



# CRAFT WEST PROJECT

CONTENTO TRADE SRL  
Technological innovation for the environment

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Wood valorisation through starch impregnation and DIC technology



## BRIEF DESCRIPTION:

### Partners:

Contento Trade srl, Campofornido, Italy  
Gradient, BP 529, Centre de Reserche, Compiègne, France  
Divergent, Centre de Transfert Université Industrie, Compiègne, France  
Centro Resturi Gallo, Fuorni (Salerno), Italy  
Neu Sechage Industriel sa, Marcq-en-Barouel, France  
All System srl, Salerno, Italy  
Ecoplan srl, Udine, Italy  
Terminal Bois Nord 19 Sarl, Egletons, France

## OBJECTIVES:

The project objectives are:

- ✓ Developing a recently patented process for the consolidation of the archaeological and fresh wood;
- ✓ Optimization of the results obtained in the feasibility study and produce:
  - archaeological wood having:
    - a resistance that guarantee structural stability, durability and aesthetic characteristics similar to the fresh wood,
    - resistance to bacteria and fungi aggression,
    - easily impregnating properties
  - fresh wood with an improved mechanical resistance, reduced porosity, better stability to hygrometric variations, easily trimmed, useful for the production of elements for external and internal use;
- ✓ realization of two pilot plants, one concerning the DIC plant, specifically adapted to the wood treatment, the other one concerning the wood impregnation with starch to test the whole process on waterlogged or fresh wood products of representative dimensions ( up to 80 mm concerning the fresh and up to 100 mm concerning the waterlogged wood);



- ✓ developing a new process useful for the restoration of quite big archaeological pieces of wood (boats) actually not treatable with the best processes actually on the market (PEG + freeze drying );
- ✓ creating a totally ecological process for the wood restoration: this technique, in fact, doesn't include any chemical nor toxic elements;
- ✓ improving the second quality wood characteristics to increase its stability and its possible applications;
- ✓ developing a quite economic and ecological technology to ameliorate the fresh wood characteristics, to make it bio-compatible for the furniture market and the interior design thanks to its good quality and low cost.

The verifiable objectives of the project are the following:

- a) archaeological wood: the consolidation treatments developed for each kind of tested wood should allow to reach the following properties:
  - ✓ resistance to compression and traction not inferior to 25% of the not treated seasoned wood one;
  - ✓ resistance to bacteria attacks similar to the not treated seasoned wood one;
  - ✓ external aspect similar to the not treated seasoned wood one (excluded the color);
  - ✓ dimensional stability to the hygrometric variation similar to the not treated seasoned wood one.
- b) fresh wood: the treatment developed for each kind of wood should allow the comparison of the following parameters:
  - ✓ resistance to compression and traction not inferior to 25% of the not treated seasoned wood one
  - ✓ resistance to bacteria attacks similar to the not treated seasoned wood one;
  - ✓ dimensional stability to the hygrometric variation inferior to the 50% of the not treated seasoned wood one.



## STATE OF THE ART

### Waterlogged wood

The waterlogged wood sector is increasing its importance in the archaeological world; there are in fact many remarkable finds both in the sea and in lakes or lagoons that still wait to be recovered. Actually the **technologies at disposition** are the following:

- ✓ simple impregnation with Polyethylene Glycol resins (PEG)
- ✓ impregnation with Polyethylene Glycol resins coupled with freeze drying systems;
- ✓ impregnation with polymerizable resins through microwave or other wave systems;
- ✓ simple freeze drying;
- ✓ impregnation in fluids in supercritical conditions; this treatment is very expensive and applicable to small pieces of wood;
- ✓ impregnation with resins and soluble substances (sugar, chromium) for low value wood objects

The feasibility study we carried out during the Exploratory phase showed that using the new developed process it's possible to obtain an acceptable consolidation level in medium-deteriorated wood, and at the end of the treatment they have an aspect similar to the fresh wood one, except for the color that is connected to the irreversible oxidation process.

Compared with the best technologies actually on the market, the one we developed have the **following improvements**, keeping almost analogous physical-chemical characteristics:

- ✓ lower costs
- ✓ total reversibility
- ✓ a natural aspect
- ✓ possibility to treat big size elements
- ✓ treatment rapidity (ten times quicker than the PEG +freeze drying technique).

The main innovation of this process is the gelatinized process to bind chemically a great part of the water initially present in the waterlogged wood and obtain a gelatinized product stable to hygrometric variations, resistant to bacteria attack and without shrinkage during hardening, through the combined action of the DIC desiccation process and some additives.



This section of the project is based on the results of the Exploratory Phase and will be developed alongside a Raffaello project, called Raffaello Arké n. 96/A/I/4, aiming at the diffusion of this new technique in Europe and at the comparison of the developed consolidation process with the results obtained with the PEG technique.

### Fresh wood

There are many desiccation techniques on the market specifically adapted to the thickness and the future use of the wood to be treated. Some are listed here:

- ✓ concerning the veneer cut wood: steam desiccation, vacuum desiccation, etc.
- ✓ concerning the sheared wood (up to 4 mm): desiccation by forced ventilation, steam desiccation, vacuum desiccation, oil bath desiccation, etc
- ✓ concerning the sawed wood (above 4 mm), natural desiccation with forced ventilation, etc.

In any case, if the wood is used outdoors, the impregnation techniques are used to improve their resistance to the meteoric agents through high pressure system and alchidic resins, creosotes and other impregnating agents combined or not with anti fungi and anti bacteria products.

These techniques are problematic from the environmental point of view since, although guaranteeing the excellent durability of the finished product, they cause a difficult landfilling of the wastes after the use because these impregnated wastes need expensive and complex incineration processes.

The results of the feasibility study carried out in the Exploratory phase pointed out the possibility to use starch impregnation, combined with the DIC desiccation to obtain an interesting mechanical resistance with a low porosity (this is also the base to improve the stability to weather agents).

The main technical innovation, in this case, is the use of gelatinized starch as "binding" agent and "filler" of the fibrous structure of the wood; the gelatinized starch, properly treated with DIC and additives is very stable, even in presence of humidity and acts as a valid surrogate of other synthetic impregnating agents.

Moreover, the filling action carried out by the gel promote the reduction in the use of varnishing products, thus the process allow the valorize wood elements usually used as combustibles or for the paper production.



The demand of eco-compatible products is constantly growing, and getting a complete natural and cheap wood material having an improved hygrometric stability would be an absolute novelty for the market.

This section of the project is based on the results of the Exploratory phase on sheared materials, and doesn't have any synergy with other European projects.