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Optimization of the Phytofabrication of Silver Nanoparticles from *Eichhornia crassipes* as Pest Control Tool for *Spodoptera frugiperda*

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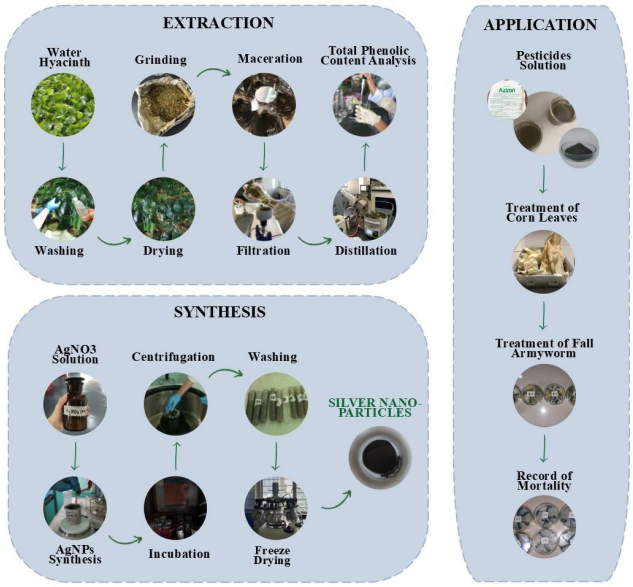
INTRODUCTION & AIM

- The Philippine agricultural industry faces a significant threat from the fall armyworm, infesting numerous regions and threatens key crops like corn and sugar cane.
- This study explores using water hyacinth, an invasive plant rich in phytochemicals, for green synthesis of silver nanopesticides, providing an eco-friendly pest control solution
- Aimed at supporting the UN's Zero Hunger goal, the research seeks to enhance agricultural productivity and sustainable food production.

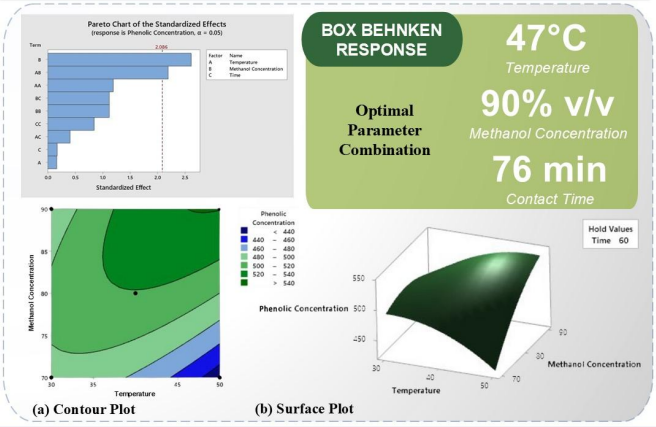
The objectives are as follows:

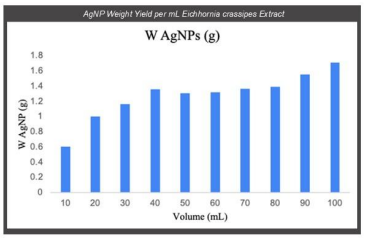
- Determine the effect of temperature, methanol concentration, and contact time on the yield of phenolic content from Water Hyacinth.
- Determine the effect of plant extract amount on the production of silver nanoparticles (AgNPs) using silver nitrate as a precursor in various ratios.
- Characterize the AgNPs produced using SEM-EDX.
- Compare the effectiveness of EC-AgNPs and a common commercial pesticide using the relative toxicity to fall armyworm (Spodoptera frugiperda) pests.

METHOD

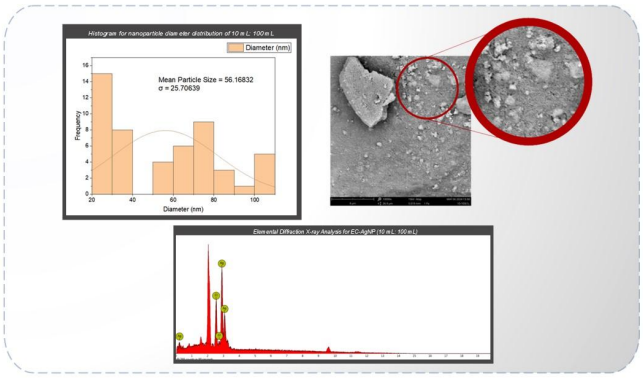


RESULTS & DISCUSSION





The graph shows that increasing the volume of methanolic extract from 0 to 100 mL generally increases the weight of silver nanoparticles (AgNPs) produced from about 0.7 to 1.7 grams. However, higher AgNP yields often lead to agglomeration, affecting usability, as increased particle reactivity and van der Waals forces cause clustering and solidification. Thus, the volume of methanolic extract is not directly proportional to the practical yield of AgNPs.



The histogram shows a bimodal distribution of silver nanoparticle diameters with a mean size of 56.17 nm and peaks at 20-30 nm and 70-80 nm. Smaller nanoparticles, predominant in the 10 mL concentration, enhance pesticide effectiveness due to their higher surface area-to-volume ratio, improving bioavailability and penetration. Thus, the 10 mL concentration is highly suitable for pest control, maximizing the efficacy of silver nanoparticles through better penetration and sustained release. While, EDX analysis showed that the silver nanoparticles are 87.89% silver, with chlorine from water hyacinth present, confirming silver ions and chloride ions as reducing and capping agents, and a sharp SPR peak at 3 keV.

Analysis of the Effectivity of EC-AgNP and Aztron WDG across Larval Instars

ANOVA Two-Way

Sources of Variation	LC_{50}	LC_{90}	LC_{95}
Rows	0.27	0.46	0.49
Column	0.62	0.10	0.14

The table shows that the P-values from a Two-Way ANOVA indicate no significant differences in the effects of each pesticide on the lethal concentrations across the 2nd, 3rd, 4th, and 5th larval instars. This suggests that EC-AgNPs and Aztron WDG have similar effectiveness at each developmental stage.

CONCLUSION

- The optimal extraction parameters for achieving the highest phenolic concentration were determined to be 47°C, 90% methanol, and 76 minutes contact time, with contact time having negligible influence on phenolic extraction.
- Increasing the volume of methanolic extract generally increased AgNP yield, but higher yields tended to agglomerate.
- Silver nanoparticles were successfully synthesized with an average particle size of 56.17 nm.
- EC-AgNPs and Aztron WDG performed at similar levels of efficacy when applied to each larval stage.

FUTURE WORK / REFERENCES

- Explore methanol concentrations greater than 90% for higher phenolic extraction yields.
- Conduct FTIR analysis to identify functional groups involved in AgNP synthesis.
- Account for environmental factors (temperature, humidity, light) affecting AgNP activity in pest application.
- Perform extensive trials to assess AgNP effectiveness.
- Consider non-toxic solvents for AgNP formulations that minimize environmental and health risks.