PHYTODEPURATION PROCESS FOR THE RECYCLING OF WASTEWATER IN DAIRY

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Abstract:

The problem of saving water is very important for the need to rationalize the use of the water resource. We have tested a method founded on phytodepuration for waste water of cheese factory, for to recover and recycle the water used in food industry, a sector characterized by high consumption of water .

The phytodepuration represents an innovative method for the disposal of wastewater. Some plants have a natural capacity to absorb and / or degrade toxic substances and contaminants to the environment, for the presence of a rhizosphere microflore, which is able to metabolize and make them available for their growth.

In the laboratory we developed a little system for phytodepuration using a plastic basin in which were placed some plants of Cyperus papirus immersed in a quantity of wastewater remained constant over time. We performed the analysis before the process and then a distance a few months to verify the variation of the parameters most important pollutants. At the end of our experience, approximately one year, it was possible to draw the following conclusions: the Cyperus papyrus proved effective to lessen the concentration of organic substances: the value of COD was lower than the initial wastewater; the concentration of phosphorus, of zinc was decreased and the concentration of chlorides also, which remained constant until the end of the experience.The plants after the stage of adjustment is not showing signs of suffering and therefore can be considered suitable for such use.

Key Words: Wastewaters, phytodepuration, cyperus papirus

Introduction

The problem of disposing of industrial waste is a subject of constant disputes because of the power polluting the environment. In fact very often you can see streams, rivers and lakes are polluted so as to make it almost impossible to aquatic life and seriously affect the health of the surrounding cultivated areas. The blame for this degradation is commonly attributed to industrial discharging their effluents into waterways regardless of the ecological damage that can provide. It is created in such a way that environmental degradation is depleting the water resources, which until a few years ago seemed unlimited, whether because the surface waters contain higher amounts of pollutants, or because their pollution through the soil, has achieved in many cases even the underground water reserves. Whether the discharges were repaid a little doses in surface water bodies, they could be slowly degraded by aerobic microorganisms present, supported by the presence of dissolved oxygen. Otherwise the pollution load is always very high and the oxygen is insufficient for the oxidation of organic matter for the survival of aquatic species .In this case are involved the anaerobic microorganisms that establish a process of decay with the development of unpleasant odors while simultaneously appears the phenomenon of eutrophication.

The Italian legislation on waste water was low and confused until 1976, when he was adopted and published the law 319/76, known as "Legge Merli". that was subsequently supplemented by the "Technical Standards " and amended by Law 650/79, which provided subsidies for the construction of sewage treatment plants enlarging the powers of municipalities as responsible for most of the tasks performed until that point by the provinces. In 1980 and 1981 were published some ministerial

directives for the regions to which were commited to regulate discharges into sewers and intallations for sewage treatment.

The law Merli and all its amendments have been replaced by the D. Lgs. 152/99, currently in force, which sets maximum limits for a number of parameters that characterize a water discharge such as color, the concentration of lead, sulphides, organic solvents and other substances. These values vary depending on the water body to which it is intended the treated water, in particular, are more stringent for discharges to surface water in relation to the wastes and can be modified by the regions according to local need.

The dairy industry in Campania is a highly productive in terms of turnover and places of employment, but the pollution caused by wastewater from the product is superior to twice that of domestic waste. The milk during the process of dairies production suffers a slow pasteurization followed by the addition of rennet, which determines the coagulation of casein .It is observed as a clear separation between the solid mass, used for the subsequent production of mozzarella cheese, and whey, which is further treated to produce ricotta. After removal of the ricotta the whey waste still contains substances of very high nutritional value, and could be an additional source of income considering other possible uses . The use of the whey as food for animals, particularly pigs, is hampered by the limited pig farms in the Campania territory, unable to absorb the large amount of whey produced each day. With regard to human nutrition the whey has very good properties so it is recommended not only to athletes but also to children, women in menopause and all those people who need a further dose of mineral salts.However till now not yet developed a practical and economic method for its use as an integrator, and various applications are proposed for disposal of this waste to particularly high costs

An innovative method for the disposal of this particular wastewater rich in organic matter is the phytodepuration

Materials and nethods

AOAC methods for determination of COD, organic matter, chlorides, Conductivity meter Crison micron C.M 2200 **(**Crison instruments Srl Lainate-MI) pHmeter Φ 50 at 20°C BeckmanCoulter (Cassina De' Pecchi – Milano Italia)

In laboratory was set up a simple system for the purifying using Cyperus Papirus , plant typical of Mediterranean regions, which grows naturally along rivers ,whose purifying capacity have been highlighted recently by several authors .The benefits that make this species interesting for the purpose of purification are easy availability, cultivation, breeding, excellent placement and environmental landscape, good adaptation to different climatic conditions.

We analyzed three samples of wastewater coming respectively from the manufacture of mozzarella (I, II, III) whose characteristics are reported in Table1. The variability of the values can be attributed to the composition of the milk to start., The sample to purify was obtained by mixing equal parts of the three wastewater

In a rectangular basin of 30 x70 cm well exposed to sunlight have been placed on a layer of 10 cm of soil 20 young shrubs and 10 liters of drinking water. The water level was maintained constant throughout the experimental phase, while stirring the water itself was performed every day to avoid the formation on the surface of a layer of fatty substances. The wastewater was analyzed before being subjected to treatment taking into account parameters such as COD, organic matter, chlorides, pH, conductivity as indices of assessment of purifying plant, as well as total phosphorus and mineral elements.

After a week were initially added 10 ml of serum every 20 days after which we taked a water sample to evaluate the parameters of pollution. The values of these parameters are given in the following graphs (Figs1,2,3)

These initial tests have allowed to evaluate the resistance of the plant in the presence of wastewater. afterwards we increased the rate of serum added, 100 ml every 20 days, and taked a sample of which we explored the various parameters.The values are given in the following graphs (Figs 4,5,6)

Samples	I	II	III
pH	3.90	3.98	4.01
Conductivity mS/cm	16.70	17.78	17.77
Dry weight g/L	42.68	36.6	68.0
Organic g/L	13.52	12.2	11.2
COD mg/L	8000	7218	6627
Na^+ mg/L	370.0	395.0	550.0
K^+ mg/L	875	600	962.5
Cl^- mg/L	2481	2127	2481
Total phosphorus mg/L	870	750	800
%Total protein mg/L	12.37	10.42	10.93
Lactose mg/L	4.6	4.3	4.4

TAB 1 Analysis of wastes

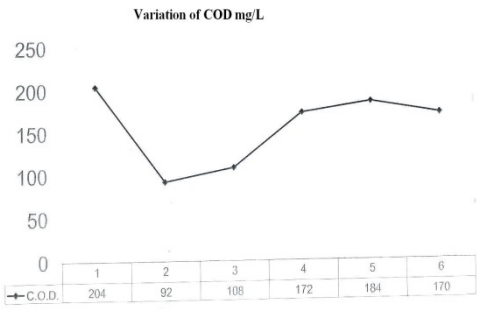

Fig. 1 COD variations

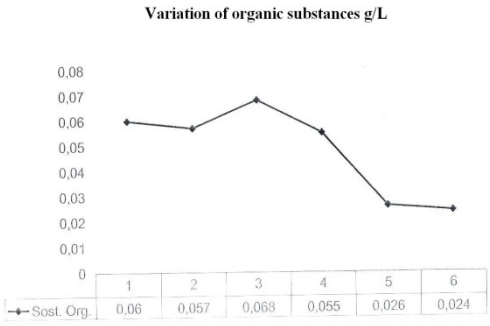

Fig.2 Organic substances variations

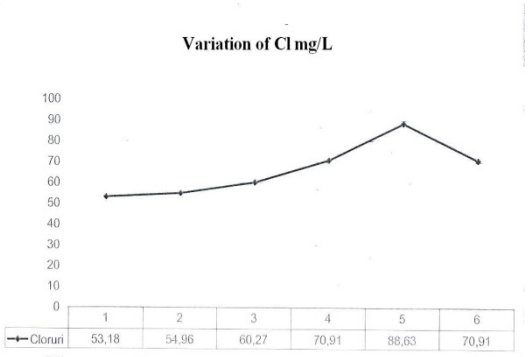

Fig 3 Cl variations

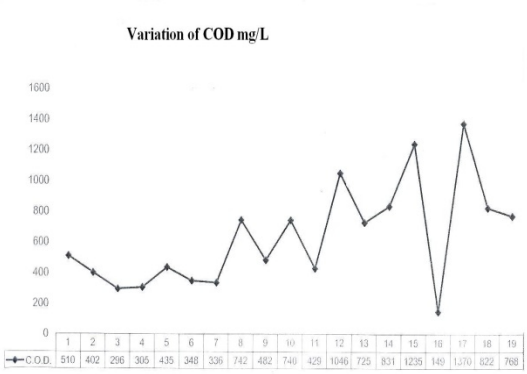

Fig 4 COD variations

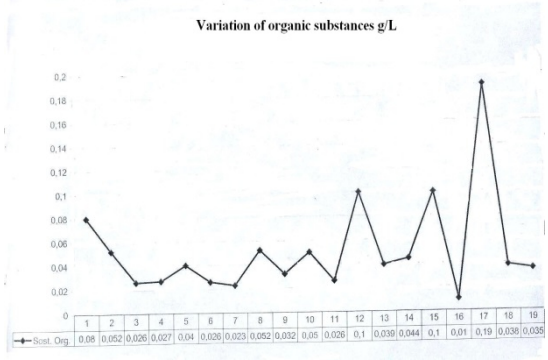

Fig 5 Organic substances variations

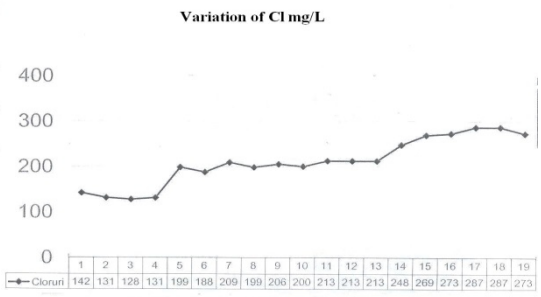

Fig 6 Cl variations

Conclusion

The techniques of phytodepuration can be successfully used for various applications, as installations for purification of waste water, or industrial wastewater depuration, o the rehabilitation

of contaminated sites: their use in any case requires a preliminary assessment to check the adequacy of the chosen system

For each class of contaminants is necessary to discriminate which of the phytodepuration techniques currently known is best suited..

We can be choose between phytoextraction, based on absorption of contaminants radical; phytotransformation, in which contaminants are degraded by the metabolism of the plant; phyto-stimulation or plant-assisted bioremediation based on the stimulation of biodegradation by microbial activity in the plant root zone; phytostabilization, using plants to reduce the mobility and migration of contaminants in soil.

The choice of plants to decontaminate soils and waters, based on the natural capacity of plants to absorb, accumulate and /or degrade, due largely to stimulation of the rhizosphere microflora, molecules in the environment in which they live. The results of research and field testing have demonstrated the applicability of such systems to a broad group of contaminants, including many metals, radionuclides and organic solvents such as chlorinated, pesticides, insecticides and explosives.

The plant species used are usually aquatic plants or highly hydrophilic since those systems are used to purify water. The process occurs through the cooperative growth of macrophytes and micro-organisms associated with them. The plants absorb the nutrients (mainly inorganic sals) present in water to be purified through the roots ; the radical development of the plant species used acts as a coupling for micro-organisms, whose activity is favored by the release of atmospheric oxygen that, absorbed by equipment of the plants is transferred to the roots and released into the surrounding environment. In practice it has a wet ecosystem in which various components plants, microorganisms, soil, solar radiation, contribute to the removal of pollutants

On the process of plant prepared in our laboratory we can make some considerations. After an initial phase during which the plant selected has shown the difficulty of adaptation, as shown in the graphs by a descent of the initial values of the parameters considered, we could record a good performance with the advance of time.

In particular, the activities of the plant compared to the COD and organic substances is very high, thanks to the constant oxygenation provided by the continuous movement in the basin

For the chlorides, however the activity of plant was initially reduced, until to reach an almost constant trend.

Note that there are no such phenomena of eutrophication due to the ability by this plant to absorb phosphorus, which is responsible with the nitrogen of this phenomenon.

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