Characteristics of the Red Yeast Rice As a neutraceutical to adjust fatty acid level

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Introduction

Red yeast rice has been used for centuries in the making of rice wine, as a food preservative for maintaining the color and taste of fish and meat, and for its medicinal properties. Today, red yeast rice is still used in traditional Chinese medicine and in powdered form as a food coloring agents, most commonly for coloring fish, alcoholic beverages, and cheeses. Considerable interest has been shown in using red yeast rice as a nitrite/nitrate substitute for the preservation of meats and as a potential replacement for synthetic food dyes. European manufacturers of meat products have recently popularized its use in coloring sausages and salami.

Red yeast rice contains mevinolin (monacolin K, lovastatin) and related monocolins as HMG-CoA reductase inhibitors. Consequently, the discovery of this powerful naturally occurring inhibitor provided both a new direction for the management of serum cholesterol and the inspiration for the subsequent development of a new class of effective cholesterol-lowering agents. And also, γ-Aminobutyric acid (GABA) was isolated as one of the hypotensive components.

The Hypothesis of lovastatin (monacolin K) biosythesis

Lovastatin (also called monacolin K, mevinolin) is a secondary metabolite from the filamentous fungi, like Monascus spp. and Asoergillus terreus, and has been shown to be derived from acetate via a polyketide pathway. Polyketides biosynthesis in bacteria and fungi is through a process resembling fatty acid biosynthesis that allows the suppression of reduction or dehydration reactions at specific biosynthetic steps, giving rise to a wide range of often medically useful products.

There are three different ways to assemble microbial polyketides, i.e. the modular (type Ⅰ) system or the iterative (type Ⅱ) system, existing in bacterial polyketide synthases (PKSs), and the iterative (type Ⅰ) system in fungal PKSs. Many fungal PKSs make not only the aromatic polyketides such as 1,3,6,8-tetrahydroxynaphthalene and 6-methylsalicylic acid, but also the nonaromatic polyketides such as lovastatin, brefeldin A and T-toxin (Fig. 1A). All of these metabolites are derived from polyketide chains that vary in their state of reduction and dehydration, as well as length.

In the lovastatin pathway(Fig. 1B), the nonaketide carbon chain is derived from one acetate and eight malonate molecules and may undergo an electrocyclic cyclization. Dihydromonacolin L, a predicted PKS product and an established intermediate of lovastatin biosynthesis, has two hydroxyls, one double bond, and a methyl group at C-6 derived from the methyl of methionine. Most of these functionalities are believed to be created by the PKS while dihydromonacolin L is being synthesized (Fig. 1B, boxed region). It has been assumed that the PKS involved is able to use different sets of activities at different steps in the assembly of dihydromonacolin L, for the formation of 1 through 6. Because none of the

microbial PKSs studied so far exhibit such discriminatory activity for the biosynthesis of a single molecule, the biosynthesis of dihydromonacolin L presents an unusual challenge.

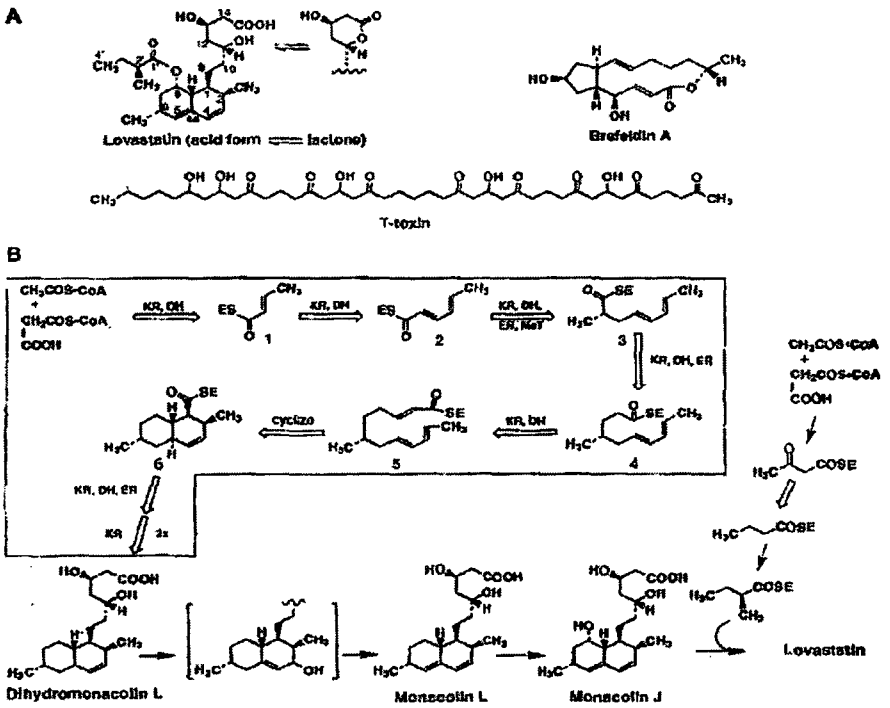

Fig. 1. (A) Typical reduced fungal polyketides. (B) Lovastatin biosynthetic hypotesis. The boxed region shows the set and order of reactions thought to be necessary for the biosynthesis of dihydromonacolin L. the first recognized intermediate in lovastatin biosynthesis.

Manufacturing Process of Red Yeast Rice

Organism

Monascus pilosus used in this study was stored on maltose slant agar at 4℃

Solid State Fermentation (SSF)

Rice was placed in a large basket for washing and soaking . The rice was cleaned in water, and the rice soaked in water for 3 hours. The excess water was drained out from the soaked rice. Then distribute the rice into proper culture containers and autoclave them at 121℃ for 30 min. The steamed rice was cooled to 40℃, approximately. The rice was inoculated and cultivated for 15 days at 28-34℃, and 80% relatively humidity. The initial moisture content was adjusted to 40%.

Analysis

The samples were taken at certain intervals during fermentation periods and smashed into powder. Monacolin K was extracted with 70% ethanol from the each samples and determined by HPLC with ODS C18 column. Mobile phase was acetonitrile:water=75:25 at the flowrate of 1ml/min. UV detection was set at 237nm.

Results

The content of monacolin K in solid state fermentaion rapidly increased with time after 4th day, and the better fermentation period for the production of monacolin K was about 12 days (Fig. 2). The thickness of substrate below 4.5cm (Table 1).

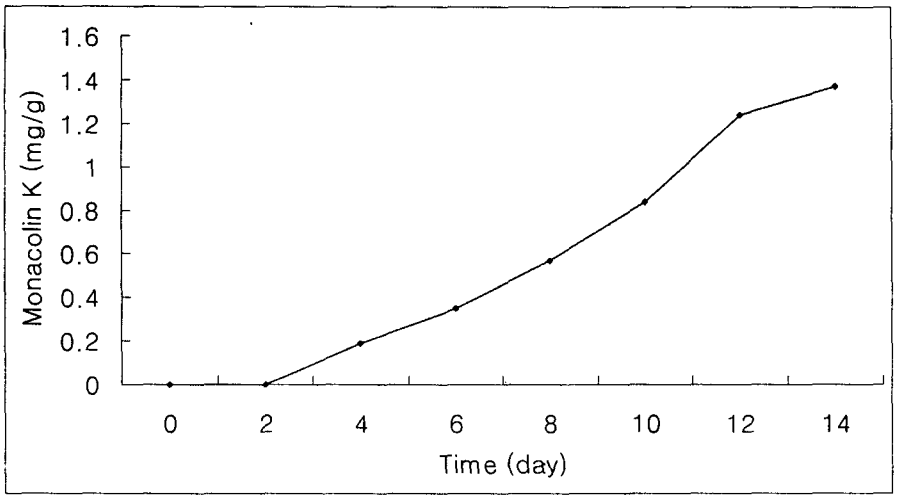

Fig. 2. The time course of solid-state fermentation for production of monacolin K

Table 1. Effect of thickness of substrate on content of monacolin K

Rice (Kg)	Thickness (cm)	Monacolin K (mg/g)
2.5	1.0	1.34
5.0	2.0	1.57
7.5	3.2	1.33
10.0	4.5	1.38
12.5	5.5	9.3
15.0	6.5	7.3