WASTEWATER TREATMENT PROCESSES DERIVED FROM ELECTROPLATING

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Abstract

The paper focuses on the effectiveness of treatment technologies applied to wastewater from electroplating processes. They monitor key quality indicators of WWTP effluent before discharge into the sewerage system of the city. Indicators monitored were copper, nickel, zinc and total cyanide.

Keywords: wastewater, electroplating, galvanochemic

INTRODUCTION

In the current conditions of industrial development, when they were covered almost all sectors of economic activity and even some sectors of social activity, activities that harm the environment, be abandoned even if they are effective in the business, because globally are harmful to society . The industrial development of recent decades worldwide has increased wastewater pollutant load hard to remember the classical technologies. Romania was declared the European Union as a sensitive area and the more it requires a high degree of purification wastewater, both industrial and municipal. Romania's Strategy of joining the European Union implies a need to address issues of environmental protection by upgrading existing technology, by making and commissioning of new installations, performances and by providing services tailored to environmental requirements [Davis, M., s.a., 1998].

By using modern technology treatment (application of physical-chemical methods of water treatment, use of combinations of biological filters) microtreatment plant construction, can achieve significant reduction in the amount of sludge resulting from purification, efficient use of existing gaps increase reliability and simplify maintenance[Anderson G., Donnelly, 1978 , Antoniu R., 1987].

Galvanochemical purification method was patented in 1975 in Russia, where research has continued industriously. Later, the process was studied and began to be applied in the U.S., Germany, France, Greece. Research has established the theoretical foundations of the process by which different versions were developed technology and have been designed, constructed and used in practice a variety of models of machines. However, no currently not fully understood all the mechanisms of the phenomena involved in the process, they remain subject, aiming at as to achieve a purification process to ensure a closed cycle of water use.

MATERIAL AND METHODS

In Faist Mekatronic ltd. water is used for industrial and hygiene and health purposes.

Wastewater resulting from use by:

- industrial waste water - of the technological process of metal coating
- waste water - from T\toilet facilities
- water cooling

Technological waste water resulting from the use SC Faist Mekatronic are harmful to the aquatic environment with members high concentrations of heavy metals and cyanide. Before being discharged trough septic trucks, these waters are subject to physical and chemical treatments in order to meet the treatment and quality under the conditions imposed by the Government Decision no. 352/2005, NTPA 002/2005, concerning the conditions of discharge of water from city sewage.

Wastewater treatment plant of Faist Mekatronic Ltd. is built to purify waste water from electroplating process and includes:

- water collecting tank containing copper cyanide;
- water collecting tank containing cyanide silver;
- basin for collecting water by chemical nickel;
- two pools post oxidation, semi buried;
- basin mixing, two pools for oxidation cyanide in water (copper cyanide and silver cyanide);
- pool acid medium coagulation of colloidal substances;
- water tank for neutralization / precipitation;
- flocculation basin;
- quickly settling lamellar type;
- final pool for control and correction of pH;
- two filter columns: one with quartz and one with charcoal.

Process wastewater from sewage applied metal coating process (electroplating) is the physical-chemical type. It is the removal of pollutants in waters subject to treatment by using specific chemical reagents, mixed with water collected in pools of reaction, allowing insolubilizarea pollutants and achieve clean water.

Sewage flow is achieved in three steps. The first step of treatment is achieved for cyanide oxidation and chemical precipitation of nickel.

Removing cyanides from water basically consists in the oxidation of cyanide CN- comp-cyanates, they are much less toxic, using sodium hypochlorite as oxidant. Oxidation reaction occurs in two phases, as follows:

$$CN^- + ClO^- + H_2O \rightarrow ClCN + 2\ OH^-$$

$$ClCN + 2\ OH^- = CNO^- + Cl^- + H_2O$$

The reaction is instantaneous and is controlled by the redox potential measuring instrument, is very slow at pH less than 9.5, with a high speed response to a pH above 10.5, reducing reaction time to about 20 minutes. With an excess of sodium hypochlorite, cyanide transforms in nitrogen and carbon dioxide:

$$CNO^- + ClO^- + 2H^+ = 2CO_2 + N_2 + H_2O + 3Cl^-$$

The reaction takes place in a reasonable time (15-30 min.). When the oxidation reaction takes place properly, the water presents an intense blue color and if it reaches beyond state cyanogen color is green.

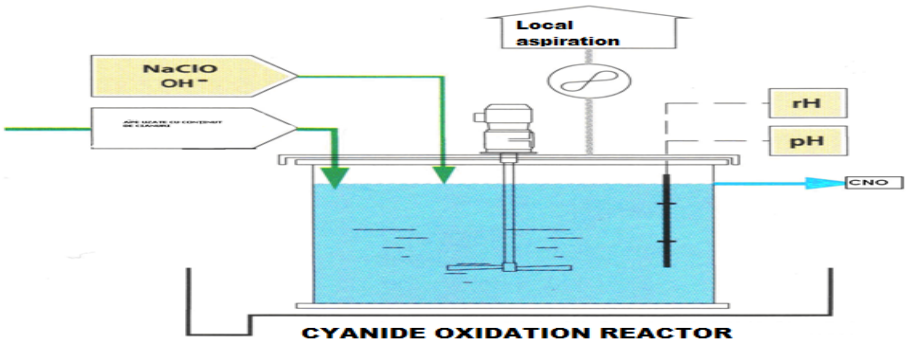

Fig.1. Reactor oxidation of cyanide waste water[Paracchini L., s.a., 2004]

After the primary treatment, oxidized laden waters are discharged into the mixing basin, where the wastewater with wastewater from other parts of the treatment of electroplating process is relaunched by stage treatment by coagulation-neutralization-precipitation-flocculation .

In this stage envisages the retention of heavy metals and anion in water. At the end of this stage, water is separated by decanting pollutant factor. The third stage envisages increasing treatment efficiency of sewage water treated by filtration with quartz filters provided to retain any flakes of mud which were decanted.

Activated carbon filter is designed to retain traces of oil and organic matter, increasing the quality of purified water.

Clarified and clear purified water is transferred to septic pools and mud containing pollutants from the process are intended to destroy, after a pre-compaction.

Monitoring parameters of purified water from SC Faist Mekatronic Ltd. was achieved by analysis of nickel, copper, zinc, cyanide in the laboratory [Documentation SC Faist Mekatronic SRL].

RESULTS AND DISCUSSION

Results of tests carried averages of indicators of water quality Ni^{2+}, Cu^{2+}, Zn^{2+}, CN^-total, are presented in the following table.

Table 1.

Concentration of main parameters

Ianuary 2009	**Ni^{2+}** (mg/l)	**Cu^{2+}** (mg/l)	**Zn^{2+}** (mg/l)	**CN** (mg/l)
1	0,39	0,07	0,31	0,25
2	0,41	0,15	0,45	0,64
3	0,75	0,2	0,68	0,8
February 2009	**Ni^{2+}** (mg/l)	**Cu^{2+}** (mg/l)	**Zn^{2+}** (mg/l)	**CN** (mg/l)
1	0,71	0,11	0,63	0,57
2	1,05	0,25	0,87	0,71
3	0,84	0,05	0,7	0,22
4	0,52	0,12	0,89	0,68

March 2009	**Ni^{2+}** (mg/l)	**Cu^{2+}** (mg/l)	**Zn^{2+}** (mg/l)	**CN** (mg/l)
1	0,31	0,1	0,46	0,15
2	0,58	0,03	0,63	0,49
3	0,51	0,16	0,49	0,77
4	0,73	0,07	0,82	0,35
April 2009	**Ni^{2+}** (mg/l)	**Cu^{2+}** (mg/l)	**Zn^{2+}** (mg/l)	**CN** (mg/l)
1	0,9	0,15	0,86	0,37
2	0,64	0,17	1,06	0,83
3	0,71	0,36	0,96	0,88

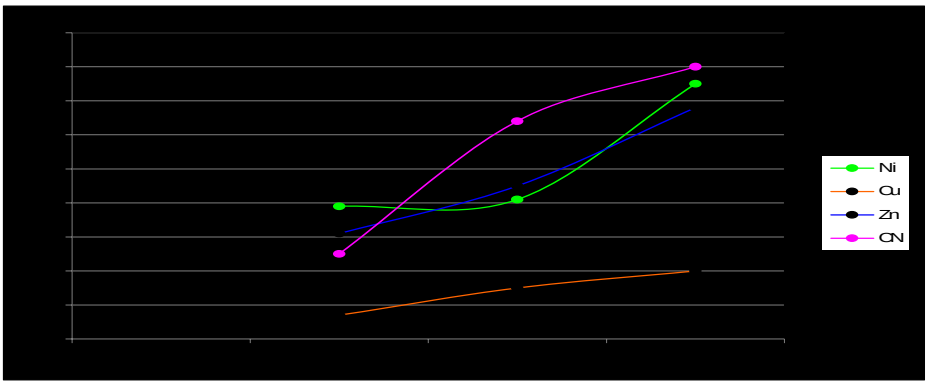

Fig. 2. The test results monitored in January 2009

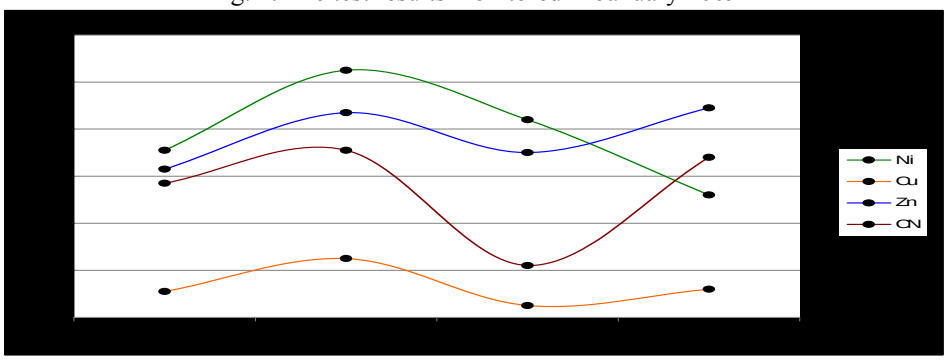

Fig. 3. The test results monitored in February 2009

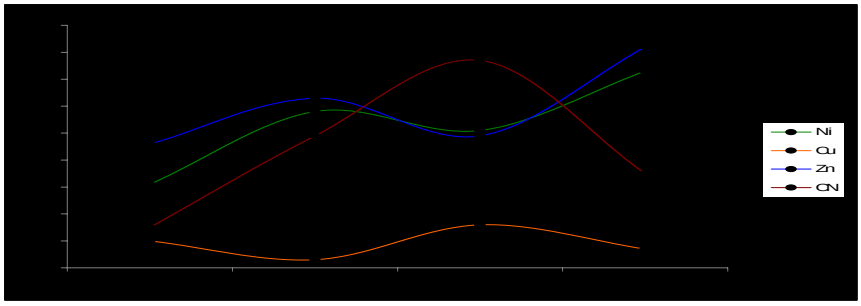

Fig. 4. The test results monitored in April 2009

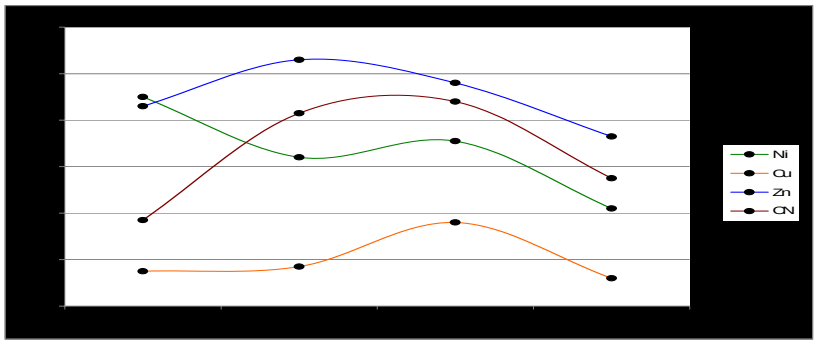

Fig. 5. The test results monitored in March 2009

CONCLUSION

It was found exceeded the maximum permissible concentration in February, the indicators of nickel and copper, exceeded the permitted maximum concentration in April, and the indicator zinc and copper indicator to third week which required corrective action by recycling treated water to mixing pool to be retreated.

The main advantages of this method of sewage treatment are:

- ensure the removal of most toxic components, including non-ferrous metal ions, organic contaminated etc.;
- allow cleaning harmful components, empowering cvasiintegrale wastewater recirculation;
- reduces overall salt content (a water desalination), allows recovery of useful elements, the ions precipitate purged;
- purified water reuse can in the process after a pre-filtration through quartz and activated charcoal filter, or after filtration through membranes.

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