Description of the "purification" phenomenon

Studies carried out on the so-called Wetlands outlined how, in these ecosystems, certain, specific self-depuration functions of the waters establish themselves naturally.

Wetlands that can be re-directed to a surface and that are constantly or temporarily naturally covered by stagnant or slowly defluent waters are represented by a polyphase system. Its characterising elements are the aquatic plant species that develop in it, the layer of water and the pedological substratum that houses the micro-flora and micro-fauna that live within the system. The purification functions of the waters depend on four components: vegetation, the layer of water, the substratum and the association of microbial populations.

The main functions of the vegetation within Phytodepuration processes can be summed up:

- the submerged portion of the aquatic plants acts as a filter and gives support to the microbial population.
- The residues of the epigeal part, that, at the end of their cycle are deposited on the water, are submerged and, together with the consumed root system, contribute to increasing the useful surfaces for micro-organisms as well as being sources of energy for them.
- Aquatic species that live with a submerged root system have certain anatomical characteristics that allow oxygen from emerged tissues to be transported towards the **rhizosphere**.

An aerobic environment is created near the root system, while in areas further away from the rhizosphere and underlying pedological substratum, anaerobiosis conditions are established. These co-habiting aerobic and anaerobic environments are essential for the oxidation processes of organic substances as well as the ammonification, nitrification and de-nitrification of the nitrogen whose content in the waters is therefore controlled and reduced.

The purifying function of the vegetation is additionally helped by the assumption of the most important chemical eutrophying elements (nitrogen, **phosphorus**, micro-elements etc.) through the roots that are extracted from the water and the system when the epigeal parts of the plants are removed.

Micro-organisms also draw necessary energy from organic substances present in the system as well as using nutritional salts dissolved in the water to develop their life cycle. Some groups of micro-organisms can also oppose the development of pathogenic micro organisms and viruses as well as metabolising toxic organic substances. Micro-organisms' efficiency in the purifying function is however closely linked to maintaining optimal environmental conditions for their development.

The substratum's main role is to support the plants and increase the surface of support for micro-organism colonies. Additionally, the chemical nature of the substratum material can itself block

some elements present. An example could be aluminium and iron that, causing the precipitation of insoluble **phosphorus**, remove it from any successive eutrophying action.

There is a distinction among Phytodepuration systems based on the vegetative form of the macrophyte present:

- floating macrophyte systems (surface flow)
- submerged macrophyte systems (surface flow)
- emergent rooted macrophyte systems (surface flow or horizontal or vertical sub-surface flow)
- combinations of the previous three

Different Phytodepuration systems are used for different purposes: some are realised for secondary type treatment of waste (mostly civil and industrial), others for tertiary treatment (allowing more demolition of nutrients and organic substances with slower biodegradability times and involving a refinement of the waste's chemical/biological quality). Natural **purification** systems (Phytodepuration and surface impoundment) fitted after traditional purification systems have an important potential ecological role as they represent an "ecosystem-filter" or "buffer" system. Ecosystem-filters are mostly represented by different ecosystems entities (lentic environments, marshy areas, underwater grasses, slow running lotic sections), organised into functional mosaics able to develop particularly good quality self-depurative abilities.