

**NASLOV PROJEKTA: Razvoj primernih hitrih metod za ocenjevanje čistosti in higiene v čistih prostorih namenjenih čistilcem objektov, akronim HyClean**

**TRAJANJE: 01.11.2011 do 31.10.2013**

**PARTNERJI:**

1. *Univerza v Mariboru, Fakulteta za zdravstvene vede:*  
Prof. dr. Sonja Šostar Turk  
Doc. dr. Sabina Fijan  
Asist. mag. Urška Rozman  
Doc. dr. Gregor Štiglic  
Prof. dr. Peter Kokol
2. *Obrtno – podjetniška zbornica Slovenije*
3. *SANLAS Holding GmbH, Avstrija*
4. *HRIBAR-BLESK d.o.o. cleaning service, Slovenija*
5. *Commex service group d.o.o., Slovenija*
6. *wfk - Cleaning Technology Institute e.V., Krefeld, Nemčija- koordinator*
7. *FRT – Europäische Forschungsgemeinschaft Reinigungs- und Hygienetechnologie e.V., Nemčija*

**Vsebina projekta**

Sekcija čistilcev v EU zaposluje približno 3.060.000 ljudi. Velik delež čiščenja (~20%) se opravlja v industrijskih obratih, obratih živilske industrije in bolnišnicah, kjer se običajno uporabljajo kontrolirana okolja kot so čiste sobe. Za takšna okolja je treba uvesti posebne ukrepe čistoče in higiene za kontroliranje števila in velikosti delcev ter mikrobiološke in kemijske kontaminacije. Te zahteve so posledica razvoja na področju standardizacije in navodil za čiste sobe. Za ugotavljanje in kontroliranje biološkega bremena takšnih okolij, je razvitih nekaj mikrobioloških metod. Te metode so ponavadi odvisne od različnih identifikacijskih metod, ki se lahko razdelijo na dve skupini: fenotipske, ki se nanašajo na biokemijske lastnosti mikrobnih celic in genotipske, ki so odvisni od lastnosti genetskega materiala celic. Fenotipske identifikacijske metode so počasne, zahtevajo veliko dela in so tudi drage ter kot takšne neprimerne za identifikacijo mikroorganizmov v okolju, kjer je potrebna stalna kontrola. Uporaba genotipskih metod za identifikacijo ima zato prednost, še posebej iz finančnega in časovnega vidika. V tem projektu bomo naprej razvili inovativno DNK mikromrežo osnovano na DNA čipu za identifikacijo mikroorganizmov s polimerazno verižno reakcijo (PCR), kar bo skrajšalo čas mikrobiološke analize površin in zraka v kontroliranih okoljih. To pa bo nadalje znižalo stroške takšnih analiz in jih naredilo s tem dostopne malim in srednje velikim podjetjem v čistilnem sektorju. Poleg kvalitativne določitve vrste mikroorganizmov, je potrebno tudi določiti število mikroorganizmov, da bi ovrednotili biološko breme in higiensko stanje površin in objektov znotraj kontroliranih

okolij. Zato bo nadaljnje delo namenjeno reševanju teh problemov z uvedbo hitre kvantifikacijske metode z ustreznim načinom vzorčenja. Poleg kvantifikacije bo možno tudi razlikovati med živimi in neživimi oz. inaktiviranimi celicami. S tema dvema metodama bo možno takoj po opravljenem delu kontrolirati in dokumentirati metode čiščenja in razkuževanja. Z uvedbo takšnih tehnologij bodo lahko mala in srednje velika podjetja povečala svojo vrednost in nadalje izboljšala pogoje dela ter povečala potrebo po osebju z višjo izobrazbo. Pričakujemo, da bo to pomagalo pri odpravljanju visokega deleža dela s skrajšanim delovnim časom v sektorju in pri stabiliziranju zaposlitve osebja z višjo izobrazbo, kar bo koristno za podjetja in družbo. Cilj projekta je tudi vplivati na povečanje dela čistilnih servisov s pridobivanjem orodij za hitrejšo, cenejšo in zanesljivejšo kontrolo kakovosti industrijskega čiščenja, kar povečuje zaupanje v kakovost opravljenega dela. To pa bi nadalje znižalo stroške pogodbenikov z znižanjem nepotrebnih zaposlitev in ustvarjanjem merljivih in zato bolj predvidljivih pogojev za proizvodnjo. Konzorcij projekta je sestavljen iz dveh združenj: Obrtno-podjetniška zbornica (Slovenija) ter Evropsko združenje za raziskovanje tehnologij čiščenja in higijene - FRT (Nemčija) in dveh raziskovalnih organizacij Univerza v Mariboru, Fakulteta za zdravstvene vede (Slovenija) ter wfk – Raziskovalni inštitut za tehnologijo čiščenja (Nemčija). Koordinator je Obrtno-podjetniška zbornica (Slovenija). Obe združenji predstavljata ustrezna čistilna podjetja. Podporo znanstvenega dela bosti izvedli obe raziskovalni organizaciji pri čemer bo Univerza v Mariboru, Fakulteta za zdravstvene vede (Slovenija) razvila tehnologijo DNK mikromreže za identifikacijo mikroorganizmov in wfk – Raziskovalni inštitut za tehnologijo čiščenja (Nemčija) bo razvil posebno pisalo za vzorčenje in tekočinsko citometrijo za šteje mikrobnih celic. Konzorcij bo tudi ustanovil odbor uporabnikov MSP (mala in srednje velika podjetja), ki bo sledil napredku in pomagal konzorciju pri diseminaciji tehnologije v sektor industrijskega čiščenja.

### **Vključevanje študentov v raziskovalno delo**

V raziskovalno delo za magistrsko nalogo v okviru projekta HyClean je vključena ena študentka podiplomskega študijskega programa Bioinformatika, 2. stopnja.

V okviru evropskega projekta HyClean je Claudia Herrler, dipl. m. s. izvedla raziskavo literature za vmesno poročilo o priporočilih na področju higijene čistih prostorov in površin s strogimi higienskimi zahtevami, kot npr. v prehrambeni industriji, bolnišnicah in farmacevtskih podjetjih. Claudia Herrler je sodelovala v raziskovalnem projektu na Univerzi v Mariboru, Fakulteti za zdravstvene vede od 21. maja do 1. julija 2012. Trenutno je vpisana na magistrskem študiju javnega zdravja na Univerzi za uporabne znanosti v Fuldi, Nemčiji.

---

**PROJECT TITLE: Development of fast methods for the determination of cleanliness and hygiene in cleanrooms, acronym HyClean**

**DURATION: 01.11.2011 do 31.10.2013**

**PROJECT PARTNERS:**

1. *University of Maribor, Faculty of Health Sciences:*  
Prof. dr. Sonja Šostar Turk  
Doc. dr. Sabina Fijan  
Mag. Urška Rozman  
Doc. dr. Gregor Štiglic  
Prof. dr. Peter Kokol
2. *Chamber of Craft and Small Business of Slovenia*
3. *SANLAS Holding GmbH, Avstrija*
4. *HRIBAR-BLESK d.o.o. cleaning service, Slovenia*
5. *Commex service group d.o.o., Slovenia*
6. *wfk - Cleaning Technology Institute e.V., Krefeld, Germany - coordinator*
7. *FRT – Europäische Forschungsgemeinschaft Reinigungs- und Hygienetechnologie e.V., Germany*

**PROJECT PROPOSAL**

Industrial cleaning sector employs approximately 3.060.000 people. A significant portion of the service (~20%) is turned over in industrial sites, food industry sites and hospitals where the use of controlled environments like cleanrooms are commonly used. In these environments over 1 trillion worth of products were produced. These sites are subject to strict cleanliness and hygienic requirements and special measures need to be taken in order to control number and size of particles and microbiological and chemical contamination. In order to assess and control bioburden of such environments several microbiological methods have been developed. The methods usually depend on different identification methods, which can be divided in two groups: phenotypic, that mostly rely on the biochemical properties of microbial cells and genotypic that rely on the properties of cell's genetic material. Phenotypic methods for identification are slow, labour intensive, have low throughput and are expensive. Therefore they are not suited for identification of microorganisms in environments where realtime monitoring is necessary. The use of genotypic methods for identification is preferred particularly because of cost and time saving aspects. One part of the project is set to develop an innovative DNA microarray based on on-chip polymerase chain reaction (PCR) for identification of microorganisms. This will substantially shorten the time of microbiological analysis of surfaces and air in controlled environments. This in turn is predicted to lower the costs of such analysis making them available for SMEs in the industrial cleaning sector. Beside qualification of specific types and species, microorganisms need to be quantified in numbers to evaluate the bioburden and hygienic status of surfaces and objects within specific controlled environments. Therefore a

fast quantification method in combination with an appropriate sampling method will also be developed based on flow cytometer analysis. Furthermore, beside quantification of bioburden it will be possible to distinguish between living and dead or inactivated cells. With these two methods cleaning and disinfection measures can be checked and documented directly after they have been done. Introducing such technology, SMEs could increase the added value and subsequently improve working conditions and demand for people with higher education. We expect that this will help reducing high part time job employments in the sector and provide steady jobs for personnel with higher education thus benefiting the companies and society. However, the project aims also to impact the outsourcing of cleaning services by providing tools for faster, cheaper and more reliable quality control of industrial cleaning thus strengthening the confidence in quality of work performed. This in turn is predicted to lead to a saving of contractor's money, by reducing unnecessary employment, establishing measurable and therefore more predictable environmental conditions for production. The project consortium will consist of two associations: Chamber of Craft and Small Business of Slovenia (CCSBS) and European Cleaning and Hygiene Technology Research Association (FRT) and two research performers: University of Maribor, Faculty of Health Sciences (UM-FHS) and wfk - Cleaning Technology Research Institute (WFK). The coordinator of the project will be the Chamber of Craft and Small Business of Slovenia and both associations represent relevant cleaning enterprises. The support for the scientific work will be realized by involvement of the research performer University of Maribor, Faculty of Health Sciences that will develop a DNA microarray technology for the identification of microorganisms, and wfk - Cleaning Technology Research Institute that will develop a sampling pen and flow cytometry for counting of microbial cells. The consortium will also establish SME users committee (SME UC) that will follow the progress, advise and help the consortium regarding the dissemination of technology through the industrial cleaning sector.

### **Research work**

One student of the Bioinformatics 2<sup>nd</sup> degree Bologna Study programme is conducting research work for her master thesis in the frame of the project HyClean.

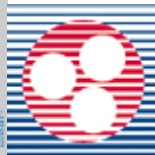
In the frame of the European project HyClean Claudia Herrler, B.Sc. in nursing conducted a literature research for the mid-term report about recommendations in the field of hygiene of cleanrooms and surfaces in environments with strict hygiene requirements, such as food industry, hospitals, or pharmaceutical firms. Claudia Herrler took part in the research project at the University of Maribor, Faculty for Health Sciences from May, 21st to July, 1st 2012. Currently she is enrolled in the Master's degree for Public Health at the University of Applied Sciences in Fulda, Germany.



---

**FRT**

  
**SANLAS HOLDING**



**OBRTNO-PODJETNIŠKA  
ZBORNICA  
SLOVENIJE**



University of Maribor

*Faculty of Health Sciences*



  
**cornetwfk**

The Cleaning Technology Institute