

Photodynamic treatment of fungi using unbound and encapsulated rose Bengal

Abstract

Rose bengal (RB) solutions coupled with a green laser have proven to be efficient in clearing resilient nail infections caused by *Trichophyton rubrum* in a human pilot study and in extensive in vitro experiments. Nonetheless, the RB solution can become diluted or dispersed over the tissue and prevented from penetrating the nail plate to reach the subungual area where fungal infection proliferates. Nanoparticles carrying RB can mitigate the problem of dilution and are reported to effectively penetrate through the nail. For this reason, we have synthesized RB-encapsulated chitosan nanoparticles with a peak distribution size of ~200 nm and high reactive oxygen species (ROS) production. The photodynamic treatment with these nanoparticles killed more than 99% of *T. rubrum*, *T. mentagrophytes*, and *T. interdigitale* spores, which are the common clinically relevant pathogens onychomycosis. These nanoparticles are not cytotoxic against human fibroblasts, which promotes their safe application in clinical translation.