

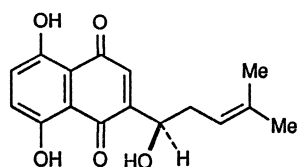
## 80.1 Introduction

Zicao, Radix Lithospermi or Radix Arnebiae, is the dry root of *Lithospermum erythrorhizon* Sieb. et Zucc. or *Arnebia euchroma* (Royle) Johnston. (Boraginaceae), respectively, collected in the spring or fall. It is officially listed in the Chinese Pharmacopoeia and is used as an antiinflammatory and antipyretic agent in the treatment of measles, eczema, and thermal burn.

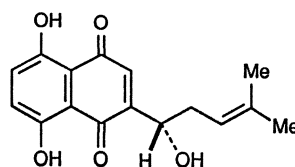
## 80.2 Chemical Constituents

### 80.2.1 Chemical Constituents of *Lithospermum erythrorhizon*

The root of *L. erythrorhizon* contains a number of naphthoquinone pigments as the main constituents. The average content of total naphthoquinone pigments, calculated as alkannin, was 0.47% [1]. Of the naphthoquinone pigments, shikonin is the main representative. It is isolated from the root of *L. erythrorhizon* and is structurally a naphthoquinone with an unsaturated side chain and an asymmetric centrum bearing a hydroxy group. The enantiomer alkannin was isolated first from another boraginaceous plant *Alkanna tinctoria* [2]. The absolute configurations of shikonin (80-1) and alkannin (80-2) were elucidated [3]. Shikonin possesses the (R)- and alkannin the (S)-configuration.



Shikonin (80-1)



Alkannin (80-2)

A series of carboxylic acid esters of shikonin were isolated from the root of *L. erythrorhizon*, including acetylshikonin, isobutyrylshikonin,  $\beta,\beta$ -dimethylacrylshikonin [4],  $\beta$ -hydroxy-isovalerylshikonin [5], isovalerylshikonin and  $\alpha$ -methylbutyrylshikonin [6]. Deoxyshikonin (80-3) has also been isolated [6].

