

## **Polymer film blend of polyvinyl alcohol, trichloroethylene and cresol red for gamma radiation dosimetry**

### **ABSTRACT**

This study investigated the polymer film composite of polyvinyl alcohol (PVA), trichloroethylene (TCE) and cresol red (CR) dye irradiated with gamma ( $\gamma$ ) rays for potential application as radiation dosimetry. The film was prepared via the solvent-casting method with varying concentrations of TCE. Film samples were exposed to radiation from a  $\gamma$ -rays radiation source of  $^{60}\text{Cobalt}$  isotope. Color changes before and after  $\gamma$ -rays irradiation were observed, and the optical properties of the polymer films were investigated by spectrophotometry. Results show that increasing the radiation dose physically changed the color of the polymer film, from purple (pH > 8.8) without radiation (0 kGy) to yellow (almost transparent) ( $2.8 < \text{pH} < 7.2$ ) at the highest dose (12 kGy). The concentration of acid formed due to irradiation increased with the increase in irradiation doses and at higher TCE content. The critical doses of PVA-TCE composites decreased linearly with the increase of TCE composition, facilitating an easy calibration process. The dose response at 438 nm increased exponentially with increasing radiation dose, but showed an opposite trend at the 575 nm band. An increase in the TCA concentration indicated a decrease in the absorption edge and an increase in activation energy, but both decreased for all TCE concentrations at higher doses. The energy gap for the direct and the indirect transitions decreased with increasing TCE concentration and  $\gamma$ -rays radiation dose. The results of this study demonstrated the potential application of PVA-TCE-CR polymer film as  $\gamma$ -rays irradiation dosimetry in a useful dose range of 0–12 kGy.