules absorb some energy, its valence electrons transfer from the lower energy bonding orbital to the higher energy anti-bonding orbital. The electron transitions of $\sigma \rightarrow \sigma^*$, $n \rightarrow \sigma^*$, $n \rightarrow \pi^*$, $\pi \rightarrow \pi^*$ are related to ultraviolet absorption spectrum. From Fig. 1, the maximum absorption peak of minor bupleurum decoction is at 273 nm. According to the properties of aromatic compounds, we can conjecture that the minor bupleurum decoction has the structure of conjugate π bond and the

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