Research on the Implementation of Cleaner Technologies for Obtaining Chemicals, in Relation to the Environment

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Any technological process, through his specific, generates pollution in the environment, which ultimately has both short term but mainly long-term, harmful effects on human health. Today, when the technological degree is high in almost all areas of activity, it is impossible to completely avoid damage to the environment caused by the impact of technological processes, but it is possible to find some actions, having an effect towards reducing the negative impact in the sense of obtaining clean technology. Cleaner technology is, on the one side a goal pursued at international, european and national level, and on the other hand is a concept that covers many aspects of both the actual economic activities and of the environmental protection. This paper aims is on the one hand, to show how a tehnological process should be analyzed by highlighting the relationships between elements of the industrial process, according to some scheme, precisely in order to obtain so-called „clean technologies and on the other hand in the specific case of chemical pollution, to present most used evolutionary models on a chemical production forecast.

Keywords: pollutants, chemical contamination, air ourification, toxicity, rainwater

Cleaner technology is a concept that covers many aspects of both economic activities, themselves and the environment protection field.

It may be mentioned as examples of components, these aspects:

- reduction of the dangerous substances and waste;
- a good working environment, both in the establishment and in the adjacent area;
- reduction of the waste production;
- reduced pollution at the level of the best technology;
- reduction of the consumption of the fossil fuels and other natural resources (water);

Analysis of a technological process must start at highlighting relationships between elements of the industrial process.

For the obtaining of the *clean technologies* environmental policy is the driver for implementing an environmental management system, that would maintain or analyze environmental performance in a geographic area.

Assessing the impact of industrial technology and development, it is important to protect human health and the environment and continuous improvement of working methods, can make this process improvement more accessible, more effective and more efficient [1, 2].

In general, the determination and environmental impact analysis of a technological process, is very difficult to achieve, [3-5] because:

- the impact is different depending on where the determination is made, however, with many factors contributing to a very different distribution of the pollutants in the environment;

-there are many elements of impact (dust, micro-powders, dusts, fumes, gases, volatile organic compounds, ozone, hydrocarbons, persistent organic pollutants, suspensions minerals, etc.) that occur during the course of a technological process, which are more difficult to determine, whether they are in small quantities, whether it requires special sensors;

-there are many factors that influence the technological process, which differs from process to process, from the technological equipment to technological equipment, from the technological method to technological method, from the nature of workpiece materials and ending with the test, trial and commissioning;

-there are many technological processes used in a process, which differs substantially from one another and should be considered separately and cumulatively, depending on how is doing the environmental impact analysis;

-it is difficult to establish with precision the equation of mass balance to compute the index of environmental quality, because it can not be made a universal and complex stand, for determining the impact of all factors at once and the concentration that contains them during the course of the technological process and after conducting the technological process;

-the computing relations established in a case are difficult to generalize, because all parameters of physical, chemical, mechanical, electrical, technological, biological and climatic factors, which contribute to the achievement of equipment used in a in a particular area, are into a dynamic most often, unpredictable;

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-it is difficult to find an inclusive mathematical function encompassing all the phenomena and changes that occur during the technological process, enabling than the optimization of the technology process, in terms of a minimum coefficient of pollution or an maximum environmental quality indicator;

Forecast production of a chemicalm is especially necessary for makingdecision,regarding the creation of new production and marketing of products, taking also into account the so-called *cleaner technologies* in relation to the environment.

In terms of the evolution of the chemicals,the level of the production are divided into two main groups:

-product with broad spectrum of uses, with the continued growth of production levels. This group includes basic chemical products used in many economic sectors, which is conducted on an industrial scale for a long time and for that it sees an obsolescence: organic acids, chlorine products, vinyl monomers, cement etc.;

- narrow-spectrum products of uses, for which the production evolutionlevels of different types is cyclical. This group includes products with very specific applications, specific and familiar phenomenon of obsolescence. As a result, various kinds are regularly replaced with the others, having either a higher-value or lower cost: drugs, dyes, textile auxiliaries, photographic materials, cleaning agents, etc.

Experimental part

The analysis of a technological process, must start at highlighting relationships between elements of the industrial process, according to the diagram in figure 1.

In analyzing the schema, should be left to the fact that the gold of the cleaner technologies is to reduce the energy use and materials and to improve the conditions for people and the environment.

This means it is important to diminish the following:

-the resource consumption

-the impacts on human health

-the environmental impact.

These statements can be found in EU policy and action program on Environment and sustainable development, which is characterized by the following requirements:

-provides availabl resources permanently (avoid the exhaustion);

-preserves the high quality of life (harm avoidance);

-prevents irreparable damage to the environment (avoiding negative impacts).

Today it is not possible to completely avoid environmental damage due to human activities. However, it is possible to find some actions which have a significant effect on these conditions in order to reduce the negative impact.

To a large extent, the effects are linked to the entries and exits of production and consumption processes. Thus, figure 1 illustrates the relationship between the industrial process and in figure 2 are played only the relationship between inputs, processes and outputs. We can thus see, the influence of parameters [6,7].

An analysis of these flows is important and can indicate for each technology, the following aspects:

-the current consumption of the resources;

-the level of these consumptions compared with those consumptions that are carried out in the *best technology possible or available*

-the possibilities to reduce this consumption;

-the amount of emissions and waste liquids and solids made;

-the level of these amounts compared to those amounts made in the *best technology possible or available* and the opportunities to reduce these amounts.

To have an overview, is convenient the classification of environmental impacts and human beings, in the different categories and topics, according to table 1.

The main topics are the same as those in the EU program. We find at the next level, the inputs and outputs from figure 2. Human impacts, are divided into three topics and environmental impacts are also divided into three topics. For the last level are chosen some examples. For two and three levels, it is possible to choose other subjects that are relevant to different situations.

As shown above, the choices must be made in processing, and the elections will influence the product's environmental impact throughout the product life.

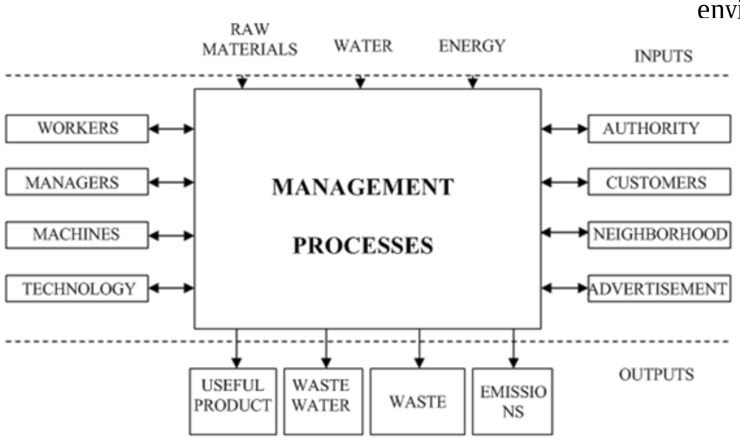

Fig. 1. The relation between elements of industrial process

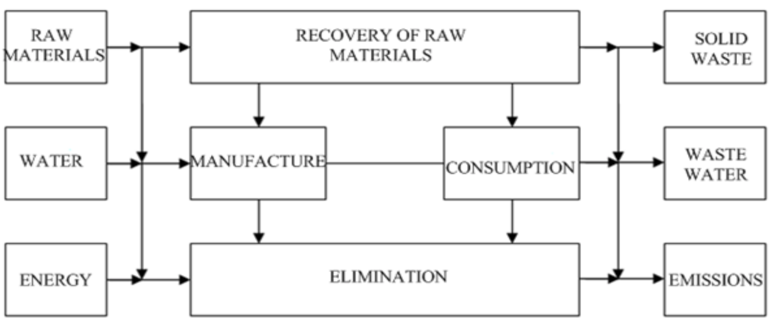

Fig. 2. The relations between inputs and outputs in the production and consuption processes

MAIN TOPIC	COMPONENT TOPIC	SINGULAR TOPIC
CONSUMPTION OF RESOURCES	ENERGY	RARE, IRRECOVERABLE
		ABUNDANCE, IRRECOVERABLE
		RECOVERABLE
	RAW MATERIALS	RARE
	WATER	UNDERGROUND
IMPACTS ON HUMAN HEALTH	BIOLOGICAL	NEUROTOXICITY
		ORGAN TOXICITY
	PHYSICAL	NOISE
	PSYCHIC	RADIATIONS
ENVIRONMENTAL IMPACTS	GLOBAL (AIR)	CLIMATIC CHANGES
		GREENHOUSE EFFECT
		DAMAGE TO THE OZONE LAYER
		GROUNDWATER
	REGIONAL (WATER)	ACIDIFY
	LOCAL (SOIL)	LOSS OF SPECIES
		ACUTE TOXICITY
		CHRONIC TOXICITY
		CENOTOXICITY

Table 1
THE CLASSIFICATION OF ENVIRONMENTAL IMPACTS AND HUMAN BEINGS IN DIFFERENT CATEGORIES AND TOPICS

Results and discussions

When preparing a prognosis, frequently, the production level of a chemical is related only with the time as the independent variable. For this purpose, based on known data on production levels until it has been done the prognosis we can deduce its evolution general tendency, the prognosis being an extrapolation of this trend in the future.

The phenomenon quantitative approach, requires the expressing of the trends in the form of a mathematical model, whose statistical accuracy verified on known data, gives a high degree of confidence compared to simple graphical extrapolation of these data.

For the two groups of chemicals,can be used different types of mathematical models that take into account the various trends that may occur in the evolution of various chemicals production.

In the case of broad-spectrum products, the mostused models shown schematically in figure 3 and figure 4, can be grouped into two categories:

Without saturation limit

a) linear model:

$$N(t) = a + bt \qquad (1)$$

b) parabolic model:

$$N(t) = a + bt + ct^2 \qquad (2)$$

c) exponential model:

$$N(t) = ab^t \qquad (3)$$

-With saturation limit

d) linear model with saturation limit:

$$\begin{cases} N(t) = a + bt; & t < t_{dat} \\ N(t) = K; & t \geq t_{dat} \end{cases} \qquad (4)$$

e) logistic model, described by a large number of equations in the literature; one of the most used is:

$$N(t) = \frac{K}{1 + e^{a-bt}} \qquad (5)$$

The notation used in the equations (1) to (5) have the meanings:

N is thelevel of the production (dependent variable);

t -time (independent variable);

a, b, c- the models coefficients;

K –the maximum foreseeable level of the production (for market saturation for the product concerned).

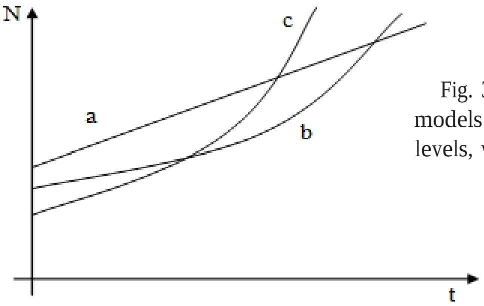

Fig. 3.The evolution models of the production levels, without saturation limit

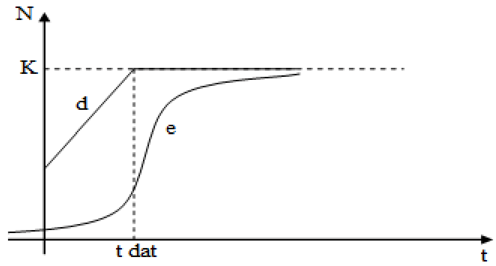

Fig. 4. The evolution models of the production levels, with saturation limit

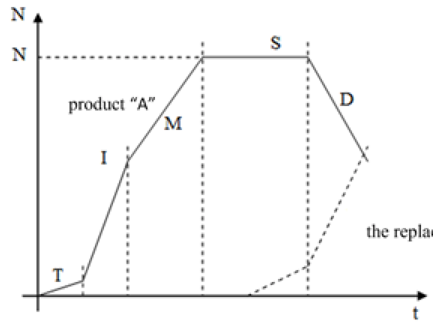

Fig. 5. The cyclical evolution model of the production level

For narrow-spectrum products,the products developments is cyclical and goes through a series of phases as shown in figure 5.

T is the product testing on the market, characterized by the slow growth and the low level of the production;

I –the imposition of the product on the market (fast growing);

M - the maturity of the product (slow growth but high level);

S - market saturation with the product;

D - decline of the product (rapid decrease in production due to the imposition of a substitute on the market).

From the curve shape, can be observed that the logistic model, can describe the evolution of the production of a chemical with narrow-spectrum usage, restricted to the phase of market saturation and determines the maximum level of production.

For developing the production prediction for a chemical is required following completion of steps [1]:

Data colection regarding the time evolution of the production level of that chemical; for chemicals of great importance that data can be obtained from statistical yearbooks, monographs and encyclopedias and for other products from specialized magazines (chemical engineering, with technical-economic nature, etc.);

Data validation it's necessary especially when data coming from different sources using different units of measure and often have different degrees of confidence; it is about the elimination of the values that appear as single, entirely different from the others;

Identification the type of the production development - acyclic or cyclic - and choosing the most appropriate mathematical model for the character of that evolution - linear, exponential, logistic etc.The working tool is the graphical representation of data regarding the production development level in time, but a great role in this stage is the experience and intuition of the person that examines of the problem.

Solving the mathematical model, respectively setting numerical values of the mathematical coefficients of the model is made taking into account the available data on the evolution of the production level, or analytically (for cases of simple models such as the growth linear, exponential or logistic) or using methods of numerical calculation for more complicated models such as the polynomial models and logistics. An important consideration for the process of developing of prognosis in general, but very important in this stage is the minimum number of values for the production level that can give plausibility for the prediction: for m coefficients of mathematical model is required minimum $(m + 1)$ level of the production values; practically not used less than five values, usually over seven values.

Verifying the correctness of the model;

Statistical calculation methods (analytical or numerical) used to solve the chosen mathematical model, almost always make it possible to obtain numerical values of its coefficients. It is however necessary to check how the model describes the evolution of the level of production or in other words the accuracy or adequacy of the model. It is about, in principle, by comparing data calculated by mathematical model comparing data at different times with the initial data from which was started at the same points in time; This comparison can be done using statistical tools - reliable tests, standard deviation, coefficient of variation - but usually is sufficient to examine the percentage deviation of calculated values from baseline data, for any moment:

$$\frac{calculated\ value - value\ date}{value\ date} * 100 \epsilon [-10; 10] \quad (6)$$

It can be considered that the model chosen is correct and can move on to making the prediction. Otherwise it is necessary to repeat the step 3 and select other mathematical model. It is worth mentioning that in adoption the decision on the correctness of the model should be considered the differences tendency between the date values and calculated values.

Making the prediction is to calculate values of the production levels attributing in the next period, the suitable values of the independent variable. Such calculated production levels only reflect the trends in the previous period from which were derived the initial data. Of course, that in any prediction, these calculated values are likely not absolutely certain becouse as to them it will manifest the influence of a number of factors not take into consideration in the prior period (with random or incidental influence) and other unknown future factors,. The time for which the prediction is made , can not exceed, according to the expertise, 1/3 up to 1/2 of the period covered by the initial data.

Conclusions

Today it is not possible to completely avoid environmental damage caused by human activities. However, it is possible to find some actions which have a significant effect on these conditions in order to reduce the negative impact. The effects are related to the inputs and outputs of production processes and consumption.

The aim of *cleaner technologies* is to decrease the use of energy and materials and to improve the conditions for people and the environment. This means, that it is important to reduce consumption of resources, the human health impacts and the environmental impacts.

The analysis of the relationships between elements of the industrial process and the analyze of the relationships between inputs and outputs of the production process, can be made for each technology separately and may indicate: the values of resource consumption compared with the best available technology, the possibilities for mitigation and the emissions and waste quantities of liquid and solid results, compared to the amount of technology that made their existence better.

Ultimately, to have an convenient overview, it is convenient the classification of environmental impacts and human beings in different categories and topics.

For developing the production forecast for a chemical, is required following completion of steps: data collection, data validation, identification of the type of production development, solving mathematical model, verifying the correctness of the model and forecast performance.

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