Claims:

1. A system for non-destructively determining the quality of a Chinese herb housed in packaging, the system comprising:

a femtosecond laser source for generating terahertz pulses;

a transmitter coupled to the femtosecond laser source for emitting terahertz radiation in response to the terahertz pulses;

an optical system configured to illuminate terahertz radiation from the transmitter onto at least one surface of the Chinese herb housed in packaging and to receive the terahertz radiation reflected by or transmitted through the Chinese herb housed in packaging to provide a return beam of terahertz radiation, and wherein the optical system further comprises a digital optical phase conjugation system configured to auto-aligning the terahertz radiation to defocus the terahertz radiation to at least one sub-interface of the Chinese herb housed in packaging;

a detector configured to detect and receive the return beam of terahertz radiation and generate an electrical signal in response to the return beam of terahertz radiation;

a signal processing system coupled to the detector, the signal processing system configured to process the generated signal into spectral data for determining the quality of the Chinese herb housed in packaging by comparing and matching the collected spectral data to a predetermined database consisting of terahertz reflectance spectra information of different types of Chinese herbs with different profiles, wherein the signal processing system comprises an algorithm for correlating the quality of the Chinese herb housed in packaging with respect to the predetermined database of terahertz reflectance spectra information of different types of Chinese herbs with different profiles.

2. The system of claim 1, wherein the algorithm is configured to calculate an absorption spectra based on collected data and to determine at least one of the properties selected from the group consisting of quality, age and hardness of the Chinese herb housed in packaging by comparing and matching the collected spectral data and the absorption spectra to the predetermined database consisting of terahertz reflectance spectra information of different types of Chinese herbs with different profiles.

3. The system of claim 1, wherein the algorithm is configured to determine at least one of the properties selected from the group consisting of type, purity, authenticity and composition of the Chinese herb housed in packaging by comparing and matching the collected spectral data of the Chinese herb housed in packaging to the predetermined

database consisting of terahertz reflectance spectra information of different types of Chinese herbs with different profiles.

4. The system of claim 1, wherein the optical system further comprises a first lens and a second lens arranged spaced apart along the optical path, wherein the first lens is configured to illuminate terahertz radiation from the transmitter onto the Chinese herb housed in packaging and the second lens is configured to receive the terahertz radiation reflected by or transmitted through the Chinese herb housed in packaging to provide the return beam of terahertz signal.

5. The system of claim 4, wherein the optical system further comprises:

a first pair of off-axis parabolic mirrors coupled to the transmitter to focus the terahertz radiation onto the Chinese herb housed in packaging; and

a second pair of off-axis parabolic mirrors coupled to the detector to pick up the terahertz radiation reflected from the Chinese herb housed in packaging.

6. The system of claim 1, wherein the optical system is an open space optical system or a fiber connected optical system.

7. The system of claim 1, wherein the digital optical phase conjugation system is configured to defocus the terahertz radiation to at least one sub-interface of the Chinese herb housed in packaging to do a THz-time domain system sampling to obtain information about the Chinese herb.

8. The system of claim 1, wherein either or both of the transmitter and the detector comprise a terahertz antenna.

9. The system of claim 1, wherein either or both of the transmitter and the detector is a non-linear crystal.

10. The system of claim 1, wherein the detector is configured to detect and receive return beam of terahertz radiation within a frequency of 0.1 to 10 THz.

11. The system of claim 1, wherein the signal processing system is configured to detect abnormal components in the Chinese herb housed in packaging in response to the predetermined database consisting of terahertz reflectance spectra information of

different types of Chinese herbs with different profiles by evaluating if the differences in the terahertz signal identity metrics fall outside an acceptable predetermined range.

12. A method of non-destructively determining the quality of a Chinese herb housed in packaging using terahertz time-domain spectroscopy, the method comprising:

illuminating terahertz radiation onto the Chinese herb housed in packaging;

measuring a terahertz signal reflected from at least one surface of the packaging of the Chinese herb to obtain a first reading;

shifting a focal point of the terahertz radiation onto a Chinese herb/packaging interface of the Chinese herb housed in packaging;

measuring a terahertz signal reflected from the Chinese herb/packaging interface to obtain a second reading;

defocusing the terahertz radiation into the Chinese herb housed in packaging and measuring a terahertz signal reflected from the Chinese herb to obtain a third reading;

carrying out Fast Fourier transform of the first, the second and the third readings and auto-correct the data using time domain delay to obtain a set of spectral data;

calculating an absorption spectra based on the first, the second and the third readings; and

determining the quality of the Chinese herb housed in packaging by comparing and matching the collected set of spectral data and/or the absorption spectra to a predetermined database consisting of terahertz reflectance spectra information of different types of Chinese herbs with different profiles,

wherein the step of defocusing the terahertz radiation into the Chinese herb housed in packaging includes auto-aligning the terahertz radiation using a digital optical phase conjugation system to defocus the terahertz radiation into the Chinese herb housed in packaging.

13. The method of claim 12, wherein the step of determining the quality of the Chinese herb housed in packaging includes determining at least one of the properties selected from the group consisting of type, purity, authenticity and composition of the Chinese herb housed in packaging by comparing and matching the collected set of spectral data to the predetermined database consisting of terahertz reflectance spectra information of different types of Chinese herbs with different profiles.

14. The method of claim 12, wherein the step of determining the quality of the Chinese herb housed in packaging includes determining at least one of the properties selected from the group consisting of quality, age and hardness of the Chinese herb

housed in packaging by comparing and matching the collected set of spectral data and the absorption spectra to a predetermined database consisting of terahertz reflectance spectra information of different types of Chinese herbs with different profiles.

15. The method of claim 12, wherein the step of determining the quality of the Chinese herb housed in packaging further includes using the collected set of spectral data and absorption spectra to derive parameters selected from the group consisting of dielectric constants, absorption coefficient and refractive index and correlating the parameters to the predetermined database consisting of terahertz reflectance spectra information of different types of Chinese herbs with different profiles to determine the selected property of the Chinese herb.

16. The method of claim 12, wherein the step of determining includes identifying an abnormal Chinese herb by matching the collected set of spectral data to the predetermined database consisting of terahertz reflectance spectra information of different types of Chinese herbs with different profiles.

17. The method of claim 12, wherein the step of shifting the focal point is carried out by auto-aligning the terahertz beam using a digital optical phase conjugation system to defocus the terahertz beam onto the Chinese herb/package interface.