Magnetic field effect in thermodynamic studies on binding of amlodipine to HSA: A spectroscopic approach

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1. Introduction

Human serum albumin (HSA) is the most abundant carrier protein of the blood with a high affinity for a wide range of metabolites and drugs [1]. Amlodipine besylate (Norvasc) a calcium channel blocker with highly potent vasodilating activity, used for the treatment of hypertension, angina pectoris and cerebrovascular disease. It may be used alone or in combination with other antihypertensive agents [2].

The influence of static magnetic fields (SMFs) on biological systems has been a topic of considerable interest for many years. The increasing production of electric (EMFs) and magnetic fields (MFs) due to the expanding use of electronic devices in normal life is encouraging studies on the effects of EMFs and MFs on living organisms, with a view to better protecting human health against their probable unfavorable effects [3].

In this work, the binding parameter of amlodipine with HSA in presence and absence of magnetic field was investigated by means of ultraviolet (UV) absorption and fluorescence spectroscopy.

2. Methods

Human serum albumin (HSA) was purchased from Sigma Chemical Company, and amlodipine was obtained from Tehran-drug Company (Iran), were used without further purification. The samples were dissolved in phosphate buffer solution (0.05 mol L^{-1}, pH 7.4). All solution was used with doubly distilled water.

The UV absorbance spectra of the HSA-drug with varied concentrations of amlodipine were recorded on Shimadzu, UV-2550 spectrophotometer, from 200 to 300 nm.

Fluorescence measurements were carried out in an F-2500 FL Varian fluorescence spectrophotometer, equipped with xenon pulse lamp, with a 1.0 cm quartz cell. The excitation wavelength was 280 nm, and the emission spectra were read at 300 – 500 nm.

A solution of 0.05 % (w/v) HSA was titrated by successive 8.8×10^{-5} M stock solution of amlodipine.

In order to understand the effect of magnetic field, all experiments were also done on the samples that 10 minute exposed in the magnetic field (52 mT).

All the experiments were repeated at least three times. All measurements were performed at room temperature.

3. Results and discussion

In the interaction between HSA and amlodipine, the absorbance of HSA increased with increasing concentration of amlodipine, and a slight blue shift was observed for the maximum peak position. These uv spectroscopy results indicate that interaction occurred between amlodipine and HSA [4].

The Scatchard and Hill equations was employed to analyze the data obtained, for determining of the binding capacity, g, binding constant, K, and Hill constant, n_H.

The results showed that g, n_H, and K in the presence and absence of magnetic field have different values (Table 1).

The fluorescence quenching spectra of HSA at various concentrations of amlodipine showed that HSA had a strong fluorescence emission band at 340 nm and the fluorescence intensity of HSA decreased regularly.

For describing the fluorescence quenching induced by amlodipine using the well-known Stern-Volmer equation:

$$F_0/F = 1 + K_{sv}[Q] = 1 + k_q \tau_0 [Q]$$