

ABSTRACTS (MASTER THESIS)

Proteome analysis of a shikonin-producing medicinal plant *Lithospermum erythrorhizon*

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A herbal medicinal plant *Lithospermum erythrorhizon* Sieb. et Zucc. produces characteristic red naphthoquinone pigments, shikonin derivatives in the root bark (Fig. 1). In this perennial plant, shikonin exists as ester derivatives, among which acetyl ester is the majority. These compounds exhibit a variety of biological activities, such as antibacterial and antiviral activities, as well as hemostatic activity. In fact, *L. erythrorhizon* has been used as a traditional medicine for over thousand years, and also as dyes for purple color.

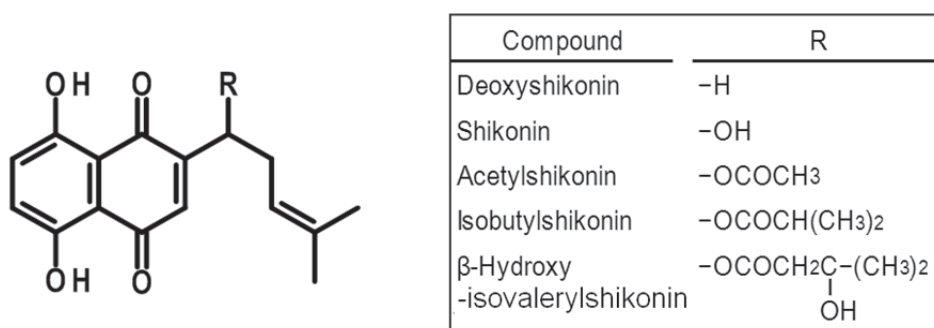


Fig. 1. Shikonin derivatives in *L. erythrorhizon*

Cell suspension cultures of this plant capable of producing a large amount of shikonin derivatives were established in 1970s, which was then utilized for industrial production of shikonin after establishment of a successful shikonin production medium M9 in 1980s [1] [2]. In the biosynthetic route, shikonin is biosynthesized from *m*-geranyl-*p*-hydroxybenzoic acid (GBA), which is generated via coupling reaction of geranyl diphosphate provided from mevalonate pathway and *p*-hydroxybenzoic acid from phenylpropanoid pathway. The biosynthetic pathway from GBA to shikonin, namely how naphthoquinone skeleton is formed, is however still largely unknown.

In order to identify proteins involved in shikonin biosynthesis, we have in this study performed a comparative proteome analysis using the cultured *L. erythrorhizon* cells under the conditions with or without induction of shikonin biosynthesis. As the results, we obtained more than three thousand protein sequences, from which ca. six hundred proteins specifically expressed only in shikonin-producing cells were picked up. We found several new enzymes including known enzymes involved in shikonin biosynthesis in the list. We will further use those candidates of the shikonin biosynthetic enzymes for the functional analysis in future.

References

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- [2] Fujita, Y., Hara, Y., Suga, C., and Morimoto, T., Production of shikonin derivatives by cell suspension cultures of *Lithospermum erythrorhizon*. 2. A new medium for the production of shikonin derivatives. *Plant Cell Rep.* 1: 61-63, 1981.