Conclusions

- **Loading LCNS onto bare or modified MSNs could reduce the negative impacts of light due to the improved photochemical stability of the loaded LCNS in MSN.**
- **The effect of MSN size on the insecticidal effect of LCNS-loaded MSN was negligible, while the surface modifications of $–NH_2$ and $–CH_3$ on MSN decreased the insecticidal effect under both the light and dark conditions.**
- **The ROS content in *O. furnacalis* larvae increased following treatment with LCNS-loaded MSNs of medium size (about 95 nm) and a surface modification of $–NH_2$.**
- **LCNS-loaded MSNs with different sizes and surface modifications inhibited SOD and CAT activities, but LCNS-loaded MSN treatment had a negligible effect on Na^+/K^+-ATPase activity in the *O. furnacalis* larvae.**
- **The high insecticidal activity of LCNS-loaded MSNs was probably caused by the increased exposure of LCNS from the sorbed LCNS-loaded MSNs rather than oxidative damage to *O. furnacalis* larvae.**