ABSTRACT

The study was aimed at maximum disinfestation of insect pests (Callosobruchus species) of stored green gram seed without affecting the nutritional profile of seed. The two control strategies viz., microwave and fungal treatment (entomopathogenic fungi, Beauveria bassiana), were successfully applied for insect disinfestations without affecting the quality of green gram seed. The microwave treatment parameters were optimized using central composite rotatable design (CCRD) and response surface methodology (RSM) for maximum insect pest mortality. The effect of independent parameters, viz., microwave power level and time of exposure on the moisture content, insect mortality, color, and phyic acid was optimized using the RSM, with the optimized value for power of 808 W and time 79 S. The optimally treated green gram seed has 8.9 % moisture, 99.5 % insect mortality, 2.22 Δa^* (green color of seed), and 591.79 mg/100 g of phytic acid. Four different conidial concentrations of entomopathogenic fungus, Beauveria bassiana was sprayed 1 mL based on the logarithmic series $(4 \times 10^2, 4 \times 10^3, 4 \times 10^4)$ and 4×10^5 conidia mL⁻¹) and incubated for 10 days. Twenty four experiments were conducted with a complete randomized block design (CRD) with three replications. B.bassiana, 4×10^5 conidia mL⁻ ¹ at exposure day 8 gave maximum (97.83 %) insect mortality, moisture content of seed was 11.5 % and protein content was 24.5 %. Optimally fungal treated samples were devoid of any mycotoxins thereby implying their safety for human consumption. In vitro protein digestibility (IVPD) of the control (untreated) sample was 83 ± 0.289 %, and that of the microwave and fungal treated treated sample using optimum conditions was 85 ± 0.296 % and 86 ± 0.320 %, respectively. These values are significantly higher (p<.05) than those of control. The mineral elements studied were Zn, Fe, Mg, Mn, Cu, K, Ca and Na. The microwave treatment resulted in a non-significant (p<.05) effect for Mg, Mn, Cu, K, and Na but a significant (p<.05) effect for Zn, Ca, and Fe. On the other hand, fungal treated seed had not much affect the mineral content. Sorption studies and storage studies of the green gram seeds and evaluation of shelf life were carried out. The GAB model fitted well with both the adsorption and desorption data of the untreated seed. For microwave treated seed Modified Chung-Pfost was found to be the best model for adsorption and GAB model was the best fit for desorption. The shelf life of seeds increased from 30 days in control to 134 days after microwave treatment and 115 days after fungal treatment at 90 % RH, 30 °C in metalized polyester package. A rapid and nondestructive FT-NIR spectroscopic method was developed for the determination of phytic acid in green gram seed.

Keywords: Green gram (*Vigna radiata*), insect mortality, phytic acid, mineral, in vitro protein digestibility (IVPD), moisture content, microwave treatment, fungal treatment, entomopathogen, *Beauveria bassiana*, Sorption isotherm, FT-NIR spectroscopy.