Contribution ID: **86** Type: **Poster**

In-Situ and Non-Destructive Detection of Oleoresin in Standing Agarwood Trees Using Portable Gamma-Ray Tomography Imaging System

Wednesday, 26 April 2017 14:15 (2 hours)

Agarwood is known for its fragrant resinous wood. It is a rare and precious oleoresin on the planet, prized for its rich and wonderful fragrance and healing properties. Because of its high economic value, agarwood has been subject to intensive exploitation in South East Asia's natural forest for hundreds of years. Consequently, agarwood-producing tree species have become extremely rare.The extinction threat to agarwoods is becoming more worrisome because their harvest is often done by trial and error; specifically, by cutting the standing trees without any reliable means to detect and confirm the presence of oleoresin. This practice is not only inefficient and technically and economically ineffective, but it also contradicts sustainable forest management principles. To decrease random harvesting, technological innovation is needed to detect the presence of oleoresin within the trees. Technology based on the measurement of energy gamma-ray attenuation to assess internal trunk or wood characteristics has been developed. The attenuation of gamma-rays is highly correlated to the atomic number and density of materials. The principle of this technology is based on measuring and recording the transmitted intensity of gamma rays that pass through the trunk of the tree. The transmitted gamma-ray intensities will differ depending on the density of the wood. Since the presence of oleoresin in agarwood changes the density of trunk wood, this technology can theoretically detect agarwood within a tree. A portable clamp-on gamma-ray tomography system, called GammaSpider, was designed and manufactured by scientists and technologists at the Centre for Computed Tomography and Industrial Imaging in Malaysian Nuclear Agency. This paper presents the results of tomographic imaging of several standing agarwood trees of different ages. In addition, the effectiveness of innoculation process to produce oleoresin was also evaluated. Computed tomography (CT) images of the samples were obtained at 1.25mm resolution. Besides a clear distinction between oleoresin, voild and wood fibre, some bright white areas occured in the reconstruction images caused by a denser medium component in the wood, apparently oleoresin deposits that attenuated the radiation. This technique demonstrates a potential application of gamma-ray computed tomography in the detection of oleoresin in standing agarwood trees. The development of GammaSpider was carried out in an attempt to provide an alternative non-destructive means to the conventional cutting methods for the detection of oleoresin in standing agarwood trees. The system has produced quality images with excellent contrast, which shows clear and correct representation oleoresin, void and wood fibre. From the CT images, the positions and extent of oleoresin could be precisely quantified. The scanner has been successfully used for non-invasive detection of oleoresin in agarwood trees in a number of field tests in plantations in Malaysia. The successful utilization of this innovative has been recognized both nationally and internationally, as GammaSpider has won a number of awards. The method offers great advantages for in-situ inspection of agarwood tress as compared to the conventional methods. Work is continuing on improvements to meet the demands of faster scanning.

Country/Organization invited to participate

Malaysia

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Session Classification: P-A1

Track Classification: RADIATION TECHNOLOGIES FOR MEASUREMENT