

The Chemical Fingerprinting, Antibacterial and Antioxidative Properties Analysis of *Isatidis Radix* for Cosmetic Application

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Research Background

Isatidis Radix (Ban Lan Gen / 板藍根) a prominent traditional Chinese medicine (TCM) utilized in southern China, has received growing interests for decades due to the therapeutic functions such as anti-inflammatory, antiviral and antioxidative properties related to a bioactive compound, epigoitrin. While the medicinal usage of epigoitrin, including applications for influenza treatment and cholesterol management, is well documented studies on its utilization for cosmetic applications remain unreported to date. In this work, the quantification of epigoitrin in commercially available *Isatidis Radix* and evaluation of their antibacterial and antioxidative activities were performed, along with the investigation of harnessing the bioactive properties of *Isatidis Radix* in potential cosmetic applications.

Objectives

- To investigate the authenticity of commercially available *Isatidis Radix* samples using spectroscopic and chromatographic techniques
- To perform quantitative analysis of active ingredient, epigoitrin in *Isatidis Radix*
- To study the antibacterial and antioxidative properties of epigoitrin
- To develop a cosmetic product with *Isatidis Radix* extract exhibiting antibacterial and antioxidative properties

Methodology

Authentication: Thin-layer chromatography to identify trace ingredient epigoitrin

Quantification: Active ingredient, epigoitrin, was separated by reverse phase High Performance Liquid Chromatography (HPLC) coupled with Diode Array Detector (DAD)

Antibacterial properties: Areas of inhibition zones were measured respectively in *Staphylococcus aureus* (*S. aureus*) and *Escherichia coli* (*E. coli*) using disc diffusion method

Antioxidative properties: ABTS (2,2'-azino-bis(3-ethylbenzothiazoline-6-sulfonic acid) assay was used to determine the % inhibition of *Isatidis Radix* extract at a specified concentration.

Findings

The HPLC-DAD chromatogram of 0.1g/mL *Isatidis Radix* solution (**Figure. 1**) was analyzed and compared with the epigoitrin standard (**Figure. 2**). A single peak with retention time at 13.34 min can be found in both chromatograms. The identity of epigoitrin was confirmed with their corresponding UV-visible spectra. The concentration of epigoitrin in the *Isatidis Radix* sample was found to be 31.42 ppm.

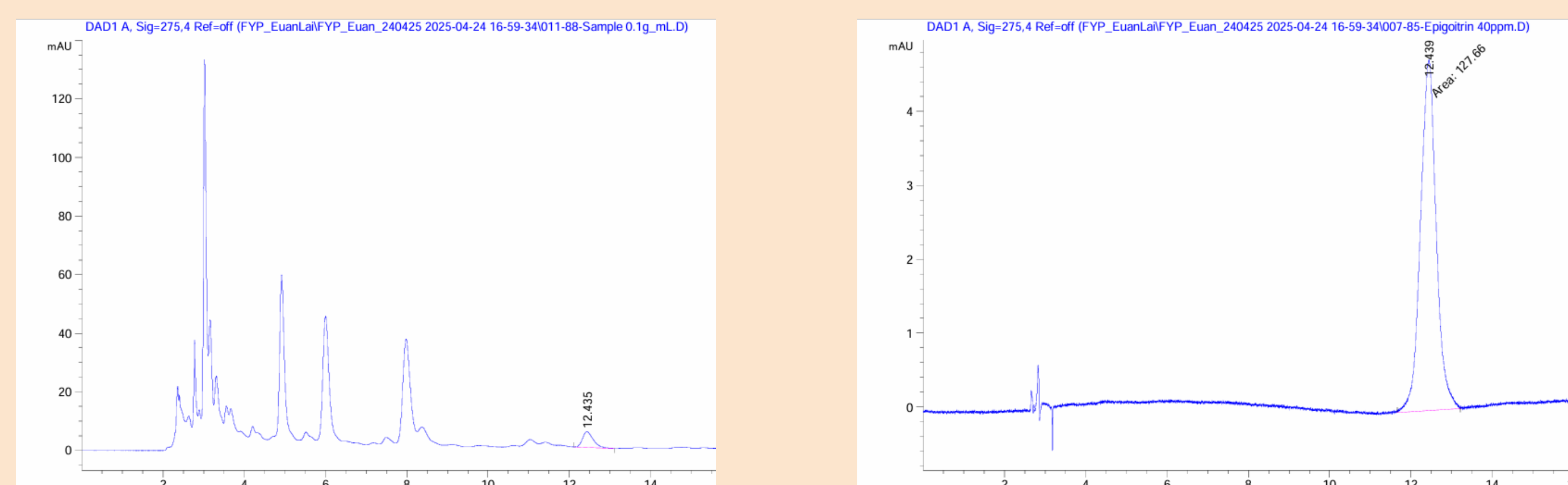


Figure 1 & 2. HPLC chromatogram of 0.1g/mL *Isatidis Radix* aqueous extract (left) and 40 ppm epigoitrin standard solution (right)

Aqueous *Isatidis Radix* solution was initially expected to show significant antibacterial and antioxidative activities. However in the disc diffusion method, sample solution at concentration 0.1g/mL showed no observable zone of inhibition for measurement in both *S. aureus* (**Figure. 3**) and *E. coli* (**Figure. 4**) culture.

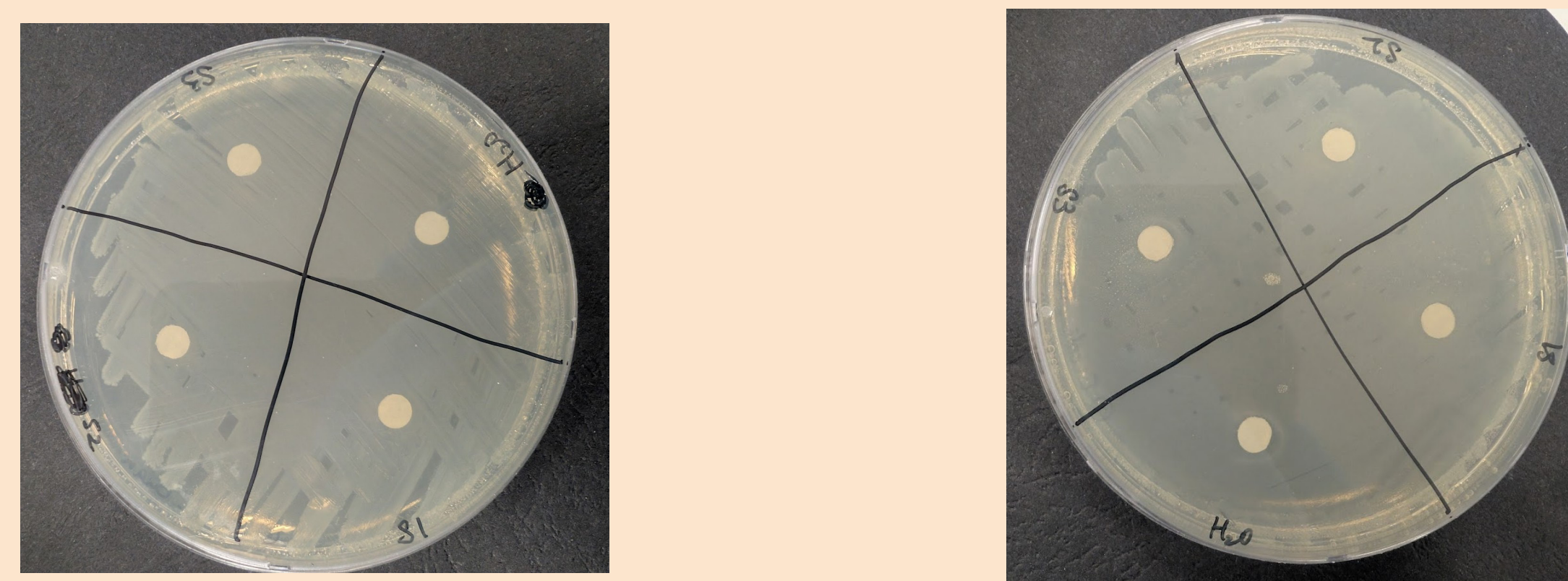


Figure 3 & 4. *S. aureus* culture (left) and *E. coli* culture (right) after 24 hours of incubation in disc diffusion method

The antioxidative capacity of *Isatidis Radix* was determined to be 12.91% with 0.8% (w/w) aqueous *Isatidis Radix* solution in the ABTS assay. It is noteworthy that the antioxidative assay should be conducted within a short period of time under darkness, considering the instability of ABTS radical solution.

Conclusion

Sample *Isatidis Radix* contained 31.42 ppm epigoitrin content and its aqueous solution showed fair antioxidative activity at 0.8% (w/w) concentration. However, its antibacterial properties remains unverified at the tested concentration and further study is required to justify using *Isatidis Radix* solution as a good substitute for other common preservatives used in cosmetic products.