TECHNOLOGY OF WATER TREATMENT IN LATIN AMERICA

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For many years most of the Latin American countries have been applying a diversity of foreign technology in the field of water and wastewater treatment. Unfortunately, almost all of this technology was taken from highly industrialized countries, all of them located in temperate climates in which the problems to be solved are radically different from those present in our region. Also, because of the idiosyncracy of people from those northern countries which together with their socio-economical and cultural patterns are radically different from ours.

During the last decade, however, a new way of thinking to this respect by the Latin American sanitary engineers have been genraeting a new technology for a better approach to the problems related with this field of water treatment.

The new knowledge is being produced, not only through applied re search, as it is in most of the cases, but also through basic research wher information is not available to develop variations to the conventional processes ammpiel in this field of water treatment.

It was been found that many of the unit operations and proceses involved in the stabilization of wastewaters and in the purification of potable waters, should be studied deeply in order to determine the degree of variability to which these treatments are susceptibles as to obtain a maximum o benefit under our climatic conditions.

So, to take into account the magnitude and variabilities of many of the design parameters values related with this matter in areas of the world, ir which the high temperature prevailing in the environment all year around make significative differences in relation with the values generaly reportec for temperature countries.

Also, because the marked different characteristics of the domestic sewage discharging from our sanitary systems. In this, the quite, different concentration of some ions present in clear waters as we will further discuss, and because of the limited facilities available to construct and to operate the water and wastewater treatment plants.

Finally, also, because of the limited economical posibilities that our countries have to design and to construct, the sofisticated treatment plants, usually built in many of the high industrialized countries.

It is of great interest to mention that our natural resources are, generally, very limited in order to be used for example, to manufacture the equipment, materials and chemical products that are frequently used in this field.

The above facts, together with the circumstance that our countries until recently, have not had a real background related with the neccesary scientific research needed in the area of the water treatment processes. Because of that it, was not possible to develop an autochthonous technology adapted to our prevailing regional conditions.

This has led Latin American universities together with international intergubernamental agencies such as the Pan American Health Organization the regional office of the World Health Organization for the Americas - to start working to develop a new technology by carrying-on experimental work, basically directed to obtain information for a better applicability of the well known foreign technology in this field of the water treatment, in order to simplify most of the conventional processes traditionally adopted by many of the Latin American countries.

To illustrate what has been said, allow me to present some cases, all of them restrained to my field of specialization, that of water and wastewater treatment plant design.

OUR TECHNOLOGY

To start with, I will make some further commentaries about the characteristics and composition of water and sewage existing in our region.

The frequent high iron content of deep well waters used as sources of water supply for rural areas and for small communities, for example, has forced us to develop or to apply various techniques to remove the high excess of this element, through quite simple and economical operating devices.

First, to oxidize the ferrous iron salts through very simple aeration towers built in place with available materials or to oxidize the ferrous com-

pounds applying the chlorine used for desinfection of the water. In this last case, the water pressure of the discharge pipe of the deep well pump is used to produce the necessary vacuum pressure to inject an hypochlorite solution into the water pumped from the fell.

Then, the removal of the ferric compounds formed during the indicated operation is accomplished, either by a "gunnite" finished excavated sedimentation tank, or by pumping the water going into the elevated storage tank through a pressure filter installed in the aduction line connected to that tank. The elevation of the tank and the pipe size of this interconnecting line, is design in order to get a satisfactory wash of the filter unit under operation. In this way, it is possible to simplify the operation of the system and at the same time to reduce the construction cost of this treatment unit.

When pressure filters are used for the final removal of the ferric iron salts, a very simple device is used to determine the optimum rate of filtration for each particular operation. A short piece of pipe, four or six inches in diameter, is filled with supporting gravel and the proper size and uniformity of sand proposed for the filling of the filter beb units; and a field experimen is then conducted to find out about the maximum velotion of filtration tha could be applied for the optimum operation of the water filtration installation.

In some other cases the ferrous iron is oxidezed through a hydraulic rapid mixing channel, designed to produce a high turbulence of the raw water going undertreatment. The floculation basin is also designed using the hydraulic energy of the water, to obtain a building up of the microfloc formed during the mixing operation. A touch of lime, in many casses, has proved to be of a great help in the formation of a heavy floc that could be easy to separate, during the settling period of the flow through the sedimentation basin that follows this operation.

The posibilities of developing economical industrial processes to manufacture natural macromolecular polyelectrolytes is being studied to act as coagulant-aids in order to promote a better flocculation of water, through the growing of the microflocs into a more resistant and setteable macrofloc latex.

High rate sedimentation technique have been lately applied for the design of clarification basins. In these cases, parallel sheets of asbestos-cement placed some 45° to 60° inclination with the horizontal, have been used with very satisfactory results in the operation of this laminar settling of the suspended solids to be removed. The high reduction of the volume required for the tank, together with the simplicity of the its construction works

makes this design satisfactory for many of the treatment plants now being built.

This helps to avoid mechanical devices, a fact that is important for the small and medium sized treatment plants located in some countries where skilled operators are not available or where economical considerations are mandatory.

Rapid filtration units have been quite recently operated through a very interesting modality. The one so called "declined rate", in which the positive filtering head is reduced during the filtration period of the unit. The increasing loss of head of filter, consequently, produces a reduction of the velocity of the water been filtered. No problems related with the quality of the treated water have been observed. This operation markedly reduces the filtration equipment conventionally used for these devices. This arrangement, of course, simplifies operation of the units and at the same time reduces the corresponding cost of construction, because regulation equipment is avoided and the washwater tank is not required. The filter bed in this case is washed with the water stored in the other filter units. The available head to carry on the washing of the filter bed is supplied, also, by the head of the water available in the other filter units.

Typical arrangements of this kind are available at the CEPIS Office (Centro Panamericano de Ingeniería Sanitaria y Ciencias del Ambiente) located in Lima, Perú, where a group of researchers are working to develop a new technology in this field of water and sewage treatment.

It is also of interest to mention that a very low effluent turbidity is not generally required in most of the cases, particularly, for filters operating to supply potable water to rural communities and small medium sized towns.

This above arrengment makes possible also to design filter units with a different concept as far as to granulometry of the filter grains, rate of filtration through sand beds and some other parameters concerned.

Coming back to the field of wastewater treatment, a through study of sewage characteristics and climatic conditions have been giving us, a very useful information related with the performance of some of the conventional and traditional processes used in the field of sewage treatment.

First, as far as BOD is concerned, it has been demostrated that the proportion of carbohydrate to proteins in our typical sewage, is much higher than the corresponding one indirectly reported for temperate countries. This, because the food diet of man in the northern countries is markely different from the one of our tropical countries. This, or course, result in a higher

biodegradability of the organic matter present in the sewage produced in our region. This circumstance, together with the higher temperature of sewage produces higher values for the so called dioxigenation constant that governs the rate of oxygen uptake from the liquid. As a result, a shorter time is required for the first stage BOD to be exerted, and the values of 5 days 20°C BOD used for design purposes, represents a higher percentaje of the first stage values of the carbonaceous matter present in sewage.

More over, the temperature of water as such is directly related with its kinetic viscosity and this with the settling velocity of particles present in water. This circumstance, produce an increase of the displacement velocity of the suspended matter to be removed during the clarification process, to allow for a much higher overflow rate value to be adopted for design purposes, when dealing with water and wastewater treatment separation units.

At the same time, the influence of the easier biodegradable organic loads applied to biological reactors such as aereation tanks, tricking filters or lagoons, produces a much better performance of these mentioned sewage treatment units.

Also, the amount of a per capital water conssumption produces a more concentrated sewage as far as BOD, COD and suspended solids is concerned. This circumstance is, therefore, markedly reflected in the performance of the so-called standard and high rate activated sludge and trickling filter systems for the wastewater treatment stabilization processes.

Another example about this matter is the one related with the "Standards for the quality of River Waters". In this case, it is important to take into account, for example, the sensibility of our autochthonous higher river fauna, specially as far as dissolved oxygen is concerned.

The prevailing fish species in our tropical countries tolerate a very low dissolved oxygen concentration content of the water. So, an smaller minimum concentration of this element could be acceptable when setting the standards for river water pollution control. At the same time, it is important to take into consideration, the higher average temperature of our continental waters which in fact, is reflected over the saturation concentration of oxygen in water. At 30°C, for example, a saturation value of 7.63 mg/l of oxygen should be compared with the corresponding value for 10°C which is 11.33 mg/l.

It is of great interest to talk now, about the increasing utilization of the so called "sewage stabilization lagoons' as a wastewater treatment process, very much used today in many areas of Latin America. The low cost and the easy characteristics of operation of these units, make it possible to

construct sewage treatment plants at very low prices, if we compare their initial cost with that of conventional treatment systems.

The area required for these reactors do not represent a real problem in our region, specially when they are built in rural areas or near small towns where the price of land is not a limiting condition. This is even more so, in the case of the utilization of the so called high rate photosynthetic lagoons, in which case the advantage becomes more clearly understood. This is due of course to the higher visible light energy values present in our latitudes.

The anaerobic digestion of sewage sludge is another interesting item to be considered here. Due to the prevailing higher all year round temperatures, it is possible to get - under some particular circumstances - a shorter retention period for the reactions to take place in these installations. More over, it is possible to concentrate the infrared rays of the sunlight, to raise the temperature of the sludge undergoing digestion.

The air drying beds used to further reduce the water content of the sludge - for the reasons already mentioned before - can be designed requiring a much smaller area.

In relation with the disinfection of potable waters, it is of interest, finally, to point out the following:

In our tropical area, one of the health problems associated with the mechanism of disinfaction of water is the one related with the presence of pathogenic protozoa (E. hystolytica) and trematodes (S. mansoni) that are, indeed, much more resistant to the action of chemical desinfectans such as chlorine, iodine and their compounds, generally used in this treatment operation of potable water. It is still under study, the possibility of using iodine compounds instead of the tradicional chlorine compounds, to disinfect water in areas where the bilraziasis and amaebiasis are endemic.

Based in what has been said during this tock we may conclude that the technology of water and wastewater treatment in Latin American countries, present today a very positive reorientation toward a bttter understanding and utilization of our own particular existing facilities.