

## **Development of Vernonia amygdalina leaf extract emulsion formulations in controlling gray mold disease on tomato (*Lycopersicon esculentum* Mill.)**

### **ABSTRACT**

Postharvest fruits including tomatoes are commonly infected by gray mold disease resulting in significant economic losses in the fruit industry. Therefore, this study aimed to develop botanical fungicide derived from *Vernonia amygdalina* leaf extract to control gray mold on tomato. The emulsion formulation containing surfactant, oil carrier and water was optimized at different non-ionic alkyl polyglucoside surfactants through eleven combinations of oil to surfactant ratio (0:10, 1:9, 2:8, 3:7, 4:6, 5:5, 6:4, 7:3, 8:2, 9:1 and 10:0 w/w). From eight selected formulations, two formulations, F5 and F7 showed stable in storage, remarkable thermodynamic stability, smaller particle size (66.44 and 139.63 nm), highly stable in zeta potential (−32.70 and −31.70 mV), low in polydispersity index (0.41 and 0.40 PdI), low in viscosity (4.20 and 4.37 cP) and low in surface tension (27.62 and 26.41 mN/m) as compared to other formulations. In situ antifungal activity on tomato fruits showed F5 formulation had a fungicidal activity against *B. cinerea* with zero disease incidence and severity, whereas F7 formulation reduced 62.5% disease incidence compared to a positive control with scale 1. Based on these findings, F5 formulation exhibited pronounced antifungal activity and may contribute to the development of new and safe antifungal product against gray mold on tomato.

**Keyword:** *Vernonia amygdalina*; Antifungal activity; *Botrytis cinerea*; Nanoemulsion formulation; Gray mold disease; Particle size; Zeta potential; Polydispersity index; Viscosity; Tomato