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Can we use Mid-Infrared Spectroscopy (MIRS) for Quantifying Artemisinin, an Antimalarial Compound of *Artemisia annua*?

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Abstract

In the tropics malaria kills one person every 20 seconds. This disease is caused by four species of the genus Plasmodium - protozoan parasites - transmitted by the female Anopheles mosquito. Plasmodium has become resistant to most of the presently available antimalarial drugs. Currently, resistance to malaria drugs is spreading and new treatments are urgently required. *Artemisia annua*, an in China for more than 2000 years well known medicinal plant seems to provide an alternative option. Artemisinin, a sesquiterpene lactone, is one of its various active agents and is effective against the plasmodium. It is part of the WHO artemisinin-based combination therapy (ACT), recommended since 2001. In addition, a treatment with tea based on Artemisia leaves has proofed to be successful in 80 % of treated cases according to ANAMED (Action for Natural Medicine). For quality control, a rapid method to detect artemisinin content in plants is highly desirable as artemisinin content strongly varies within plant and among varieties. Currently employed methods are high performanceressure liquid chromatographyic (HPLC) with electrochemical detection, recommended by the World Health Organisation (WHO), and an indirect measurement using gas chromatography (GC). Alternatively, we tested if Difuse Reflective Fourrier Transform Mid-Infrared Spectroscopy (DRIFT-MIRS) can be considered as a novel and fast option to determine artemisinin content in plant materials. For this study, the artemisinin content of 20 plant samples was measured with HPLC and MIRS. Pure artemisinin was used to identify corresponding MIRS reflectance peaks and regions. Due to the characteristic intrinsic chemical structure of artemisinin characteristic peaks could be detected by MIRS. Both HPLC and MIRS measurements were subsequently linked to produce a Partial Least Square Regression model for artemisinin quantification. The artemisinin content of unknown samples was well predicted by this model. Estimating 20 other plant samples with HPLC and MIRS showed a high correlation of artemisinin content (r^2=92 %) between the two methods. Thus, MIRS is considered to be a fast and viable alternative method with flexibility in application while requiring only small amounts of samples.

Keywords: *Artemisia*, artemisinin, malaria, mid infrared spectroscopy

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