

Final publishable summary report

Executive summary

The rise in the number of patients in hospitals treated for nosocomial infections is rising, particularly in patients associated with indwelling urinary catheters. Urinary Tract Infections (UTI) account for circa 40% of nosocomial infections and 80% of UTIs are associated with the use of indwelling urethral catheters. Indwelling catheters are used during and after certain types of surgeries to collect urine specimen, monitor accurate urine output, and aid the patient in the case of severe illness or injury. The catheter associated urinary tract infections can prolong the stay of hospitalisation, resulting in increased direct costs for the National Health Service, which is caused by an increase use of drugs, additional laboratory and other diagnostic studies. Prolonged stay not only increases direct costs to patients or tax payers but also indirect costs due to lost work, furthermore catheter associated UTIs are responsible for increased hospital mortality.

Uropathogens can enter the catheter via two routes: the extraluminal contamination by direct inoculation (external catheter surface) and the intraluminal contamination by reflux of bacteria and contamination of urine in the collection bag (internal catheter surface). Both contaminations are caused by initial conditioning of urinary protein films, which allows for subsequent bacterial attachment and biofilm formation. The extraluminal infection route is blocked with the use of application of external hydrogel-silver films, oral administration or coating of catheters with antibiotic drugs. While for the intraluminal infection no real solution is available at the present moment.

The Safe Catheter project was able to design and realise a cost-effective device able to create a barrier that avoids migration of the bacteria intraluminally, avoiding the biofilm to reach the bladder and cause infection. The project developed a novel retrofit system device that can be integrated along the external tube connecting the catheter to the urine bag. The principle consists in triggering the photocatalytic TiO_2 film with inexpensive energy UV LEDs powered by small coin batteries.

The main project results achieved during the project were:

1. TiO_2 triggering form with low power UV LEDs and possible upgrades with visible light LEDs;
2. TiO_2 thin film deposition on a plastic substrate, to ensure adhesion of the film;
3. Development of the Safe Catheter system as innovative catheter antibacterial device constituted by the assembly of different components.

These results were achieved successfully with minor deviations from the original activity plan.

The Safe Catheter device was tested and validated in laboratory conditions and showed full compliancy with the previous laboratory tests.



Figure 1 – Safe Catheter Device