ANALYSIS THE PROCESSING STAGE OF SOPHORA FLOWERS BY FOURIER TRANSFORM RAMAN SPECTROSCOPY

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Abstract: Sophora flower, a commonly used traditional Chinese medicine (TCM), has two traditional processed procedures. Using FT-Raman spectroscopy, the chemical reaction occurs during the processing of Sophora flowers - changes from Rutin to Quercetin, has been clearly tracked. Also, the quantification criterion to control the processing degree of Sophora flower samples is provided.

The roasted Sophora flower can relieve the cold property caused by raw Sophora flower. The charred Sophora flower has weak function of cooling blood but very well at hemostasia [1, 2]. It can be seen that processing, the traditional technique used to change medicinal properties and effects of TCM, now is facing a difficult problem -- how to control the processing degrees.

Fig. 1. Left: Raman spectra of the rutin from room temperature to 200°C
Right: Raman spectra of the Sophora flower samples from room temperature to 170°C

Using Fourier transform Raman Spectroscopy (FT-Raman), which can reduce the fluorescence aroused by the herbs, the Sophora flower samples at different temperatures were studied. This may
provide a novel and reliable method to control the processing stages of Sophora flower samples. To make the accurate assignment, Rutin, which is the main component in Sophora flower, is investigate by FT-Raman spectroscopy parallelly as a reference.

Fig. 1 shows the Raman spectra of rutin (left) and Sophora flower samples (right) under different temperatures. Rutin has the peak at 1298cm$^{-1}$, which assigned as the C-C stretching between two cycles [3]. As the temperature increased, this peak is getting boarder, and gradually moves to the higher position. Around 170°C, the peak changes to 1304cm$^{-1}$, while heating around 200°C, the peak appears at 1312 cm$^{-1}$. The characteristic peak of quercetin (structure is shown in Fig.2 right) can be seen at 1317cm$^{-1}$, which also be assigned as the C-C stretching between two cycles. Since rutin is a kind of glucoside compound (structure is shown in Fig.2 left), which R is the rhamnoglucosly. At higher temperature, R is inclined to drop from the molecule, then the bond of O-R breaks and quercetin forms (The reaction equation is shown in Fig. 2). Because of forming the statable structure, the characteristic peak of quercetin moves to 1317cm$^{-1}$. The same results are obtained in Sophora flower samples. As the temperature increased part of the rutin in Sophora flower samples changed to quercetin. This is the reason why Sophora flower has changed its medicinal effects after the processing. It can be estimated that the stir-fried Sophora flower samples were processed at 170°C. While the temperature up to 200°C, the charry Sophora flower samples formed.

![Fig.2. The thermolysis of rutin](image)

Via FT-Raman spectroscopy, the chemical reaction occurs during the processing of Sophora flowers - changes from Rutin to Quercetin, has been clearly tracked. The result gives a theoretical explanation to the traditional treatment of Sophora flower samples. Also, the quantification criterion to control the processing degree of Sophora flower samples is provided.

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References: