European Cooperation in the field of Scientific and Technical Research – COST -

Secretariat

Brussels, 29 June 2004

COST 298/04

DRAFT MEMORANDUM OF UNDERSTANDING

Subject :	Draft Memorandum of Understanding for the implementation of a European concerted research Action designated as COST E46 "Improvements in the Understanding and Use of De-Inking Technology"

Attached is the abovementioned Memorandum of Understanding.

DRAFT

MEMORANDUM OF UNDERSTANDING

FOR THE IMPLEMENTATION OF A EUROPEAN CONCERTED RESEARCH ACTION

DESIGNATED AS

"IMPROVEMENTS IN THE UNDERSTANDING AND USE OF DE-INKING TECHNOLOGY"

The Signatories to this Memorandum of Understanding, declaring their common intention to participate in the concerted Action referred to above and described in the Technical Annex to the Memorandum, have reached the following understanding:

1. The Action will be carried out in accordance with the provisions of document COST 400/01 "Rules and Procedures for Implementing COST Actions", the contents of which the Signatories are fully aware of.

2. The main objective of the Action is to improve the efficiency and effectiveness of de-inking technology in line with the introduction and use of new printing methods and vehicles, increased customer expectations and environmental considerations.

3. The economic dimension of the activities carried out under the Action has been estimated, on the basis of information available during the planning of the Action, at Euro 18.7 million in 2003 prices.

4. The Memorandum of Understanding will take effect on being signed by at least five Signatories.

5. The Memorandum of Understanding will remain in force for a period of four years, calculated from the date of first meeting of the Management Committee, unless the duration of the Action is modified according to the provisions of Chapter 6 of the document referred to in Point 1 above.

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COST E46
"IMPROVEMENTS IN THE UNDERSTANDING AND USE OF DE-INKING TECHNOLOGY"

A. BACKGROUND

De-inked pulp has become a principal raw material source for many European and global papermaking operations. For example, in the newsprint sector 7.4M tonnes of recovered paper (17.1% of all recovered paper) were used by CEPI countries in 2002, much of which was de-inked. Many newsprint and tissues grades commonly contain 100% de-inked pulp and in many others it makes up a substantial proportion of the furnish. Other grades, for example, lightweight coated for offset, printing and writing grade for office and home use, now commonly contain de-inked pulp.

De-inking systems have continued to develop and are based on either wash de-inking or flotation de-inking. Flotation de-inking has become the major process and is carried out in numerous types of flotation systems, which consist essentially of multiple cells and injectors interconnected by pumps and pipes. The technology used is borrowed from the mineral processing industry of the 1960s. At the very basic level, the flotation process involves the passing of air bubbles through the wastepaper stock, which is in a liquid/slurry form. Ink particles that attach to the air bubbles rise to the surface of the slurry for removal.

Superficially the flotation de-inking process seems very simple but in reality the de-inking process is not well understood. It is an extremely complicated process to analyse and model. Many processes occur simultaneously during flotation where chemical, physical and hydrodynamic aspects are involved. The process is then further complicated by the variability of the recovered papers. These are printed using a range of processes, (offset coldset, heat set offset, sheet fed offset, solvent or water-based rotogravure, solvent or water-based flexo, xerography, inkjet, other digital based processes, etc.), on to a range of paper substrates, (coated, uncoated, mechanical, woodfree, calendered, surface treated), which enter the recycling loop with different degrees of ageing and pre-history.

Whilst the de-inking process has been found to provide a satisfactory means of de-inking the vast majority of printed output, there have been a number of notable print/ink systems that are increasingly causing problems and concerns to de-inking operations. These include, for example:

Flexo

The de-inking of flexo printed papers has been the subject of much research. Modifications and adaptations of conventional de-inking processes have been proposed which have enabled small proportions of flexo based material to be tolerated. Further, ink manufacturers have addressed the issue by seeking to formulate new inks which have at least some improved de-inkability for newsprint and other applications.

Digital print

As digital printing technologies increase and the printed output by such methods increase, more of this material will end up in recovered paper collections. The de-inkability of such printed material could threaten the efficiency of current systems. It has already been shown that material printed using water based, pigment based ink-jet inks, as commonly found in a range of well known office and home based printers, is not de-inkable. Worse still, researchers have shown that the presence of around 10% amongst other recovered papers will ruin the de-inkability of the whole material.

With the increases in:

- Reliance on de-inked pulp as a raw material;
- The continued development of new printing engines and print vehicles – inks, toners etc.
- Demands for reduced waste arisings from processes
- Customer and end use expectations

The necessity for effective and efficient de-inking is more paramount than ever.

In particular, there is need to better understand the fundamentals of the de-inking process, so that de-inking operations can be better developed and optimised. This will enable paper mills to deal with the changing nature of incoming material, or will permit the engineering of inks and printing techniques that minimise de-inking problems and maximise the efficiency of de-inking technology.

B. OBJECTIVES AND BENEFITS

The main objective of the Action is to improve the efficiency and effectiveness of de-inking technology in line with the introduction and use of new printing methods and vehicles, increased customer expectations and environmental considerations.

The specific objectives are:

- To develop a better understanding of the mechanisms involved in de-inking
- To better understand the fundamental knowledge on flotation process variables
- To propose methods for the improvements in de-inkability of difficult to de-ink inks and toners
- To monitor and assess printing technology, ink and toner developments and market requirements for printed papers and their potential impact on de-inking efficiency and de-inkability
- To create a platform for interaction between European scientists and technologists for the transfer of knowledge and expertise

The expected benefits to the European pulp and paper industry will be:

- Improvements in quality and uniformity of de-ink pulp
- More efficient and effective de-inking operations
- Improvements in environmental credentials
- Development of cost effective solutions for difficult to de-ink inks and toners

Research results will be exchanged by participants of European research organisations, universities and others who are actively working in the specific field of de-inking technology and combining this European knowledge with those working in the fields of chemistry, physics and hydrodynamics that have a bearing on the process technology. It is expected that such a programme will be multidisciplinary in nature as well as providing a platform for developing cross-sectorial opportunities.

Dissemination of the output from the Action will take place by workshops, seminars/conferences and publications.

C. SCIENTIFIC PROGRAMME

The programme envisaged will set out to address specific objectives.

Objective 1: Development of a better understanding of the mechanisms involved

Objective 2: Developments of methods to improve the de-inkability of difficult to de-ink inks and toners

Objective 3: Assessment of developments in printing technology, ink and toner and their potential impact on de-inking efficiency and the opportunity for the development of de-inking friendly inks or printing techniques

The output from each of these specific studies would be combined to develop effective protocols to handle the changing nature of incoming recovered papers and to provide improvements in the overall efficiency of de-inking operations.

The de-inking process has evolved over many years to provide a means of ink removal from recovered paper. It involves a number of process stages that assist in the overall production process. There is some inherent flexibility in the process that enables the tailoring and optimisation of systems to deal with variability of incoming material.

Key to the de-inking process is the ability to detach the ink from the fibres. This is achieved by a combination of mechanical action and chemical means. Mechanical action is provided in a pulper at high pulp consistencies but can also be achieved later in a disperger or kneading stages. The chemicals used for detachment are different surfactants, sodium silicate and sodium hydroxide.

Flotation is a selective process of separating particles from a slurry involving hydrodynamic, physical and chemical (physico-chemical) aspects. The major steps in the flotation process, as applied to de-inking are: aeration, mixing/collection and separation. The physico-chemical interactions drive ink collection and aggregation with the air bubbles. The hydrodynamic aspects direct ink particle and air bubble collision and ink removal.

The flotation process can be influenced by the variance of physical, chemical and hydrodynamic factors. Physical variables include ink particle size and density, slurry stock concentration and temperature. Chemical variables include water quality, slurry pH and surface tension values governed by flotation chemical agents such as frothers and collectors. Hydrodynamic factors include the flow patterns of air bubbles and the slurry in the flotation cell. All three factors can be manipulated according to the end use requirements, flotation cell design, de-inking chemical selection and overall recycle system set-up.

The scientific programme will seek to provide a better understanding of the different mechanisms occurring at various stages throughout the process. Such knowledge will be invaluable in developing systems to handle a continuously changing raw material.

Improved knowledge of ink/toner detachment and redeposition mechanisms will enable methods to be developed to improve the de-inkability of those inks and toners known to be difficult to de-ink. However such methods will require continuous updating in line with technological developments occurring in printing methods and the main print vehicles i.e. inks and toners.

The alternative approach to developing and refining current de-inking technology would be to develop de-inking friendly inks or printing techniques that would simplify the de-inking process. Such an approach would require active input and involvement of ink manufacturers and printing machinery manufacturers. However, such a holistic approach, although longer term in nature, may be the best route forward for effective de-inking, both in technological and economic terms.

D. ORGANISATION

A Management Committee (MC), including elected Chair, Working Group (WG) co-ordinators and representatives appointed by the Signatories of the MoU will lead the Action. The MC will work out its rule of operation at its first formal meeting in accordance with the existing COST regulations. The MC will meet twice a year to review progress.

The following Working Groups are proposed:

WG 1: Mechanistic studies
WG 2: De-inking studies
WG 3: Assessment of printing technology and developments
WG 4: New approaches to de-inking –to include: improved and novel de-inking technology and the design of de-inking friendly printed products

Note WG 4 will be developed from the outputs of WG1-3 and will include personnel from these WGs (1-3). It is anticipated that WG 4 would start at the beginning of Year 3.

All working groups will elect a Leader who will assist the Chair and Vice Chair in ensuring that the work is of a high standard. The meeting frequency of the working groups will be 1-2 times per year, as decided in the WG's. Wherever possible, the MC, WG and other meetings associated with COST will be held at the same time and venue.

In addition to the separate WG meetings, seminars will be organised once per year. These will be joint meetings with all WGs to ensure discussion between the WGs.

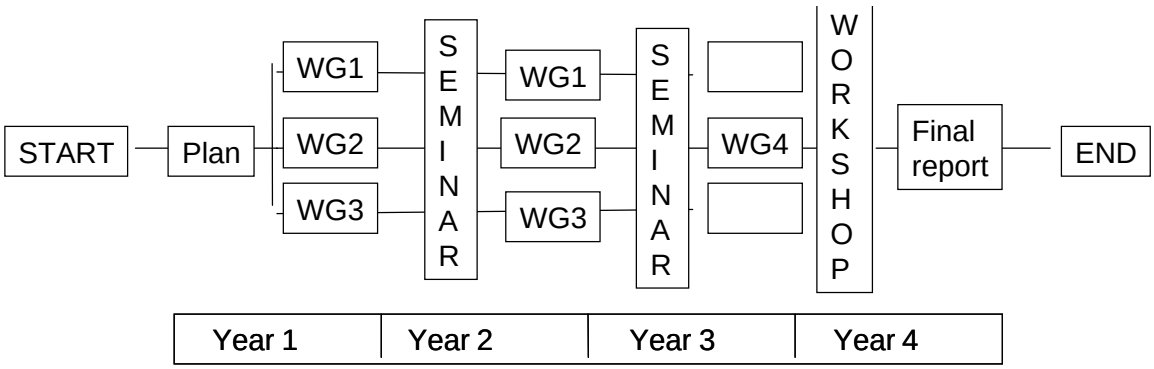
The Action will encourage the exchange of scientists between the participating research laboratories through short-term scientific missions.

The COST activity will be carried out in co-operation with existing national and international research programmes related to recycling and papermaking. Scientists from related fields (engineering; ink and toner formulation; material science) are encouraged to take part in the Action in order to provide input of new ideas. The form of co-operation will be exchange of information.

A website for the Action will be created and maintained to enhance the communication within the Action, inform the external scientific community and disseminate the results.

E. TIMETABLE

The Action will run over a period of four years. Meetings and seminars in the working groups will be held according to the plan below. The seminars will be common for the three working groups. The MC meetings and the seminars will be held at the same time.



F. ECONOMIC DIMENSION

The following COST countries have actively participated in the preparation of the Action or otherwise indicated their interest: France, Germany, Hungary, Italy, Latvia, Slovenia, Spain, The Netherlands, Sweden, UK.

On the basis of the national estimates provided by the representatives of these countries, the economic dimension of the activities to be carried out under the Action has been estimated, in 2003 prices, at roughly Euro 18.7 million.

This estimate is valid under the assumption that all the countries mentioned above but no other countries will participate in the Action. Any departure from this will change the total costs accordingly.

G. DISSEMINATION PLAN

The management committee will organise annual seminars (general or thematic). These will form part of the planning process at the start of the Action for each of the working groups. Dissemination of research findings at other international conferences will also be encouraged. The Management Committee (or a nominated Dissemination Group) will at the early phase of the Action plan activities for publication and exploitation. Results of research carried out by the working groups will, where appropriate, be submitted to international scientific journals and reviews.

In addition to conventional scientific articles in professional journals, results of the Action will also be disseminated through the Internet. A Website of the Action will be established after the start of the activity. Each participant is expected to provide relevant information to construct a network of www-pages relating to the project. Summaries of the working group meetings and annual seminars will be presented on the web pages.

The management group will also maintain an active contact with the COST Forestry and Forest Products Technical Committee by:

- Attendance of the chair or his/her representative at the meetings of the Sector Group on Pulp and Paper
- An annual report through the Sector Group on Pulp and Paper
- Contribution to the COST Forestry and Forest Products Technical Committee Activity report

Co-operation between this COST Action and other relevant Actions will be ensured. Exchange of scientists and joint experimentation will be facilitated within the Action by Short Term Scientific Missions and at least five missions are planned for each year.

Companies expected to be interested are paper manufacturers, chemical suppliers, machinery manufacturers, ink and toner manufacturers and de-inking equipment suppliers at the start of the Action, the MC will ensure the distribution of information by collecting an updated mailing list of companies potentially interested in participation in the Action.