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A NEW 3M-LONG ULTRASONIC REACTOR A PILOT LINE OF ANTIBACTERIAL AND ANTIFUNGAL MEDICAL TEXTILES BASED ON A SONOCHEMICAL PROCESS

PROJECT OBJECTIVE

Hospital-acquired (nosocomial) 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. An active infection control program of patients and personnel and hygiene measures, have proven to significantly reduce both the number of infections and the hospitalization costs.

The SONO project coordinated by Prof. Aharon Gedanken , Bar-Ilan University directly addresses the above problems by developing a pilot line for the production of medical antibacterial textiles. During the project a pilot line has been developed for the production of medical antibacterial textiles (Fig 1). The pilot line is based on the scale-up of a test bench developed and patented by BIU laboratories. The process uses a sonochemical technique to produce and deposit inorganic, antimicrobial nanoparticles on medical textiles, e.g. hospital sheets, medical coats and bandages. Sonicators are used industrially for light and heavy duty cleaning, for water disinfection and for sewage treatment. The concept has already been proven (and patented) on a lab scale where sonochemistry was applied to impregnate nanoparticles in a single-step process.

Fig. 1: Fig1: Experimental pilot line for 500 mm textile width

CEDRAT TECHNOLOGIES CONTRIBUTION

For this project Cedrat Technologies is in charge of the Sonicator development (Fig 1), which includes several transducers (Fig 2). To perform such development, Cedrat Technologies will use:

- The knowledge on electro acoustic modeling and lab capabilities in the field of innovative sonic or ultrasonic transducers
- The experience in their applications in new processes deriving from ultrasonic cleaning, mixing, homogenizing and ultrasonic reactors.

An industrialization of the process is last part of the project. Its aim is to scale-up the pilot line in order to be able to use a sonochemical impregnation process for a wilder range of textiles. Therefore, an optimal transducer dedicated to a textile coating application has been designed and developed to deal with a 3 meter textile width. At the beginning of the project, a conventional tubular ultrasonic

Fig. 2: Prototype of classic tubular ultrasonic transducer

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transducer was designed in order to gather knowledge about the technology. The aim was to know the advantage and the inconvenient of solutions checked in the state of the art. Several prototypes based on the existent technology have been designed, optimized by simulation. Interesting results have been obtained by tests with the prototypes and these fit with the performed simulations.

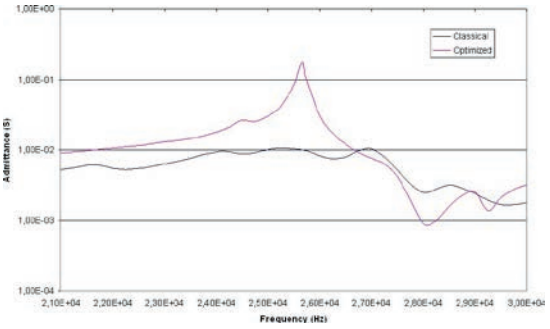

Fig. 3: Admittance in function of frequency in water for classical and optimized design of transducer.

OPTIMIZED TRANSDUCERS RESULTS

The feedback from the simulation and the experiments gave a better understanding of the transducer issues in the particular case of particle deposit. Showing that, this mature technology isn't compatible with a large deposit surface (and is limited to a 1 or 2 meters width max) and doesn't produce a very uniform deposit. Even if the second issue can be solved by multiplying and staggering the transducers, the first issue can't be solved with this design.

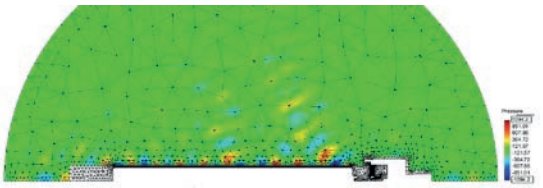

Fig. 4: The pressure level generated within the water in classic transducer design of transducer (based on simulation results)

Therefore, Cedrat Technologies decided to optimize the design of the transducer (Fig 3 and Fig 4) in order to get modularity and extend the deposit surface width to at least 3 meters (Fig 5). A side effect on this optimized design is the more uniform deposit of particle even without staggering the transducers.

MODULAR ULTRASONIC TRANSDUCER (MUST) BY CTEC

Cedrat Technologies used its knowledge and expertise on ultrasound (US) transducer technology to develop a new kind of transducer so called the Modular Ultrasonic Transducer MUST (Fig6) which is now available as a standard product. To know more about its performances please refer to the dedicated technological datasheet.

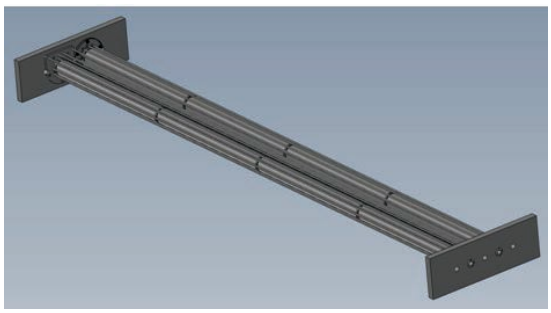

Fig. 5: Suggestion of disposition of two 3-meters long transducers with conveying rolls

	UNIT	CLASSICAL US	MUST
Acoustic Power (for 0.5m of tube)	W	3 070	3 110
Electroacoustic conversion factor	%	23	42

Table 1: Comparison table of Power performance between the classical transducer and the MUST (based on simulation results)

Fig. 6: Modular Ultrasonic Transducer (MUST)