Inactivation of *Clostridium difficile* by 405nm HINS-light
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**Clostridium difficile**
- *Clostridium difficile* is a major cause of **hospital-associated diarrhoea** that can be fatal for the young, elderly and immunocompromised.
- Under adverse conditions, this anaerobic bacterium forms **spores** which can survive in the environment up to 5 months.
- It is transmitted mainly by the oral-faecal route, however the environment also plays an important role in transmission.

**HINS-light**
- HINS-light is a novel light-based decontamination method which uses visible violet light, with a peak wavelength of 405nm, to induce lethal oxidative damage to exposed microorganisms.
- HINS-light has been used to develop an environmental disinfection system for use in hospital isolation rooms.

**Spores vs Vegetative cells**
*C. difficile* spores are 10-15 times more resistant to various chemicals and physical agents than vegetative cells. This makes spores difficult to eradicate and facilitates spread of *C. difficile* in the environment.
*C. difficile* sporulation is triggered under adverse conditions i.e. in aerobic conditions, dessication, and starvation, such as the hospital environment.

**C. difficile sporulation cycle**

**Aims**
To establish the susceptibility of *C. difficile* vegetative cells and spores to 405nm light
This could aid development of this novel method for the reduction of *C. difficile* contamination, and cross-infection within the hospital environment.

**Methods**
Spore and vegetative cell suspensions were exposed to high irradiance 405nm light, and surviving populations enumerated.

**Results**
Exposure of vegetative cells to 252 J/cm² 405nm HINS-light achieves a 3-log₁₀ population reduction.

Spores require a dose of 2430 J/cm² to achieve a similar 3-log₁₀ reduction, demonstrating the higher resilience of spores compared to vegetative cells.

**Conclusions and Further Research Questions**
- In conclusion, it is evident that 405nm HINS-light can successfully be used for the inactivation of both *Clostridium difficile* vegetative cells and spores.
- Spores however are much more resilient than vegetative cells, requiring more than 10x the dose for inactivation compared to vegetative cells to achieve a ~3.5 reduction.

- Can inducing germination of spores enhance HINS-light decontamination?
- Can synergistic decontamination be achieved through combined use of 405nm light and disinfectants?
- Can this decontamination effect be replicated in the clinical environment?