



European Union  
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# Medical antibacterial textiles obtained on a pilot line based on sonochemical process

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## About DAVO STAR IMPEX

**DAVO STAR is a successful family-run enterprise whose main activity is offering integrated services for the clothing industry to world-wide spread companies activating in this specific field..**

**Since the foundation, in 1994, the company has constantly grown and diversified its activity.**



*DAVO headquarters in Bucharest*

- Originally the activity was centered on the production of ready-made clothes, such as jackets, coats, trousers, skirts, blouses, etc..
- In 1998 we built our own factory, with 3 levels and 1800 square meters unfold surface.
- The business grew constantly and we reached in 2002 a total production capacity of approximately 60.000 pieces /month.



- Using the latest technology (AutoCAD Gerber System) we provide our customers with accurate patterns, expert grading, efficient markers and detailed product's specifications.
- Employing our skills on sophisticated CAD tools our experienced pattern makers and technicians can generate, edit and maintain an inventory of patterns for all DAVO customers.





## **Integrated projects funded by the European Union in FP6 and FP7.**

As a proof of its constant interest in everything that is innovative in textile and clothing area, from the state of the art technologies to the multi-disciplinary approach, DAVO obtained in 2010 the certification from the National Authority for Scientific Research and dedicated an important part of its resources to this particular domain.

Because Romania became a member state of the European Union, our company was given the opportunity to participate, along with prestigious universities and research institutes, in collaborative projects funded by the European Commission.



2005-2009

**Multifunctionalized medical textile for wound (e.g. Decubitus) prevention and improved wound healing**



2009-2013

**A pilot line of antibacterial and antifungal medical textiles based on a sonochemical process**

***As a result of our participation to this project, DAVO has a sonochemical pilot machine installed on site.***



## **Functional materials for fast diagnosis of wound infection**

*Project funded by HORIZON 2020 (2013-2017)*



## **IT Production Technology for custom garments**

*Project funded by CROSSTEXNET- ERA.NET (2013-2015)*



CROSSTEXNET

## **PlasmaTex-A new class of antibacterial coatings for textiles and plastics**

*Project funded by M-ERA.NET (2016-2018)*



## Background for the implementation of the GP

- Is known as the **hospital-acquired infections** are a **major financial issue** in the European healthcare system.
- The **financial impact** of these infections counteract medical advances and expensive medical treatments by **increasing the length of hospital stay by at least 8 days** on average per affected patient, hence adding more than **10 million patient days** in hospitals in Europe per year.
- The **statistics on patient safety** in the EU show **alarming tendencies**:
  - **1 in 10 patients** are **affected** by hospital-acquired infections;
  - **3 million deaths** are caused by **hospital-acquired infections** yearly.



## Background for the implementation of the GP

Since **textiles** are a common material in healthcare facilities, it is important that they **do not transfer pathogens to patients or hospital workers**.

**Medical textiles** include: bed sheets, blankets, towels, personal clothing, patient apparel, uniforms, gowns, and drapes for surgical procedures.

The growing **need for antibacterial textiles** has resulted in revolutionary progress in the textile industry.



The 7th EU Framework **SONO project** in which DAVO worked as partner, directly addresses the above problems, by developing a **pilot line for the production of medical antibacterial textiles**.

## Aim the project

The **main objective**: to build a **pilot line based on a sonochemical reactor** to produce **biocidal textiles by impregnating antibacterial nanoparticles** (e.g. MgO and ZnO) on the fabrics.

The proposed **pilot is based on modeling of sonochemical reactors.**

The **process is metrologically and safety controlled.**

## Stakeholders involved

- Manufacturers of the sonochemical reactors/ ultrasonic industrial devices;
- Manufacturers of the antibacterial textiles/ medical textiles;
- End-users of the antibacterial textiles /medical textiles;
- Scientific institutions as a users of the new knowledge.

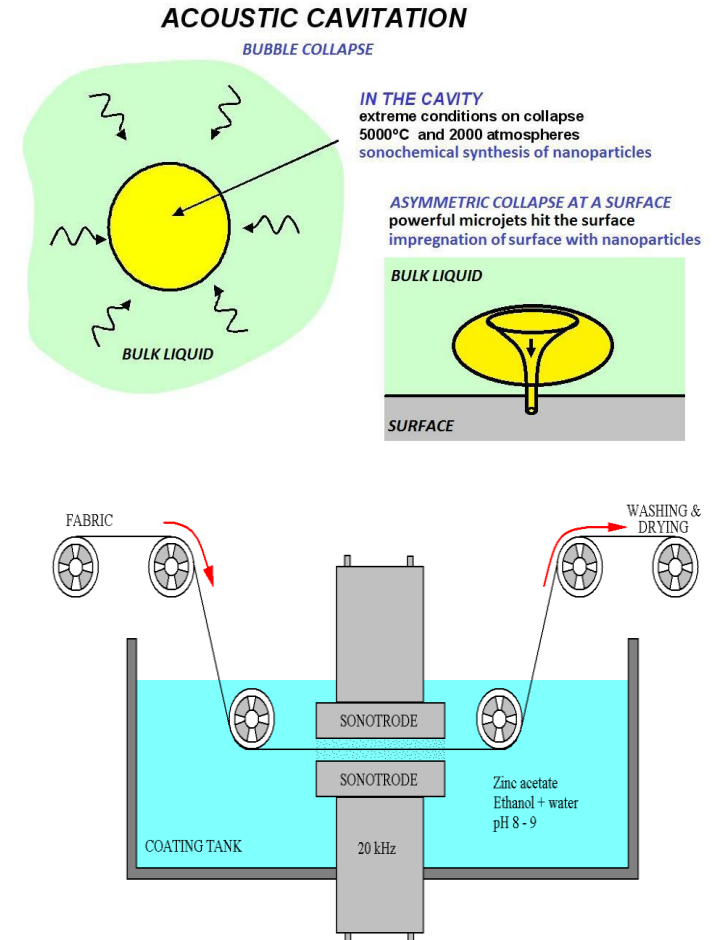
# Detailed content and working of the Good Practice

The **sonochemical technique** is a **single step process** in which ultrasound causes both:

- the **formation of metal oxide nanoparticles**, (CuO, ZnO)
- and **simultaneously impregnates** these nanoparticles in the textile fibres.

During the project, **two pilot scale coating machines** have been built.

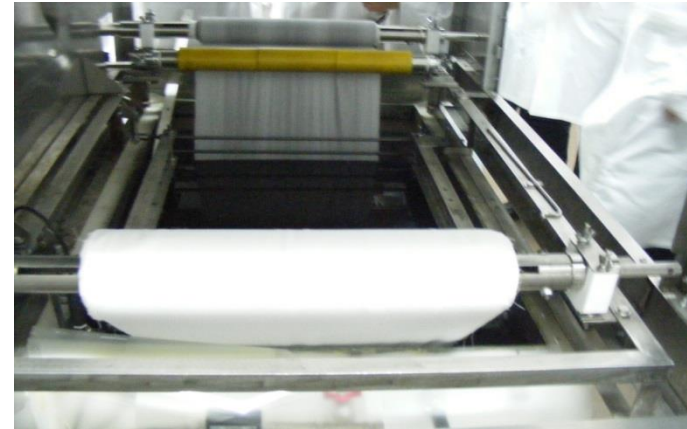
- One machine, based on **piezoelectric transducers**, has been manufactured by Cedrat (France), and installed at a textile company in Italy (Klopman International Ltd).
- Another machine, **based on magnetostrictive transducers**, has been manufactured by Viatech (Russia), and installed at **DAVO Star Impex SRL**, in Romania.



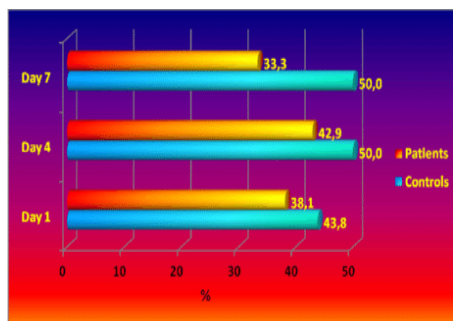
*Schematic of the sonochemical system used for the coating of fabrics with antibacterial MO NPs*

# Description of the GP

- For the hospital experiments, large quantities of **ZnO - coated cotton fabrics** were prepared by utilizing the **sonochemical roll-to-roll pilot installation**.
- The **coating** was done in a **continuous mode** by **adding a compensation solution** every 10 min.
- The results indicate that the fibers are coated with a **constant amount of ZnO** (~0.3%wt).
- The obtained textiles were **characterized** in terms of **coating morphology, structure and stability to washing**.
- The **antibacterial efficiency** of the sonochemically coated textiles was **validated** in a **hospital environment** by a reduction in the occurrence of nosocomial infections



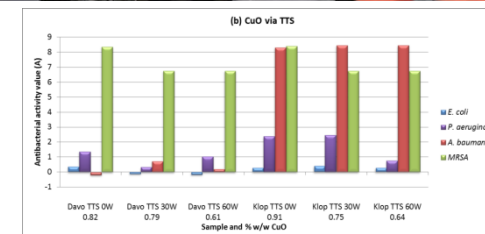
*Pilot line installed at DAVO*



*Nose S.aureus rate dynamics during study*



*Dress gown made from ZnO- coated fabric*



## Success factors of GP

- A novel pilot line based on a one step sonochemical process to produce and impregnate antibacterial nanoparticles on textiles;
- Development of innovative products (medical antibacterial textiles);
- Development of a process environmentally friendly and with economic efficiency;
- Open-up new market for antibacterial textiles.



## Difficulties encountered and lessons learnt from the practice

- One of the major difficulties was the manufacturing of the medical textiles (bed sheets and dress gowns) from ZnO coated fabrics for the hospital trials at EMI in Bulgaria because the pilot line width is 50cm.
- The products were made in DAVO's facility using high performance equipment and the solution for this issue was using the 50 cm wide fabric in a special machine to make a hidden stitch and thus increase the width of the material to 150 cm.
- The project proposed a good solution of the problem on the pilot scale. For implementation in industrial scale the transducers must reach 1.5 m width. A solution is to develop new Modular Ultrasonic Transducers (MUT). Several MUT can be aligned to cover large widths keeping high power and good homogeneity.

## Impact on “Sustainable chemistry, including reduction of chemical”

- **Lower product cost**

Ultrasound reaction – a low cost process and antibacterial agents - Zn or Mg oxides versus silver for existing products;



- **Low fibres damage** due to the fast process and treatment of final textile versus fibre treatment used in some of the products today;

- **Environmentally friendly**

- ✓ The process is based on water solution and there is no leaching of the nanoparticles to the environment;

- ✓ Zn and Mg are not toxic metals and low amounts of Zn/Mg will be required for the final product due to the efficiency of the ultrasonic dispersion;



- **Short production time**

The sonochemical impregnation is an one step process, in which the nanoparticles are simultaneously created in solution and applied onto the fabric surface, at such a high speed, that they either form chemical bonds with the textile substrate, or physically embedded in the fabric, in cases where no functional groups are available in the fibre.

## Remarks on the durability of the GP results and impacts

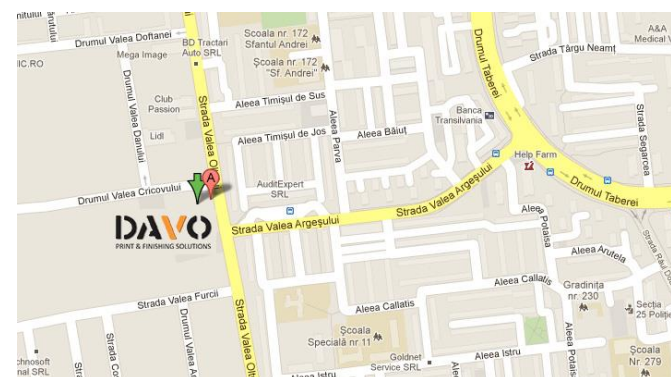
- Hospitals routinely use huge amounts of textiles. Compared to other methods for producing antimicrobial fabrics the **sonochemical coating technology** has the **potential to be competitive** on both economic and environmental terms.
- **Synthesis of the antibacterial nanoparticles** and their **impregnation into the fabrics** is accomplished in a **single step process**, using **low cost precursors**, and **without the use of toxic chemicals**.
- The **SONO antibacterial textiles** can not only be **commercialized** in hospital field, but also **everywhere where antibacterial and antifungal products are needed** (aged people, children, people with low defense, military purposes, emergency equipment, etc.).

## Good Practice value added at regional and transregional (EU) levels

- **Advanced processes** and **novel industrial concepts and methodologies** for medical antibacterial textiles;
- The **new concepts of production** and their implementation that could have an important and durable **impact on economy and employment** if the products are commercialized;
- **Contributes directly** to the **quality of the European** citizen by reducing nosocomial infections;
- **Create new high skill employments** and industries related to personalized services;
- **Reduced costs** related to the **treatment of infectious diseases** acquired during hospitalization.

## GP Contact

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# RESET

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# Thank you!

Questions welcome



*Project smedia*