



## Development of Liquid Dosimeter using Polyvinyl Alcohol-Silver Nitrate for Food Irradiation

Phasit Petisiwaveth<sup>1</sup>, Rujira Wanotayan<sup>1</sup>, Nuanpen Damrongkijudom<sup>1</sup>, Sumalee Ninlaphruk<sup>2</sup> and Sumana Kladsomboon<sup>\*1</sup>

<sup>1</sup>Department of Radiological Technology, Mahidol University, Nakhon Pathom, Thailand

<sup>2</sup>Office of Atoms for Peace, Bangkok, Thailand

\*Corresponding author, E-mail: [sumana.kla@mahidol.edu](mailto:sumana.kla@mahidol.edu)

### Abstract

Food irradiation is a well-established and powerful technology for food processing and preservation that can maintain the quality of the food compared with other preservation methods. The effectiveness of ionizing radiation in food processing depends on its radiation dose. Thus, the dose must be controlled by a reliable and practical dosimeter to avoid overexposure of radiation to sensitive products. In this study, a liquid dosimeter based on polyvinyl alcohol-silver nitrate (PVA-AgNO<sub>3</sub>) nanocomposite was developed as an alternative method for low doses (10 Gy to 1 kGy) gamma irradiation measurement in food irradiation. PVA-AgNO<sub>3</sub> was prepared by dissolving 5 g of PVA powder in 95 ml of distilled water. Then, the concentration of AgNO<sub>3</sub> solution was varied at 0.01, 0.1, 1, and 3 M in the PVA solutions. The PVA-AgNO<sub>3</sub> solutions were exposed to gamma-ray using Co-60 source (Gamma Cell 220) at radiation doses of 0, 1, 2, 4, 8, 10, 20, 40, 80, 100, 200, 400, 800, 1000, and 1200 Gy. Finally, a UV-vis spectrophotometer was applied to generate the calibration curve between the radiation doses and optical density of the solution. The result showed that the color of PVA-AgNO<sub>3</sub> solution has changed from colorless to yellow when exposed to low doses (<10 Gy) and from colorless to brown when exposed to high doses (>100 Gy). Moreover, the calibration curve of the PVA-AgNO<sub>3</sub> dosimeter showed a strong linear relationship between absorption intensity and radiation doses in a different dose range with the correlation coefficient ( $r^2$ ) of 0.979-0.999, which corresponded to different concentrations of the AgNO<sub>3</sub> solution. Thus, the concentration of AgNO<sub>3</sub> can affect the sensitivity of this dosimeter. Based on our preliminary results, this liquid dosimeter has a high potential to be utilized as an alternative radiation dosimeter in food irradiation in the future.

**Keywords:** Radiation dosimeter, Food irradiation, Gamma-ray sensor, Polyvinyl alcohol, Silver nitrate