What is Red Yeast Rice?

Red yeast rice is a red fermented rice product of red yeast Monascus spp. (e.g. M. purpureus). In some Asian countries / territories (including China and Taiwan), it has long been used as a food colorant, flavour enhancer, for meat preservation and wine brewing.

In recent years, red yeast rice and products thereof have been considered as “dietary supplements" or “health foods" because they can inhibit biosynthesis of blood cholesterol & lower blood pressure, and have antioxidant effects. In Taiwan, there are many different types of commercial red yeast rice and Monascus products (e.g. cake, sausage, sauce, wine, dietary supplement capsule, etc.). In Hong Kong, food supplements prepared from red yeast rice are also available in the market.

The health promoting effect is likely linked to an ingredient called “monacolin K”. In United States, monacolin K is considered identical as a prescription drug called “lovastatin”. Therefore, red yeast rice dietary supplement with “undeclared” lovastatin cannot be sold in United States.

Occurrence of Citrinin in Red Yeast Rice and Products thereof

Although red yeast rice and products thereof may be beneficial to health, it is also noted that some Monascus species can produce a mycotoxin called “citrinin” during fermentation. This toxin may cause damage to kidney and liver of animals, and is considered toxic to humans. For these reasons, contamination of red yeast rice products with citrinin has attracted attention and is definitely a public health concern.
Indeed there are several reports about the detection of excessive citrinin in red yeast rice and products thereof. For example, last month Taiwan FDA announced that 5 red yeast rice products were unsatisfactory because they contained citrinin (7 ppm to 28 ppm), exceeding the legal tolerance level of 5 ppm.

**Co-occurrence with other mycotoxins**

Apart from citrinin, other mycotoxins like ochratoxin A or patulin may also appear in red yeast rice or other Monascus products. This is because crops after harvest under storage conditions can be contaminated with other mycotoxin producing fungal species (e.g. *Penicillium* spp., *Aspergillus* spp.). If co-occurrence of different mycotoxins exists, this shall increase the overall toxicities of the red yeast rice / other *Monascus* products.

**Tolerance Level of Citrinin in Food**

Compared to the most well-known mycotoxin “aflatoxins”, little attention has been paid to citrinin even though it has been detected in many different foodstuffs (most often in grains and grain-based products), and has been reported as a natural contaminant in Canada, USA, Africa, Asia and Europe.

To date, only few countries have set regulatory limits of citrinin. In Taiwan, maximum levels of citrinin in different types of red yeast products are clearly specified:

<table>
<thead>
<tr>
<th>Product Type</th>
<th>Tolerance Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Monascus Colors</td>
<td>&lt; 200 ppb</td>
</tr>
<tr>
<td>Red Yeast Rice used as Raw Material</td>
<td>&lt; 5 ppm</td>
</tr>
<tr>
<td>Red Yeast Rice Products / Monascus Products</td>
<td>&lt; 2 ppm</td>
</tr>
</tbody>
</table>

On the other hand, European Union has also established a maximum level of 2 ppm for citrinin in food supplements based on rice fermented with red yeast *Monascus purpureus*.

**Inadequate Regulatory Limits of Mycotoxins in Hong Kong**

In contrast, existing food law in Hong Kong only specifies the tolerance level of aflatoxins in food, but not other mycotoxins like citrinin, ochratoxin A, patulin, etc.

Given the fact that red yeast rice and other foods possibly associated with citrinin and other mycotoxins are sold in Hong Kong, government should clearly specify maximum concentration of citrinin and other mycotoxins present in food. This shall enable the industry and enforcement officers to judge food product compliance easily.

Moreover, in order to characterize the health risk of citrinin as a contaminant in food, there is a need for more data regarding the occurrence of citrinin in foods sold in Hong Kong, and to assess the potential human exposure levels.