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BENTOMET

**DESIGN AND CONSTRUCTION OF A BENTONITES RECYCLING LINE FOR THE
PRODUCTION OF A HEAVY METAL ADSORBENT**

Deliverable D.6.3.5

Visits of potential clients

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PU	Public	✓
PP	Restricted to other programme participants (including the Commission Services)	
RE	Restricted to a group specified by the consortium (including the Commission Services)	
CO	Confidential, only for member of the consortium (including the Commission Services)	

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1. Objective of the market analysis

The main objective of this deliverable D6.3 “Visits of potential clients” is to study, identify and contact the main interested parties in the products developed in the BENTOMET project.

The design and construction of a bentonites recycling line could be very useful for several industries, in special those generating waste bentonites in their industrial processes and having to pay for the subproduct treatment to companies specialized in the treatment of this waste.

Furthermore, the product obtained from this recycling line could be very interesting for a wide range of industries, as it is an efficient adsorbent for heavy metals present in wastewaters, which has, in addition, a very affordable price.

The market analysis has been focused on four groups:

- Providers of bentonites: wineries, among others.
- Industrial sectors which generate heavy metals.
- Potential clients of the product obtained from the bentonites recycling line.
- Competitors.

2. Bentonites Providers

There is a wide diversity of companies that could provide contaminated bentonites for their recycling, as they are used in a lot of processes as oil, wine and cider clarification.

In the case of the project, bentonites from wine clarification have been selected as raw material, so several wineries have been contacted in order to collect samples of used bentonites for characterization tests and to evaluate different types of bentonites wastes (red wine, white wine), to process in the recycling line.

The bentonites wastes have been collected from Bodegas Fernández de Arcaya, Bodegas Barón de Ley and Bodegas San Martín, which are close to the bentonites recycling plant.

- **Bodegas Fernández de Arcaya**

Familiar winery which started its activity in 1990 with the varieties Tempranillo, Cabernet Sauvignon and Merlot in their own vineyards, planted since 1982.

For this purpose, all their buildings were remodeled by installing small stainless steel tanks, which all together have a production capacity up 594.000 litres.

The ageing is completed in American and French oak barrels. The winery makes red and rose wine under the brands “Fernández Arcaya” and “Viña Perguita”.

Bodegas Fernández de Arcaya has a clear orientation to the production of quality “Crianza” and “Reserva” red wines, without neglecting the production of young red, rose and white wines. These wines are commercialized with the brands “Fernández de Arcaya” and “Viña Perguita”.

- **Bodega Barón de Ley**

This winery was designed and founded in 1985 with the objective of building a winery inspired in the “Chateaux” of Medoc, with the objective to manufacture wine as work of art.

So they bought the land of Imas in Mendavia, placed on the left hand of Ebro river, with the best climatic conditions and the best soil composition for an excellent wine.

The first results of this ambitious project came out in 1990, when the first bottles of Barón de Ley were commercialized.

Currently Bodegas Barón de Ley has a winery for the elaboration, ageing and bottling wine of DOC Rioja.

In this winery, different wines are elaborated: young wines, “Crianza” wines, white and rose wines with the brands:

- Barón de Ley Gran Reserva y Finca Monasterio
- Barón de Ley Reserva.

- Barón de Ley blanco y rosado.

A sign of the quality of these wines are the important prizes they have won.

- **Bodegas Navarsotillo**

Familiar winery where exclusively DOCa Rioja wines with ecological agriculture certification are elaborated.

Navarsotillo defends the ecologic agriculture betting for the collection of quality foods through low environmental impact techniques.

All the winery's activity is supported by modern installations. For the wine ageing, American and French oak barrels are used and it has adequate bottle rack for the wine ageing, taking care of the tastes of the wines.

This is completed with exhaustive work procedures to assure the final product quality.

A prove of this work are the certifications of quality management systems, environmental management and food safety management. The certification of Navarsotillo is expanded with their certifications of Organic Product for USA (NOP certification) and for Suisse (Bio Suisse).

The current production is nearly 700.000kg of grapes per year. The sales volume is about 400.000 bottles of wine (250.000 of red young wine and 150.000 of "Crianza" wine). For this production, 500 barrels are used (80% American oak – 20% French oak) which are replaced roughly 90 barrels per year.

- **Bodegas San Martín**

Bodegas San Martín is a Cooperative Society founded in 1914. The winery is placed in the area named as East Middle Navarra, in the village San Martín de Unx.

It produces 3.000.000 litres of wine per year, which are mostly sold in the north of Spain (Navarra and País Vasco) and exported to France, Germany, Netherlands, USA and Venezuela.

Bodegas San Martín dedicates the most of its wine-growing area to autochthone grape varieties as Viura (Macabeo) in white wines and Garnacha and Tempranillo in red wines. It has some French varieties as Merlot and Cabernet Sauvignon which complete and expand its wines.

- **Bodegas Aroa**

In 1998 a business of organic products was established by Laket and Aroa in the same company. Since 1998 the actionists were regrouped and there were founded two societies, Laket Bio which continues with the distribution of organic products and Aroa Bodegas which produce wines.

The wines elaborated in this winery are selected wines, produced with several varieties of red grape: Tempranillo, Cabernet Sauvignon and Merlot, as a result of a impeccable viticulture.

All Aroa's wines are controlled and certified by the CPAEN-NNPEK.

- **Doniene Gorrondona Txakolina**

Doniene Gorrondona (Bentalde S.L) is a modern winery where txakoli is produced by a professional way.

The winery is placed in the coastal town of Bakio, considered the heart of txakoli in Vizcaya.

The main activities of the winery are:

- Viticulture: they produce all the grapes in the winery.
- Winery: they elaborate about 70.000 litres of txakoli
- Distillery: they distill the residues of the production of txakoli
- Enoturism: they organize visits and wine tasting in the winery

Hondarribi Beltza and Hondarribi Zuri are the identity signs of the winery, autochthones varieties of red and white grapes, which are giving positive results in the several productions they are making.

In addition to the installations for txakoli elaboration, the winery has a distillery constituted by five copper stills where the residues of Hondarribi Zuri and Hondarribi Beltza are distilled.

3. Recycled bentonites sectors of application

The products developed in this recycling line will be mainly addressed to the industries which generate heavy metals wastes which are very toxic and whose treatment is very difficult.

These wastes, which would afterwards contaminate water or air, could come from natural sources or human activities. Currently, the most important source is, without any doubt, the last one.

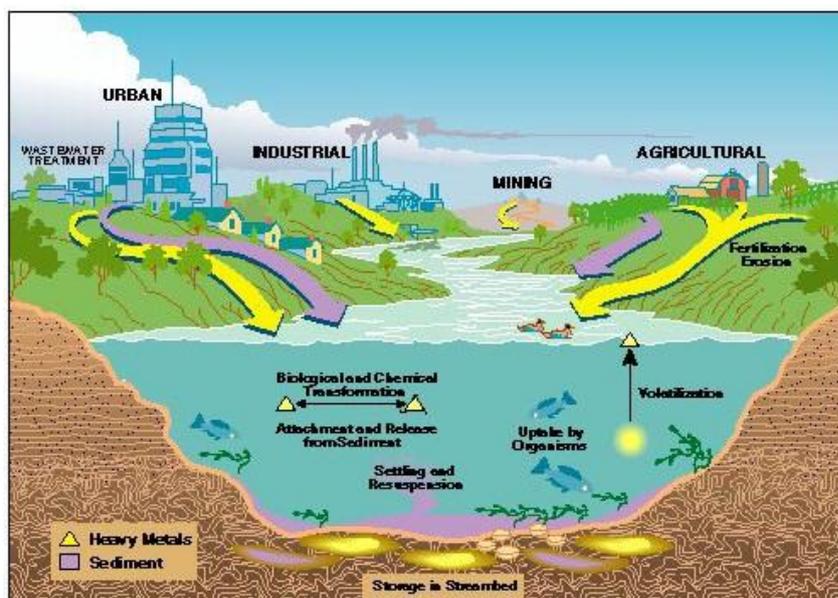
There are two main human pollution sources which generate great amounts of heavy metals wastes:

1. Urban wastes: Domestic activities mostly generate organic wastes, but the sewage drags all type of substances: cars emissions (hydrocarbons, lead, other metals...), acids, salts, etc.

The binding construction of waste treatment plants in towns is cutting down this kind of pollution, but in Spain the waste water treatment is still lame.

2. Industry: Depending on the kind of industry, many types of wastes are produced. Usually, in developed countries, many trades have efficient water purification systems, especially those which generate hazardous pollution as heavy metals. On the other hand, in some non-developed countries, the contamination of water due to industrial wastes is very high.

This pollution is shown in the next picture:



Polluters can be classified according to the industry which produces them:

Industrial area	Main polluters
Building industry	Solids, heavy metals, pH
Mining industry	Solids, heavy metals, pH, organic matter, cyanides.
Energy industry	Heat, hydrocarbons, chemicals
Textile industry	Chromium, tannines, sulphides, dyes, surfactants, organic solvents, fats, formic and acetic acid, solids...
Automotive industry	Lubricating oils, paints, waste water.
Shipbuilding industry	Oil, chemicals, solvents and pigments.
Steel sector	Metal husk, oil, dissolved metals, acids and bases.
Inorganic chemistry	Hg, P, fluorides, cyanides, amoniac, nitritos, ácido sulfhídrico, F, Mn, Mo, Pb, Ag, Se, Zn, etc. y los compuestos de todos ellos.
Organic chemistry	Organohalogen, organosilicious, carcinogenic compounds and other which affect to oxygen balance
Fertilizers	Nitrates and phosphates
Paper industry	Solids and other which affect to oxygen balance
Pesticides	Organohalogen, organophosphate, carcinogenic compounds, biocides, etc.
Painting and dye industry	Compounds of Zn, Cr, Se, Mo, Ti, Sn, Ba, Co, etc.

The current document will focus on the main industrial sectors producing wastes containing heavy metals.

3.1) Textile industry:

The textile industry is chemically intensive, employing different chemicals for every process, from the coating of the fabrics to the printing and finishing processes.

The wastewater from these processes is usually toxic and could pollute important rivers. These dangerous discharges could negatively affect human health, wildlife and environment. Some heavy metals, such as cadmium, lead and mercury, are employed to produce some dyes and pigments. Chromium (VI) is commonly used in some textile processes and in leather tanning.

These metals are accumulated in the body along the time and are highly toxic, having irreversible effects, including in nervous system damage (lead and mercury), or in kidneys (cadmium). Cadmium is also associated with cancer.

Chromium (VI) is very hazardous and carcinogenic even in low quantities.

3.2) Steel industry

The steel sector is characterised by having an important social and economic impact. In Spain, approximately 137.000 companies work in this sector, which results in, approximately, a third of the industrial production of Spain.

The steel industry contaminates the soil in several ways:

- By dust and aerosol emissions which are carried by air and placed on the growth and soil.
- By effluents which contaminate soils in floods.
- By landfilling where metals can be corroded and leached to soil. Many heavy metals are used in steels and alloys, so the manufacturing or recycling of these materials can result in environmental pollution.

3.3) Mining industry

Although current techniques of mining and casting are, in general, efficient and the rock pieces have low amounts of heavy metals, during the XIX century, these pieces had great amounts of heavy metals because the inefficient separation processes. In this sense, the waste particles, which could be carried by water or air, were a significant source of heavy metal pollution in soil in regions near mines and casting areas.

Once in the soil, the mineral particles are oxidized and, then, the heavy metals are introduced into the soil.

3.4) Microelectronic industry

A wide range of heavy metals including Cu, Zn, Ag, Au, Pb, Sn, Y, W, Cr, Se, Sm, Ir, In, Ga, Ge, Re, Tb, Co, Mo, Hg, Sb, As and Gd are used in the manufacturing of semiconductors, wires, connections and other electronic components. For that reason, the environmental pollution resulting from these manufacturing processes, as well as any accidental contact of their wastes with soil, could be considered as the main source of contamination of this industry.

3.5) Chemical industry

Another important heavy metal pollution source is the manufacturing or use of batteries, paints, pigments, catalysts, stabiliser polymers, plastics, medical products, additives in oils and lubricant, all of them widely employed in the chemical industry.

3.6) Paint and dye sector

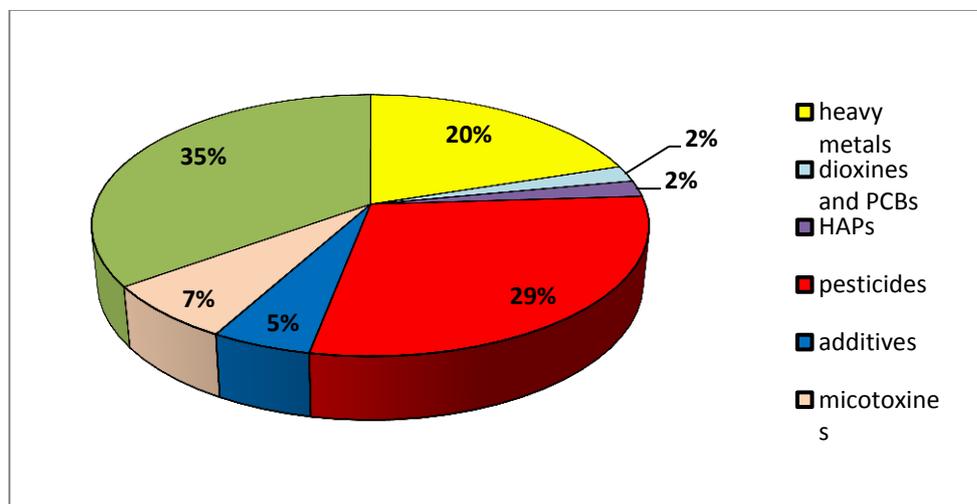
Paints and dyes have synthetic products from petrochemical industry which could affect the environment and human health.

The risks related to these products are the presence of heavy metals as lead, cadmium, mercury etc, and organic volatile compounds as xylene, toluene, phenols and formaldehydes, which are emitted by paints and varnishes while they are applied and even weeks later.

3.7) Agricultural Industry

Agricultural practices are another very important source of heavy metals in water and in soils and affects to most of the world, especially in areas of high activity. The main sources are:

- Impurities in fertilizers: Cd, Cr, Mo, Pb, U, V, Zn
- Waste water and slurries: Cd, Ni, Cu, Pb, Zn
- Animal dung, mainly birds and pigs, of the intense animal production: Cu, As, Zn
- Pesticides: Cu, As, Hg, Pb, Mn, Zn
- Organic fertilizers wastes: Cd, Cu, Ni, Pb, Zn
- Wood preservatives: As, Cu, Cr
- Metallic objects corrosion: Zn, Cd



4. Recycled bentonites potential clients

Several companies have been contacted with the aim of offering them the product developed in this project. They belong to those industrial sectors identified as potentially interested, and this classification has been used to describe the potential clients in the present document.

In the case of the Waste Water Treatment Plant SMSA, several activities have been performed, as different samples of water from this company have been used in order to identify heavy metals and test the efficiency of the modified bentonites. Waters coming from different locations have been evaluated: Estella, Viana, Allo, Arroniz, Lerín, Lodosa, Los Arcos, Mendavia, Sesma and Valdega.

Waste Water Treatment Plants (WWTP)

- SMSA

Servicios de Montejurra (SMSA) is a company in charge of managing and promoting the rational use of water at Montejurra's Mancommunity.

SMSA does this task from an integral perspective because it treats the water in all its phases, from its collection to its discharge in the river.

As the management entity of the integral water cycle, the activity of SMSA covers the processes of:

- Water collection
- Water purification
- Water distribution
- Sewage treatment
- Water spill

Its main tasks are the treatment of water and urban wastes, but it also develops other actions of great interest in social areas.

- EDAR TAFALLA OLITE

It is the waste water treatment plant of Tafalla and Olite. In this plant several processes are done with the objective of obtaining purified water suitable for being discharged. These processes are: pre-treatment, physical primary treatment, biological secondary treatment of active slurries.

Furthermore, the slurries produced are sanitized and dehydrated.

This waste water treatment plant discharges water to Cidacos River, this water is the most important fluent volume so its condition needs to be optimal.

- **EDAR TUDELA**

This waste water treatment plant provides service not only to Tudela but also to Murchante, Cascante and Fontellas. Its water treatment tasks are very important because it returns the fluent to the most polluted river in Spain: Ebro river. This river is the second longer in the mainland and it passes through Spain, France and Andorra.

In Navarra there are other waste water treatment plants which release their water to Ebro River, for example in Viana, Mendavia, Lodosa-Sartaguda, Azagra, Castejón. Valtierra-Arguedas and Bajo-Ebro.

- **NAVAGUA**

It's a Navarre company which designs, builds, installs and maintains plants and equipment which could treat all kind of water for its use in industries, towns or sanitary water.

Its activity goes from defining the best kind of treatment for each circumstance to the installation and maintenance of the corresponding equipment.

Metal industry

The metal industry is an important source of heavy metal pollution due to the waste processed. So, different wastewater effluents from this sector have been characterized during the present project, in order to identify heavy metals in the wastewaters of this type of industry and also prove the performance of the developed product when applied to such waters. Tecmoem and Teim are the two companies whose waters have been collected and studied. Furthermore, other industries have been contacted to offer them the developed product.

- **TECNIMOEM**

Tecmoem is a company founded in 1997 in Navarra, which develops, produces and distributes beds and complements for domestic, sanitary and geriatric use.

It has become a leader in the sector thanks to the quality of the developed processes, this company has expanded their products to the entire Spain and now it is expanding to international market.

- **TEIM**

Tecnología Electrostática e Industria del Metal (TEIM) is a company founded in 2008 in Marcilla (Navarra) which produces machined metal sheets. They make several processes such as cutting, welding, sanding, etc. of metal sheets of several materials like electroplated, iron, aluminum or alloys.

Despite its recent start up, TEIM has a defined market, the major part of their products being devoted to industrial clients out of the metal sector, for example: Gamesa Valencia, Jofemar, Faeco, Exkal y Metalcomponentes MB.

- **ACEROS MOLDEADOS DE LACUNZA**

Aceros Moldeados de Lacunza S.A. started its business in 1977. The production of AML S.A. is based on:

- Carbon steel
- Alloy steel
- Austenitic stainless steel
- Austenitic-ferritic stainless steel (Duplex)
- Base materials Nickel (Hastelloys)

Applicable specifications are all those recognized internationally. Mainly DIN and ASTM, ASME, BS, EN, SEW, JIS, RCC-M, etc, these being submitted to periodical control and updating.

The production capacity of AML S.A. is:

- Monthly Production Capacity: 250 Tm. (net)
- Max. Weight per Piece: 3.500kg. (net)

- **MECANIZACIONES ALAVESAS S.L.**

Mecanizaciones Alavesas S.L is a company devoted to the automation of the processes of bottling and packaging. It was founded in 1979 as a small mechanical workshop to offer to their main clients the best solutions for their daily problems.

Currently, the machinery catalogue offered by MECAL to its customers can be divided into standard machines (bottling lines: depalletizers, cage loaders / unloaders, washing machines, capsule and encapsulator distributors, packers, boxers, conveyor belts, etc.) and specific machinery (capper of heat-shrinkable capsules, stoppers of caps, fillers of trays of means pallets, etc.).

The activity developed by MECAL can be broken down into Engineering-Development, Manufacturing, Automation, Marketing and Technical Assistance.

- **MECACONTROL GROUP**

MECACONTROL started out as a small family factor devoted mainly to the production of plastic moulds back in the early 1990s. Ever since then, the company has staunchly focused on offering its customers a comprehensive service in line with each of their specific needs.

The target markets of this company are: automotive, electronics, household goods and furniture, the industrial processes performed being:

- Plastic injection
- Aluminum Die-casting
- Blow moulding
- Overmoulding
- Extrusion
- Bi-material injection
- Screen/pad printing
- AdBlue
- Hot stamping + heat transfer printing
- Eutectic bottling (AKKU)
- Assembling
- Mould construction
- Mould design
- Machining
- Trimming tools
- Gas aided injection
- Painting / soft touch

Below, it can be seen the main features of each one of the companies taking part of MECACONTROL GROUP:

IP Mecacontrol

- Horizontal Plastic Injection (50 - 800Tn)
- Vertical Plastic Injection (50 - 140Tn)
- 2K Translational / Rotative plate Bi-Injection
- Horizontal and vertical overmoulding injection
- Blow moulding and eutectics bottling
- Screen and pad printing processes. AdBlue and assembling.
- R+D center (CAD/CAM capabilities + personnel)
- Aimed to customers assist & Supplier develop.

Molteplas

- Horizontal Plastic Injection (45-> 1700 Tn)
- Gas assisted Injection
- Ultrasonic Welding
- Hot stamping and heat transfer printing
- R+D center as above

Mecacontrol Coating

- Water Soft Touch and solvent coating.

Fundiciones Mecacontrol

- State of the art fully automated cells
- From 320 to 900 Tn
- Melting tower for raw material
- In-house capability for die casting dies and cutting tools
- X-rays, 3D machine and spectrometer
- CNC machining x 5 machining centers
- Mecacontrol Polska
- Horizontal Plastic Injection (40-450 Tn)
- 2K / Bimaterial
- Assembly lines

Talleres Mecacontrol

- Design and construction of tools
- Moulds, die casting dies, profile machining
- Milling machines, water cutting, electro erosion, & wire erosion
- CAD / CAM station

Plasotec

- Plastic extrusion: profiles, snorkel tubes, etc.

Recycling industry

Looking for companies which could be interested in the heavy metal adsorbent developed in this project at European level, Coolrec, one of the project's partners, works for some recycling companies which could be interested in the product. Some of the main companies in this field are included in this section, together with a Spanish company.

Apart from the mentioned companies, Coolrec also works for other sectors which may be interested in the developed adsorbent:

- Producers and importers of ICT, domestic and other electrical or electronic appliances
- Institutes like universities and colleges
- The health sector: hospitals, laboratories, research centres
- All other companies, institutions and professional disposal businesses that have waste appliances and/or plastic-metal combination

- **EUROPEAN RECYCLING PLATFORM (ERP)**

European Recycling Platform (ERP) was founded in 2002 as the first pan-European organization to implement the European Union's regulations on the recycling of electrical and electronic waste (WEEE Directive). ERP manages a consolidated network and has developed vast international expertise, expanding its recycling services to include batteries as well as packaging.

ERP has more than 2.700 members worldwide and is the first in the market offering compliance for WEEE, batteries and packaging in over 32 countries.

- **RECUPEL - RECYDEL**

Recupel is a Belgium company which dedicates to recycle materials with the objective of preserving the environment.

They recycle electrical devices, bulbs and luminaires in response to the 'take-back obligation', Recupel organizing the collection and processing of WEEE in Belgium.

The take-back obligation is the regulation that stipulates that every shop/merchant that 'brings an electro-appliance onto the Belgian market' must also take care of the collection and processing of the discarded appliances.

They work closely with the merchants, municipalities, intermunicipal companies and recycling shops, as well as with specialised companies for the transport and ecological processing of the discarded appliances.

- **ECOINTEGRA**

This treatment plant for Waste Electrical and Electronic Equipment began its activity in 2007, initially only as a treatment plant for cold appliances. It has progressively expanded its activity and, at the moment, it is authorized to treat the main categories of WEEE (treatment line for cold appliances, treatment line for CRT and flat monitors and treatment line for other WEEE, large household appliance, PAE, etc.).

ECOINTEGRA employs 40 people, 90% of whom are people with disabilities. The main characteristic of ECOINTEGRA consists of being a model in waste management as well as having a great transparency so that society knows the environmental and social work that it performs. It has the certifications ISO 9001 and ISO 14001.

Paints and dyes industry

In this sector, different industries which could be interested in the developed products have been contacted, and some of them have provided wastewaters to be treated with the developed adsorbent: Andreu Nort, Labelgrafic, De Medrano and Sarrio Papel Leiza.

- **TINTAS ARZUBIALDE**

Tintas Arzubialde is a company founded in 1963 in Logroño which produces inks for printing. Furthermore, they also manufacture varnishes, lacquers and chemical products for graphic industry.

- **ALAVESA DE BARNICES**

Alavesa de Barnices, S.A. is one of the main providers of wood industrial coatings in Spain. The company was created in 1971 in Oion (Álava) and is member of AFESAPI (Spanish paints producers association) and they also have a filial company in Portugal.

- **KUPSA**

KUPSA Coatings is a company founded 40 years ago with a trajectory focused on the production of wood protection products and similar materials.

Nowadays KUPSA has a production capacity of more than 30.000 tons per year of products for wood, industrial carpentry, and related products, plastics, etc., what puts it at the forefront of the sector in Spain.

- **BARPIMO**

Barpimo is a familiar company founded in Nájera (La Rioja) fifty years ago, which manufactures and commercializes varnishes and paintings for wood, decoration, building and industry.

It has experienced a continuous internationalization process. As a result, Barpimo Group has now more than 5000 clients in the five continents.

- **PINTURAS FIERRO**

It is a family company founded more than 100 years ago in Barbastro (Huesca), which manufactures and commercializes paintings.

All its products are properly tested under rigorous certifications made at develop and quality control laboratory by qualified staff.

The production of the company can work in continuous or discontinuous thanks to its versatile installations.

- **COLORCENTER**

Color Center, S.A. is a chemical company founded in 1978 which has been dedicated since its start to the design, manufacturing and marketing of dyes and auxiliary products for the textile industry.

The company works in the development, acquisition and formulation of new materials and nano-materials, always in an environmentally friendly way.

They have a wide range of products which cover all steps in the textile process and other related ones, giving products as detergents, softeners, oils, organic emulsions, pigments and others.

- **- ANDREU NORT**

This is a company with global trajectory; recognized as an international leader in furniture design and due to its state-of-the-art manufacturing facilities and practices. The organization sees its team of integrated and involved professionals as an investment in ongoing R & D. Andreu Nort works to create sustainable and innovative designs, providing durable furniture solutions that allow to enjoy the spaces that people utilize in a smart and healthy way.

Year after year, they have become globalized without losing their local spirit. They are currently present in the most demanding markets in the world and they have a permanent presence in North America, Europe, Eastern Europe and Asia.

- **- DE MEDRANO. TEJIDOS ACABADOS TEYCU S.L.**

Teycu S.L. is a company dedicated to post-textile technology. Its main aim is based on achieving the solution for each client needs through latest technology finishes.

From its headquarters in the town of Arnedo, La Rioja, it creates, processes and markets its products under the brand deMedrano through an established sales network. This is why the company has been a member of the Footwear Technology Centre of La Rioja (CTCR) since its inception in January 2007.

The addition of machinery equipped with state-of-the-art technology at its facilities allows the company to work with widths up to 250cm with fire retardant, breathable, waterproof, anti-tear, UV protection finishes, etc. It is committed to customization and differentiation as a way forward, while bringing the added value needed by the client to excel in a competitive world.

- **- SARRIO PAPEL LEIZA**

This company origins date back to the acquisition, between 1997 and 1999, of three companies with a long tradition in their home markets: Cartiere del Garda in Italy, Condat in France and Torraspapel in Spain. Lecta is a private company controlled by CVC Capital Partners, a leading European private equity investor.

With a manufacturing capacity of close to 2 million tons, Lecta currently has 7 state-of-the-art mills in Spain, France and Italy for the production of specialty papers, coated

woodfree paper and base paper. Lecta's mill in Zaragoza (Spain) also has a pulp manufacturing plant.

With its network of offices and merchants in 10 countries, Lecta has consolidated its position as the leading manufacturer and merchant in Southern Europe, with excellent coverage in other key strategic geographic regions. This gives the company a thorough understanding of market needs and enables it to stay close to its customers.

Lecta boasts an extensive range of products to meet the needs of customers in markets as diverse as labels and flexible packaging, commercial printing and publishing, thermal printing and business forms. Publishers, printers, paper merchants and converters in more than 130 countries, on all five continents, place their trust in its brands, widely-recognized in all major markets.

Chemical industry

- **TIMACAGRO**

Timac AGRO is a company dedicated to the development, manufacture and commercialization of fertilizers and animal feed products. It is a leader in the national specialty fertilizer market. The three pillars of Timac AGRO are innovation, technical advice and industrial potential.

The production plant of Timac AGRO is located in Lodosa (Spain). It was founded in 1908 and, in this production plant, products exported to 114 countries are manufactured. Currently 80 people work there.

Its productive capacity is the following:

- Solid fertilizers: 270.000 tonnes / year
- Water-soluble fertilizers: 15.000 tonnes / year
- Liquid biostimulants: 10.000.000 liters / year

- **PREPARADOS QUÍMICOS NAVARRA S.L. - PEQUINSA**

PEQUINSA was founded in 1975 to provide specific solutions to industries such as Construction, Ceramic Factories and Final Treatments (Clay, Waterproofing, Marbles Recovery, Cement Derivatives, etc.).

They manufacture all their products, both conventional which are included in a catalogue and special products made for specific customers, to solve problems of application and finish.

Its product catalogue is divided into several parts: construction, products for ceramics, marble, granite and natural stone, industrial maintenance and automotive sector.

5. Competitors

Traditionally, industrial effluents have been treated with a combination of physical-chemical methods, such as flocculation, precipitation and filtration; and biological processes as activated slurries. However, these processes fail because they aren't able to reduce the amount of heavy metals under the levels permitted by law.

Furthermore, these technologies are not capable to differ easily the composition of the wastes, subproducts being then difficult to reuse or recycle and, as a consequence, the obtained slurries are very difficult to treat.

WWTP aren't designed to treat toxic wastes. Metals and its toxicity persist even in the treated slurries; for that reason, they must be removed from the emissive source, in a specially designed pre-treatment.

This specific treatment should be characterised for not being too expensive since, in some occasions, large volumes of effluent need to be treated. As a result, research has focused their efforts on developing new materials and techniques capable of adsorbing heavy metals.

Some of the technologies employed are based in the separation of metals from the effluents and the subsequent recovery using chemical precipitation, solvents and adsorption and ionic interchange processes based on membrane technology. Hereafter, they are briefly described.

5.1. Chemical precipitation

It is considered the standard treatment for removing metals from all type of waters. The capacity of removing metals depends of two factors:

- The solubility of the most soluble metal species that can be formed, which depends on the pH and the concentration of the precipitating species.
- The separation of the solid from the aqueous solution.

These factors make that precipitation is not very effective when the metal is in low concentration, because a precipitating agent is needed to form a precipitate, and in many cases the solid formed particle hasn't the enough stabilization to separate from the solution.

To overcome these barriers, a co-precipitation treatment is often used, adding iron or aluminium hydroxide with the precipitating agent with the aim of they acting as a coagulant or adsorbing the non-precipitating metals.

5.2) Recovery with solvents

It is one of the more usual separation technologies to remove heavy metals from industrial effluents. This process is often used at a larger scale when the concentration of the polluter is higher.

Solvents used are more selective each time, which allow the separation of specific molecules from the aqueous phase while the rest are retained. The recovery with solvent has a great commercial application in those cases which a selective separation of metallic ions is required.

This procedure consists in getting in touch an organic apolar solvent with the waste water, metallic ions being transferred to the organic phase forming a metallic complex insoluble in water. When the organic phase is charged with the metals, it is put in contact again with another aqueous phase and the metallic ions are transferred to this new aqueous solution which is returned to the process again (reextraction).

This technology requires great amounts of organic extracting agents, which increase the economic costs. When the amounts of pollutant are under 5g/L this process is not economically viable.

5.3) Membrane technology

A membrane is a semipermeable barrier which can be crossed only by some chemical species.

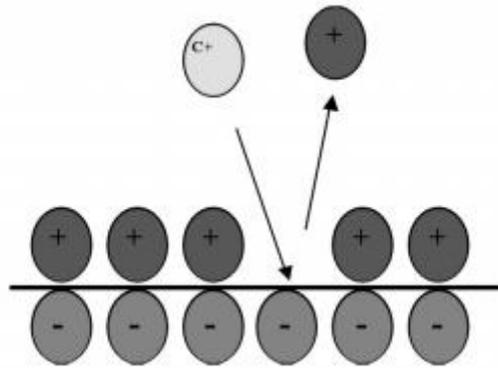
Historically the membrane technology has had a vast application in treatment and desalinization with the inverse osmosis. In this process a potential difference is used to overcome the osmotic pressure gradient. Under these conditions, ions cannot pass through the membrane and they are separated from the solvent.

5.4) Ionic interchange:

It is an electrostatic interaction mechanism due to the Coulomb attraction forces which have place when an ion from a solution is interchanged for another ion with the same charge which is bonded to an immobile solid particle. When the concentrations of the metals in effluents are low, the use of membranes or recovery with solvents are inefficient. In this case, ionic interchange is a very good alternative.

Usually, it is a fast and reversible process that depends on the water ionic force. When the ionic force is high, there is a big competition between soluble cations for the interchange places on the solid's surface.

The following picture shows how the cationic interchange between two species is produced:



There is a company which produces bentonites with the aim of employing them as heavy metals adsorbents in water: SEPIOLSA.

SEPIOLSA is a mining company founded in 1986 which extracts and commercialize special clays (sepiolite, bentonite, estevensite-kerolite, atapulgite, etc.) which are used in several industrial applications: adsorbents, animal feed additives, sand for cats, oil and fats clarification and industrial adsorbents for toxic products, among others.

It has a business model with own mine yards in Madrid (sepiolite and bentonite), Toledo (clarifying earths) and Senegal (atapulgitite), and processing plants in Guadalajara (Spain), Mbodiene (Senegal) and Ostende (Belgium).

However, the bentonite they produce is pure and not-improved with magnetic particles, so the stage of removing the solid after the treatment is difficult.

6. Summary

The market analysis has allowed the consortium to confirm that the recycling of bentonites has a huge interest in different sectors.

On the one hand, there are different companies (such as wineries) interested in the recycling process in order to reduce the amount of wastes generated in their processes and the cost of their treatment in specialized centres.

On the other hand, there are companies interested in the recycled material to incorporate it in the depuration of their industrial wastewaters, rich in heavy metals.

As a result, the product and technology developed in the BENTOMET project have great potential from a marketing point of view. More specific information about the market entry strategy, the business plan and the exploitation can be found in the corresponding deliverables: D5.6 "Report on technical and economic assessment concerning the industrial production, distribution and marketing, including a Life Cycle Analysis", D6.1 "Plan for Using and Disseminating Knowledge and Exploitation Agreement" and D6.2 "Business Plan".