

A carboxyl-functionalized graphene quantum dot catheter coating effective against drug-resistant *Candidozyma auris*

Laure van Hofwegen¹, Muhammad Hassnain², Annie Pan¹, Karin van Dijk¹, Ferry Hagen³, Payal Balraadsing¹, Sedat Nizamoglu⁴, Sebastian Zaat¹

¹Department of Medical Microbiology and Infection Prevention, Amsterdam UMC, The Netherlands

²Department of Biomedical Science and Engineering, KOC University, Turkey

³Department of Medical Mycology, Westerdijk Fungal Biodiversity Institute, The Netherlands

⁴Department of Electrical and Electronics Engineering, KOC University, Turkey

Introduction

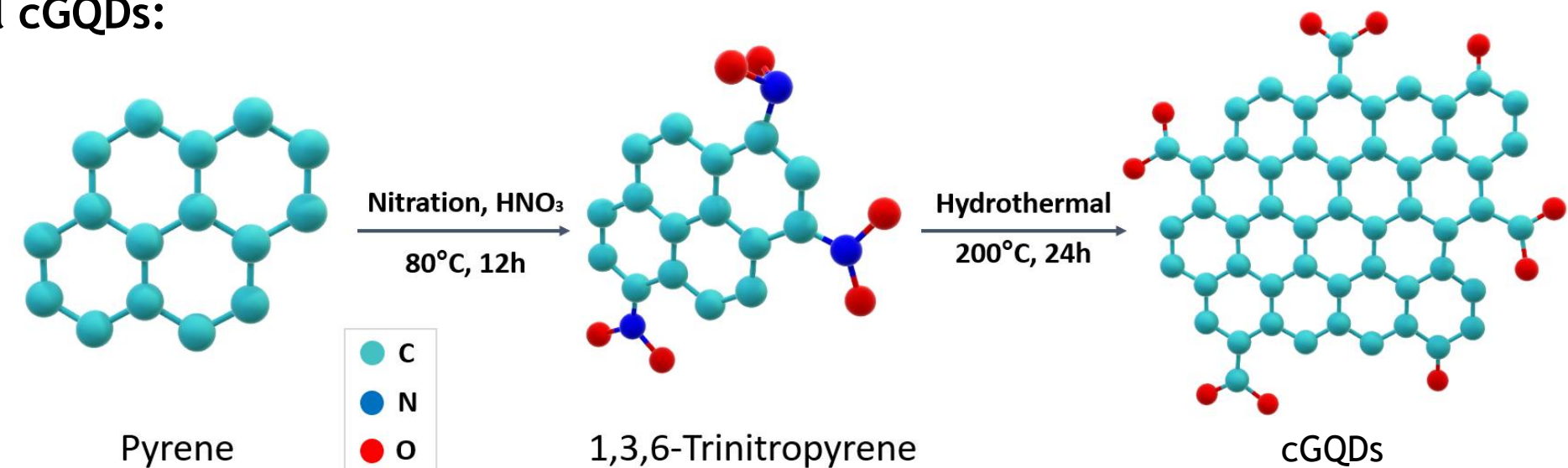
Candidozyma auris is an emerging opportunistic pathogen that can cause serious catheter-related blood stream infections. The traditional antifungal treatment with polyenes, azoles or echinocandins is becoming less effective due to resistance development, complicating treatment. To combat the rising antifungal resistance, nanoparticles such as graphene quantum dots (GQDs) could serve as an alternative strategy. When excited by light of a specific wavelength, GQDs can utilize oxygen molecules and generate singlet oxygen, which has broad microbicidal activity. We aimed to investigate a newly developed carboxylated form of the GQD (cGQDs) in colloidal form, as well as incorporated into a cGQD thin film on catheters, for their fungicidal activity against *Candidozyma auris* and *Candida albicans*.

Aim of the study

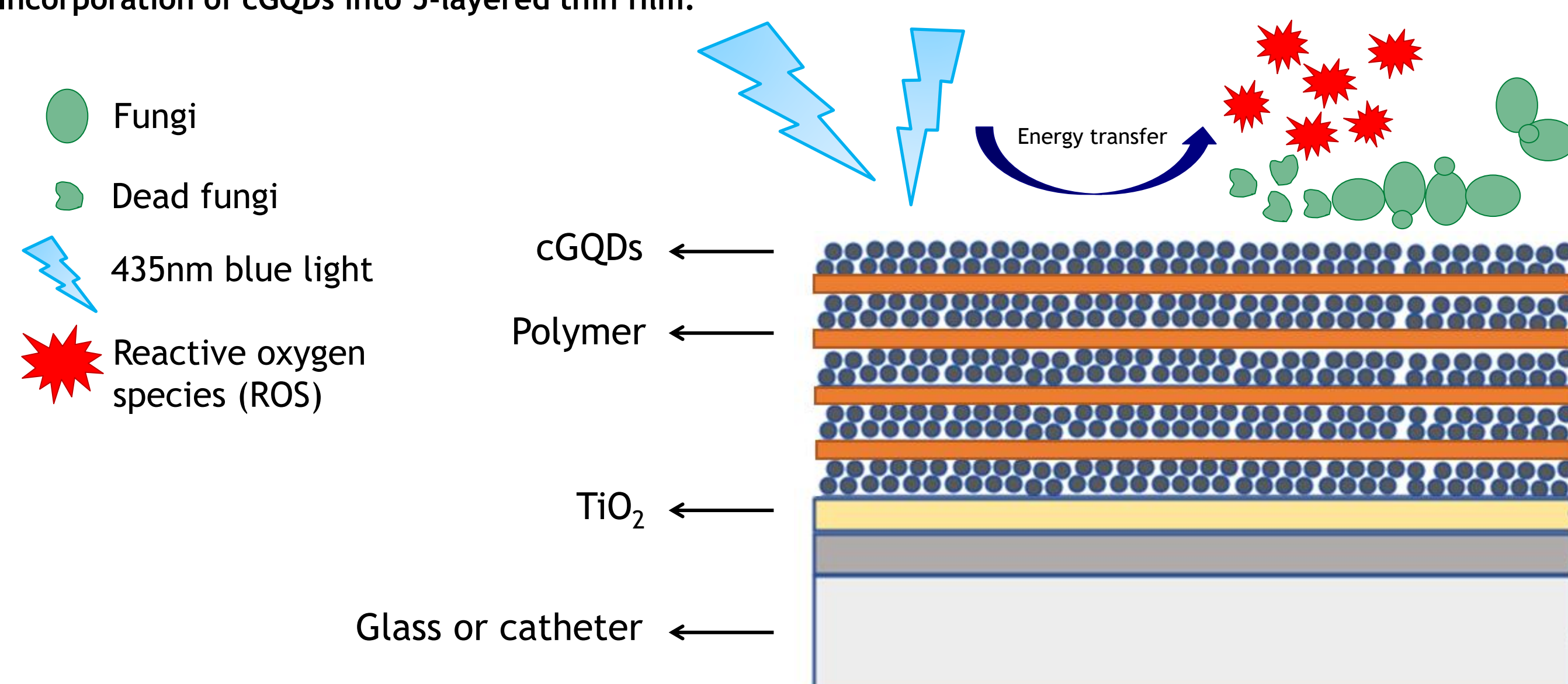
To determine the fungicidal activity of colloidal cGQDs and a cGQDs thin film on catheters against *Candidozyma auris* and *Candida albicans*.

Composition and antimicrobial mechanism of cGQDs

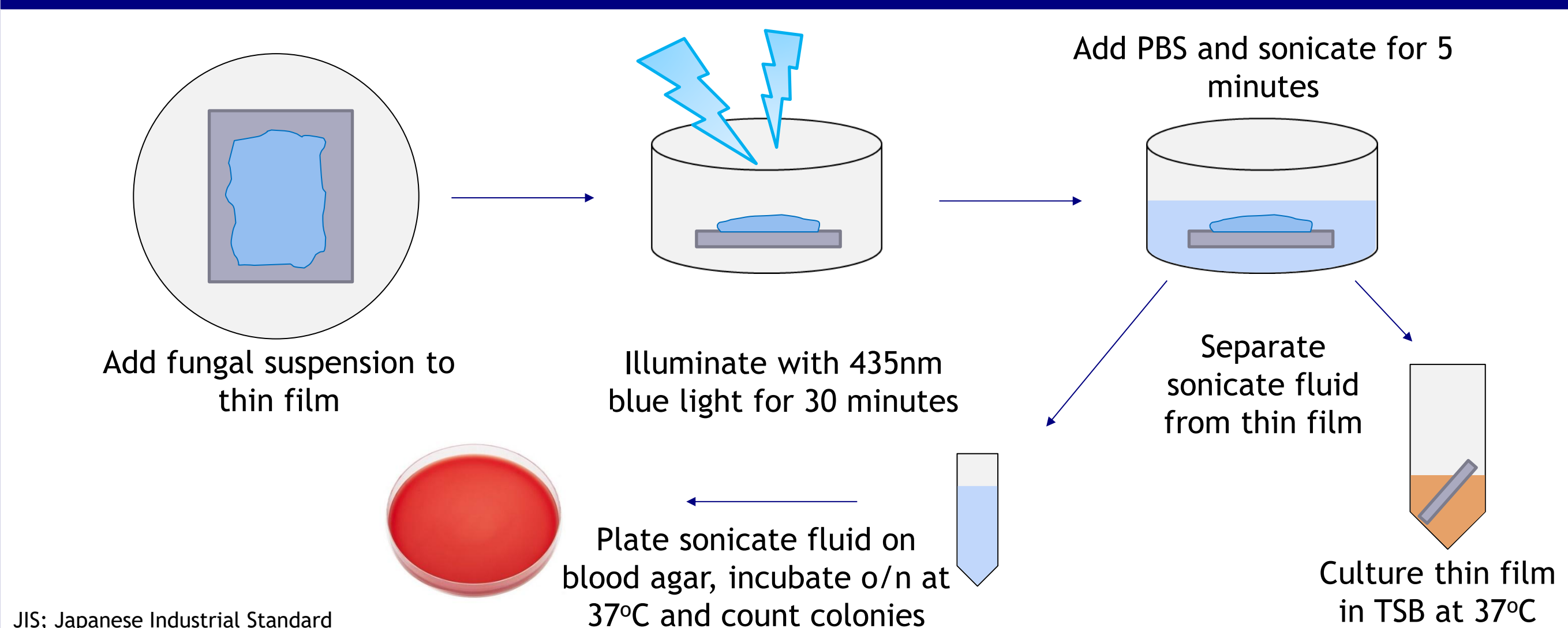
Synthesis of colloidal cGQDs:



Incorporation of cGQDs into 5-layered thin film:

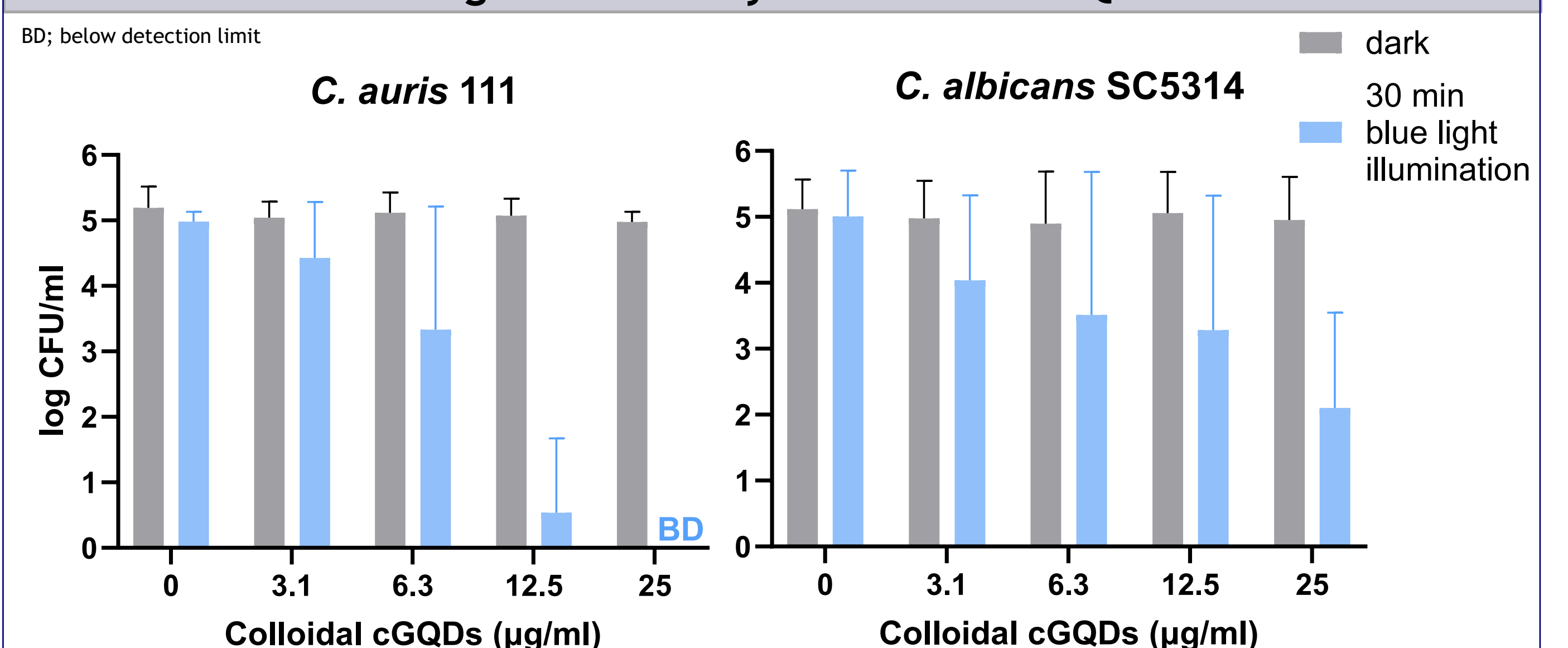


Surface fungicidal activity assay (JIS assay)

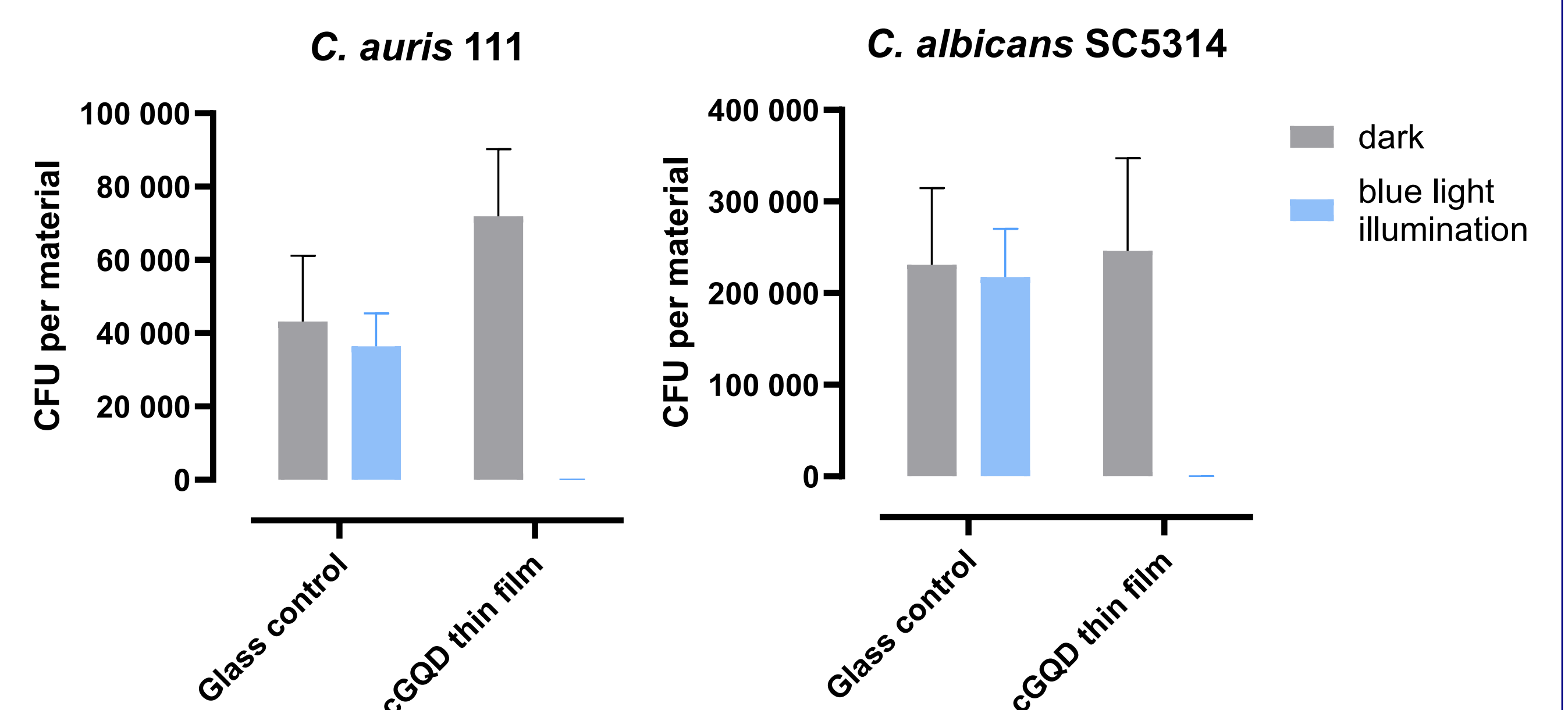


Results

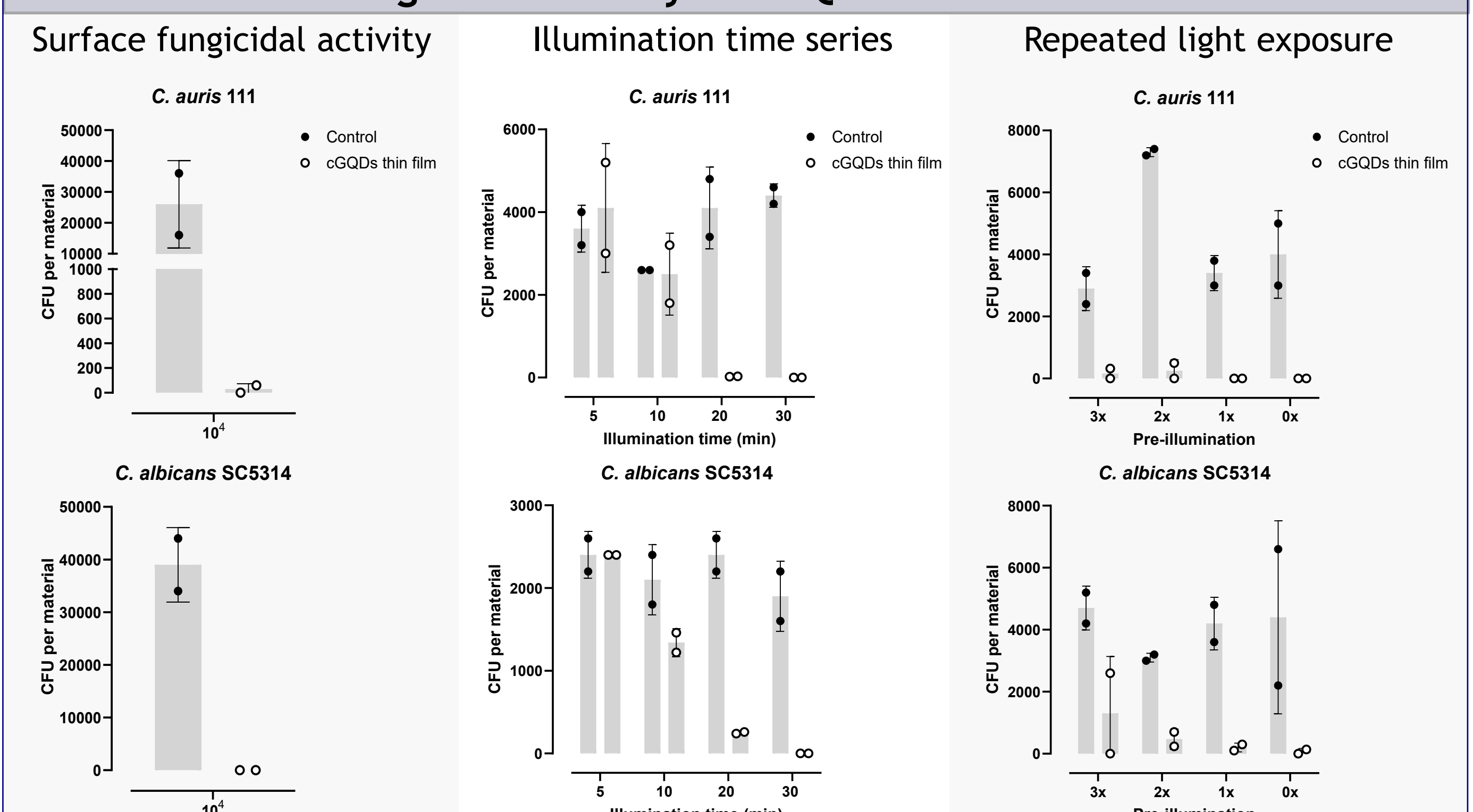
Fungicidal activity of colloidal cGQDs



Surface fungicidal activity of cGQD thin film on glass



Surface fungicidal activity of cGQD thin film on catheters



Conclusions

- Colloidal cGQDs and the cGQDs thin film have strong fungicidal activity against both *C. auris* and *C. albicans* after photo-activation
- The technology can be applied to catheters and possibly orthopedic devices to prevent infection

