

ENSOLVEX TECHNOLOGY

Ensolvex is a process of low environmental impact that allows to reclaim polluted soils which are not treatable with bioremediation techniques. At the same time it also bypasses the application of 'hard' technologies such as thermal desorption or confinement techniques, altogether at competitive treatment costs.

With respect to bioremediation techniques, the Ensolvex technology is suitable when there are

- high concentrations of pollutants;
- presences of contaminants that are severely toxic to the microbial flora or recalcitrant to biodegradation;
- clayey and muddy soils, where scarce permeability impedes the access of air and nutrients to the microbial flora;
- short times for decontamination.

The heart of the Ensolvex process is the extraction of organic compounds from different contaminated matrices, such as soils, sludges and sediments, using ethyl acetate.

The choice of the solvent is based on:

- high efficacy of pollutant removal;
- lack of toxicity;
- easiness of regeneration (with ecological and economical advantages).

The main segments of the Ensolvex process consist of a stage of pre-treatment to eliminate coarse material (vassals), the actual solvent extraction, the removal of the saturating solvent from the treated matrix and the final distillation for the recovery and recycling of the solvent.

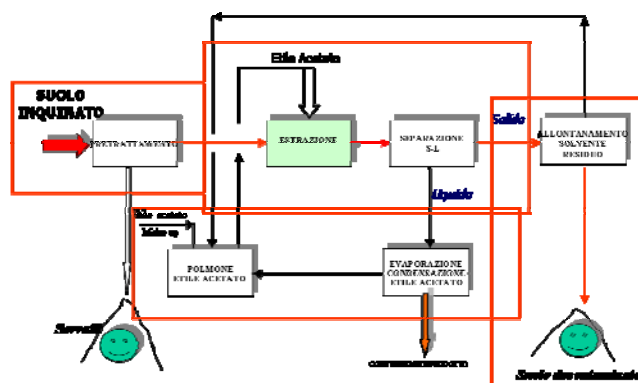


Fig.1 Scheme of Ensolvex plant

The Ensolvex process is capable of decontaminating soil polluted with hydrocarbons down to regulatory levels in industrial as well as residential cases, setting up the process through successive steps of extraction, in relation to the various properties of the soils such as:



Fig. 2 Ethyl acetate extracts after successive steps.

- different texture;
- different types of organic pollutants;
- wide range of concentrations.

APPLICATIONS ON OTHER CONTAMINATED MATRICES

The treatment with the Ensolvex process of the oily detritus (cuttings) produced during drilling activities allows to reduce the volume and the organic load of the material to be disposed of. The economics of the treatment are supported by the chemical properties of the recovered oily base, a valued product (such as for instance Lamium 11). It is suitable for reutilization in the make of new perforation sludge.

This recovery renders the Ensolvex treatment of the oily detritus competitive with alternative techniques such as thermal desorption.

Setting up the process on a bench scale provides for a stage of extraction using an agitated reactor, the separation of liquid from solid with a decanter centrifuge and the removal of the imbibed solvent by evaporation.

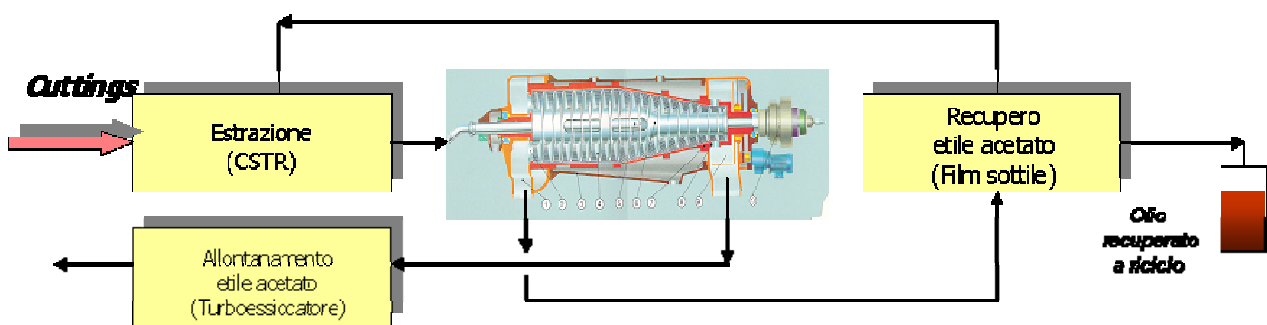


Fig. 3: Scheme of Ensolvex process applied to cuttings

The application of the Ensolvex process is under way for the treatment of oily refinery sludges in order to declassify the material to be disposed of from a hazardous waste codification: In addition to the recovery of the oily phase as slop, the solvent extraction aims at reducing the critical parameters DOC and TOC below the levels of admissibility for the controlled deposit of the product in non-hazardous waste land fills.

With regard to the treatment of contaminated sediments, linking the Ensolvex process to a classification in humid (Soil Washing) allows to reach the specific requirements for the reutilization of the materials when the properties of the contaminants and the granulometry of the sediment will be favourable: Soil Washing of predominantly sandy sediments, polluted with hydrocarbons, PCB, metals and DDT, produces a sand, deprived of heavy metals, which subjected to solvent extraction conforms with the current regulation for the recovery of material.

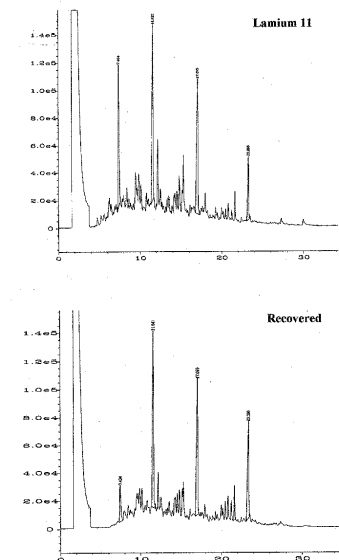


Fig. 4: Chromatogram of lamium and of the oily product recovered by the process

DECONTAMINATION OF THE EX REFINERY OF RHO

In the ambit of the industrial development of the Ensolvex process two commercial agreements were signed with a company operating in the environmental field; one of specialized assistance oriented to the completion of the first industrial plant, the second that provides for the cessation of the non-exclusive titled licence on the basis of royalties.

In the ambit of the first agreement a completed demonstration plant was installed and put to work on the site of the former refinery of Rho. In 2002 a regional decree authorized the industrial trial of the treatment of contaminated soils within the definite decontamination project of the site where the new premises of the Milan fair were successively established.

The demonstration plant installed at Rho has allowed the treatment of circa 30000 m³ of soil with a medium contamination of 7000 ppm.



Fig. 5 Cochlear extraction unit



Fig. 6 Centrifugation unit



Fig. 4: Loading unit

Upstream from the solvent extraction stage a soil washing pre-treatment was utilized to separate the coarse fractions of soil (circa 85%), which resulted at specifics as soil for industrial use, concentrating the contamination in the finer fraction to be treated with the Ensolvex process.



Fig. 7 Distillation unit

DECONTAMINATION OF BASIN A - ZONE 2 AT THE REFINERY OF GELA

The definitive project with safety measures of the decontamination of Basin A Zone 2 of the refinery of Gela was approved by the agencies in charge and was converted to law in January 2005. The Ensolvex process will thus be applied to treat the portions of soil underneath the basin most contaminated with organic compounds. In the ambit of the stated Project of Decontamination a specific technology is identified for each of the various contaminated matrices to be subjected to the treatment.

The executive project of the treatment plant is carried out by Research and Development of Refining and Marketing in collaboration with Snamprogetti Engineering of Fano. The Ensolvex plant, with capacity of 4 t / h, was created and completed in 2010 within the area subject to remediation. The commissioning and start-up activities will start in 2011.

In addition the Ensolvex technology is considered within the decontamination projects of the Syndial site at Avenza, polluted with pesticides containing chlorine, phosphorous and nitrogen; TPH and IPA; and of the former refinery of La Spezia, polluted with TPH, IPA and BTEX.

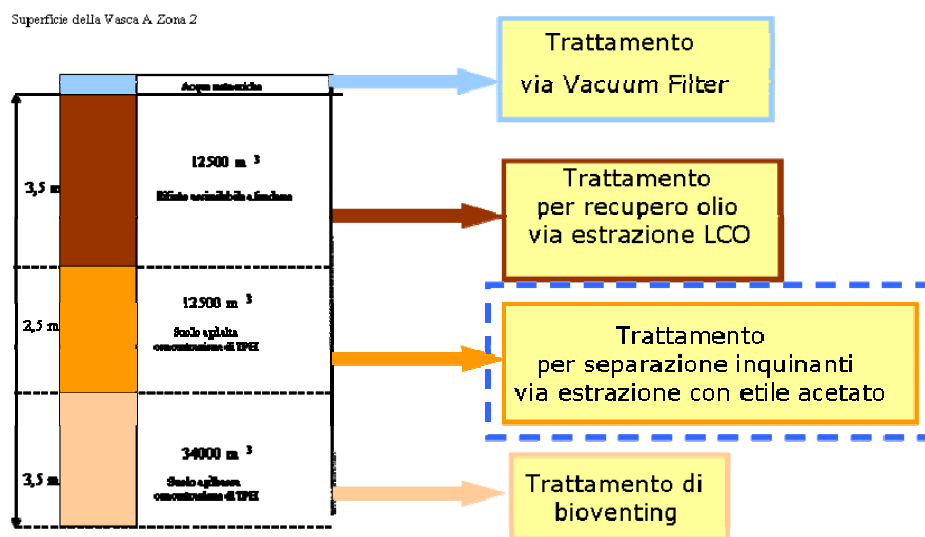


Fig. 8: Scheme of treatment technology for the decontamination of basin A Zone 2