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ACRONYM	**PLASMALEATHER**	
TITLE COLD PLASMA TREATMENT FOR NEW, HIGH-QUALITY WATER REPELLENT LEATHERS: AN INNOVATIVE, ECO-FRIENDLY TECHNOLOGY TO ENHANCE THE PRODUCT PERFORMANCES AND THE COMPETITIVENESS OF THE EUROPEAN TANNERIES		
Project Nº: **R+D Program / Type:**	CRAF – 1999 - 71226 Competitive and sustainable growth	
Starting Date: 1 August 2002	**Final Date:** 30 November 2004	**Duration:** 28 MONTHS
Prime Proposer: Sicerp S.P.A	**Coordinator:** SICERP S.P.A	
RTD's Performers: - Università degli studi di Milano –Dipartimento di fisica (UNIMI B1) - Mori Meccanica S.R.L. - Conciariacerca Italia S.R.L. - AIICA - ELKEDE	**Other Partners:** - ANTIBA S.P.A. - GB Leathers S.P.A. - Conceria Leonica S.P.A. - Hijos de José Bassols S.A. - M.C. Clols S.A. - Alexiadoy Efrosini - Paschalidis Georgios - E. Kamalakidis – A. Peladis - I. Tsilas – N. Giakoymidis & Co. O.E.	

OBJECTIVES:

The research work is designed to develop, test and optimise on a pilot scale an innovative, versatilr, environment-friendly and chemical-free hydrophobising system based on the use of cold plasma technology.

A successful outcome would lead to the development of a new cold plasma water repellent treatment of leathers with the following results:

- the production of new types of improved quality water and oil repellent leatehers, namely:
  - a wider range of types of types of water – oil repellent and resistant to water spot leathers offered to customers thanks to the possibility of applying a unique and versatile treatment to all types of leathers, all types of final destinations and tanning processes involved.
  - an improvement in the quality of currently produced finished leathers, thanks to the possibility to give a lasting water repellency and resistance to water spot without affecting the technical and organoleptic properties also in the case of very high quality leathers (e.g. aniline leathers);

  It is foreseen that the achievement of these obejctives will lead to the increase of tanneries' market share with a consequent 10-20 % increase in their turnover.
- the elimination of the consumption of traditional chemical products for superficial hydrophobisation treatment, so achieving:
  - a substantial reduction of production costs associated with water repellent leathers,
  -the complete elimination of the air pollution currently assiciated with this type of superficial treatment;
- the improvement of working conditions thanks to the substitution of the old water repellent treatment based on the use of a large variety of water and stain repellent agents with a safer chemical-free technology.
- The improvement of the image of the tanning industry and of professional qualification of workers thanks to the use of a new high-tech production system and to the introduction in the market of a new leather product characterised at the same time by high "naturalness" and high performance.

The above-mentioned objectives will be achieved through the design and realisation of a machinery at industrial scale based on the experimental technology.

DESCRIPTION of the WORK:

The technical agenda includes an initial phase of "state-of-the-art analysis" (task 1) aiming at the definition of:

- the hydrophobic performances, and related properties, of currently produced leathers (task 1.1),
- the environmental performance obtained with the traditional superficial hydrophobisation techniques (task 1.2),
- the technical-economic aspects of the production process for water repellent leathers (task 1.3).

This initial work is essential both for identifiying the customers' requirements the leathers treated with the new technology should meet and for specifiying the specific needs and problems each SME must overcome. Since the tanning productive cycle is characterised by a variety of workings, the commercial leathers (and related production processes) tested at this stage of the research and then subjected to the plasma treatment will be representative as much as possible of different types of hides (bovine, sheepskins, goatskins, pigskins, calfskins), different types of tannages (chrome, organic,semi-metallic tannages), different market destinations (footwear, apparel, leather goods, upholstery).

The data obtained in the first task will be the starting point as well as the point of reference during the "laboratory scale prototype" optimisation study (task 2), aiming at defining the optimal operational treatment parameters for the different types of substratesto obtain high quality water repellent leathers. In particular, since the entire plasma process can be subdivided in two main phases, the evacuation phase and the plasma treatment phase, the optimisation study will be specifically carried out for each of them, as described hereafter:

- Initially, using the equipment currently at the University's disposal, it will be performed the "vacuum and outgassing characterisation" (evacuation phase) (task 2.1) in order to define the behaviour of leathers in the required high vacuum conditions. This means that the outgassing time and the residual pressure will be recorded for each type of leather, the volatile substance outgassed will be analysed, any possible surface leather changes will be assessed. This study will allow to identifiy, for each type of leather, reference values for the parameters conditioning the subsequent plasma treatment and to define the vacuum system dimensional parameters for the industrial scale prototype.

The results of this task will permit to perform an important preliminary assessment about the efficacy of the evacuation phase, with respect to the range of possible applications.

- If the check will be positive, soon after the end of the firts phase characterisation, the operational process parameters of the plasma treatment phase will be optimised (task 2.2). For this purposed the existing lab-scale prototype will be adapted to the treatment of leathers through the modification of some technical parts used for textiles. After each experimental trial the leather samples giving positive results for their water drop resistance will be subjected to the quality control study. Experimental trials will be carried out also for the definition of the operational parameters for oleorepellency

The "design and construction of the extended scale prototype" (task 3) will start as soon as the vacuum and outgassing characterisation (task 2.1) will be over, an will continue by using both the productivity data obtained from the technical – economical survey in task 1 and results of task 2.2. At the end of this task, the new prototype will be tested without leathers in order to characterise the plasma parameters and optimise the main operational factors affected by the scale up.

Before proceeding to test the prototype at semi-industrial scale, it will be necessary that each tannery prepares the optimal substrates, through the "adoption of the recommended proces on-site". Using the list of recommendations produced within task 2 for the efficient use of the new technology, each tannery will therefore optimise its own leather making process, through a series of trials. The leathers resulting from this trials will be subjected to a quality control study (for their compliance with the specific product quality values, (as defined in task 1) and subsequently to the plasma treatment with the laboratory equipment, to validate the effectiveness of the on-site preparation trials.

The optimal substrates will then be used for the "prototype system testing and validation" on a piilot

basis (task 5), so assessing the quality performances of the new water repellent leathers for their compliance to SME's specifications and quality standards. During the testing of the prototype the technical staff of the tanneries will be trained for the proper functioning and maintenance of the new equipment.

In parallel, the "productive, environmental and economic impact" (task 6) of the insertion and integration of the new machinery in the leather making process will be studied and assessed, in the various possible productive configurations of participating tanneries. The main scope of the productive assessment will be to guarantee the treatment of the greatest number of leathers in the respect of the production time and consistently with the available space. Furthermore, the survey will monitor and assess the environmental effectiveness of the technology (mainly air emissions and energy consumption) and will allow to better quantify the added value the new technology cna give to the product.

Each SME will carry out all the necessary activities regarding data collection, hides processing, experimental trials, technical assessment as needed in the different phases of the project. RTD performers will have scientific and technical tasks according to their highly specialised skills and experiences. The University of Milan will be responsible for the modification of the existing lab-scale prototype, will design and realise the plasma source for the industrial-scale prototype and will carry out all the microscopical analysis of leathers. MORI, together with the University of Milan, will be responsible for the development of the industrial scale prototype, based on the results obtained during the optimisation study at small scale, focusinf in particular on the vacuum system. The tanning industry Research Centres of Italy, Greece and Spain (CONCIARICERCA, ELKEDE and AIICA), in addition to the assistance to the SMEs of their respective countries in every activities and to the performance of the related laboratory analysis (leathers, emissions), will be responsible for preparing tools, inventories and technical reports, by collecting the various results, for use by all the other partners.