Optimizing Air Flow Instilled in an Aeration Pool

Prof.dr.eng. **Mariana PANAITESCU**[1], Prof.dr.eng. **Fănel-Viorel PANAITESCU**[2]

[1] Constanta Maritime University, panaitescumariana1@gmail.com

[2] Constanta Maritime University, viopanaitescu@yahoo.ro

Abstract: *The experiment is considering a case study for two municipal wastewater treatment plants that have been equipped with a new control system over a period of 10 months: 1) The experiment was carried out in parallel and the same conditions for water treatment on installation A and installation B, (experimental group) and 2) experiment on another pool with aeration controlled by the classic method (reference group). Both methods have been tested beforehand. Various cases have been studied during the experiment, corresponding to the main ways of controlling the aeration process. The values chosen for aeration control parameters are common values used in these cases.*

Keywords: *Flow, wastewater, treatment, plant, aeration, control, parameter, air, flow, algorithm.*

1. Introduction

The experiment has in mind a case study for two installations of municipal wastewater treatment plants which were equipped with a high-performance control system (experimental group) (Figure 1) [1]. The experiment was carried out over a period of 10 months, as follows:

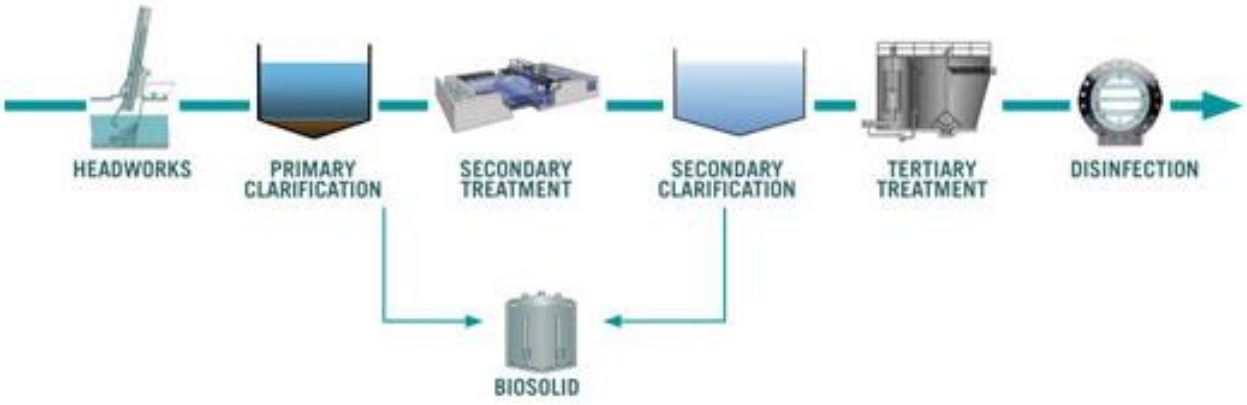

Fig. 1. The flux of municipal wastewater treatment plant [1]

- experiment was conducted in parallel and to the same conditions of water treatment plant, both on the aeration tank from wastewater plant A and on B using the process control system performance (experimental group) and
- experiment on another aeration tank with controlled aeration the classic method (reference group).
- both methods were tested (Figure 2).

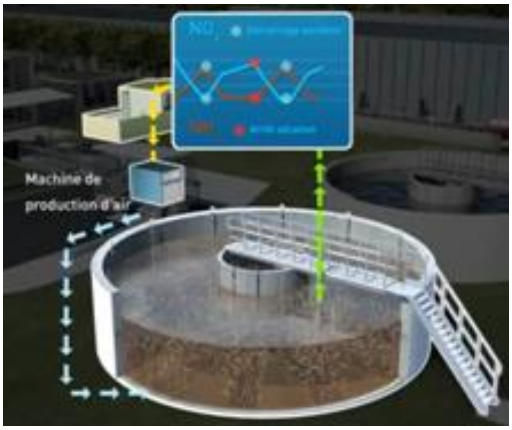

Fig. 2. The experiment on the aeration tank

2. Material and methods

The equipment is composed of: electrodes are sensitive to ions (ISE) for ammonium nitrate (VARiONPlus 700 IQ WTW), a controller with programming logic (PLC-based on a patented algorithm aeration).
Doses of ammonium and nitrate were checked weekly to assess the estimated value of online sensors.
Energy consumption has been expressed through the "rate of electricity consumption (kWh)/day/treated water (m^3)/day.
The goal of the experiment is to shape the movement of air injected into the aeration basin with the possibility to optimize the air flow by adjusting the breathed it.

2.1 Injection of constant air flow versus variable air flow

Aeration can be carried out using air blowers equipped with a speed regulator. In this case, it is possible to adapt the air flow according to the amount of pollutants to be removed. In the present study, by adding a controller, decreases the amount of air provided by approximately 30%, leading to better air management required for operation (Figure 3).

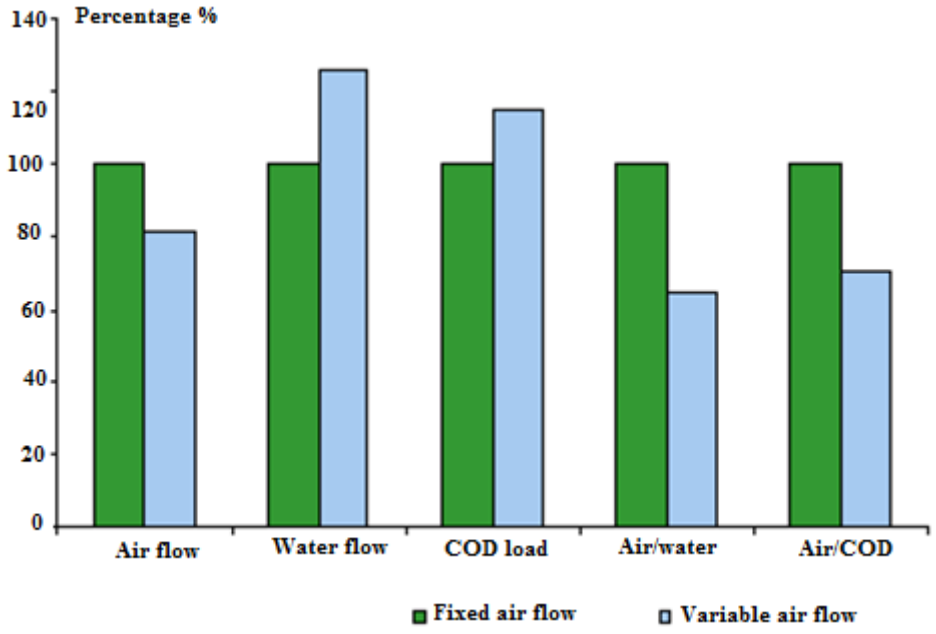

Fig. 3. Comparative power supply with constant and variable air flow [1])

2.2 Optimize air flow control through ammonium sensors/nitrates online

In this case, a group is controlled by a conventional programme in which the air flow is variable and the other is controlled by a programme [2], based on the monitoring of ammonium and nitrate samples.
The ratio between the required air flow and the treated water flow is used to compare the energy required in each group, considering that treated water has the same quality in both cases. This report shall be presented for the supply of constant air flow (Figure 4) and for the supply of variable air flow (Figure 5). In both cases, a 15% energy saving is achieved for the same qualities of purified water.

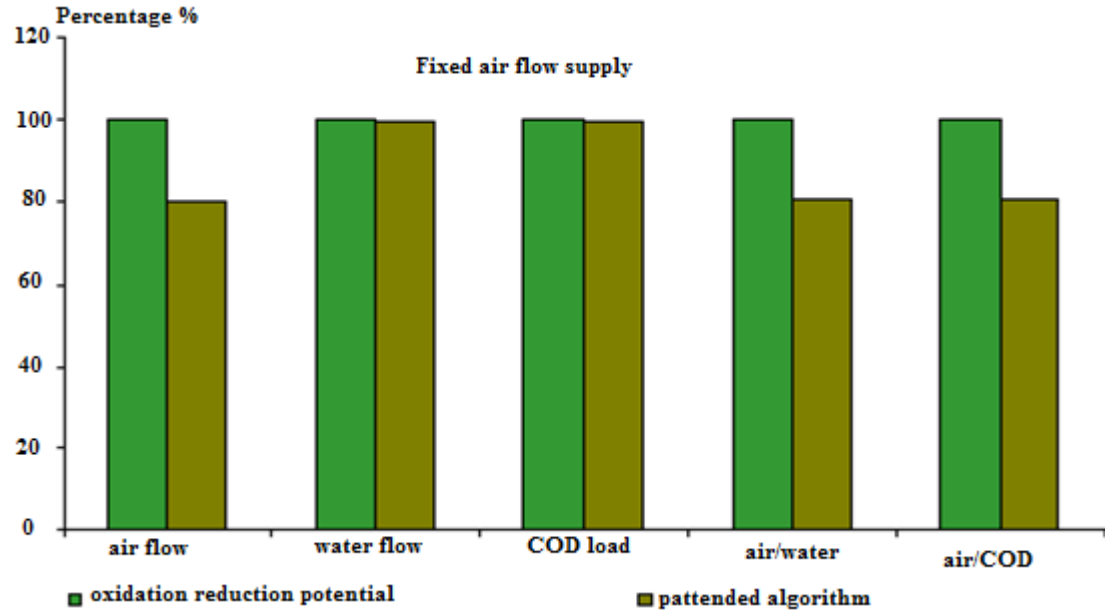

Fig. 4. Comparison between the controlled supply system with constant air flow and patented algorithm [2]

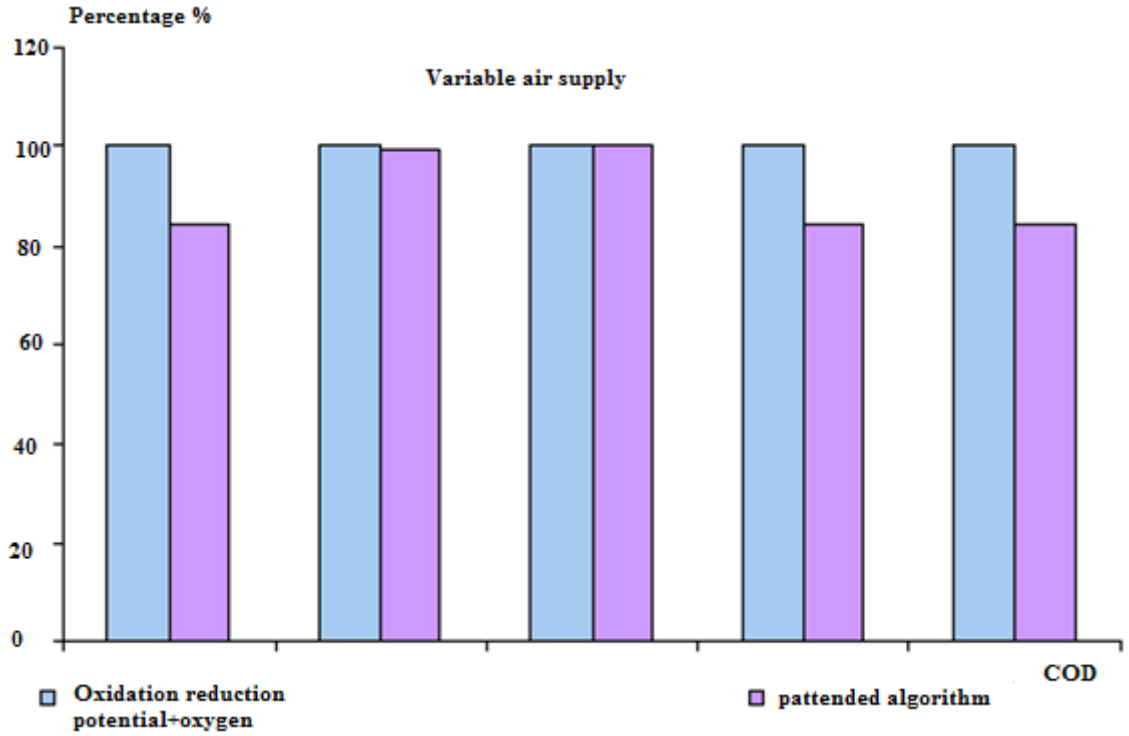

Fig. 5. Comparison between the controlled supply system with variable air flow and patented algorithm [2]

3. The study of biological parameters

Use oxygen is always delivered in excess in the aeration basin to ensure that the nutrients are removed under aerobic conditions. Lack of oxygen in that area favors sludge congestion and foam formation.
As shown in Figure 6, there are no significant differences in the speed of decantation in the classic and patented algorithm process.

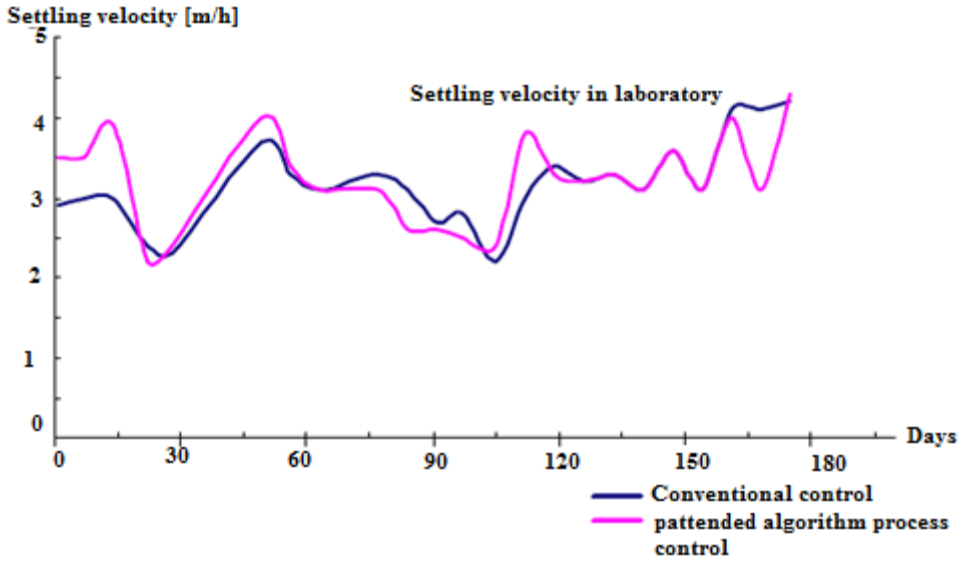

Fig. 6. Setting speed using the conventional controller and patented algorithm [2]

In the test on properties of sludge dehydration there were no differences in the consumption of polymers and the concentration of solid matter in suspension [3].

4. Conclusions

Advantages

Environment: A 10-15% decrease in energy consumption compared to traditional adjustment systems.

Performance: Can be adapted depending on the dimensions of each wastewater treatment plant a system that can easily be integrated into the logical diagram of the control and controls panels in most wastewater treatment plants.

Economy: By adjusting the air flow according to the needs of the treatment process, the energy costs are reduced.

References

[1] *** Degremont Technologies. "Treatment Solutions-Wastewater", November 9, 2018. Accessed November 9, 2018. http://www.degremont-technologies.com/-Wastewater.
[2] *** Degremont Technologies. "Biological treatment of effluents with high concentrations of ammonia ", November 9, 2018. Accessed November 9, 2018.http://www.degremont-technologies.com/Cleargreen-TM-Biological-treatment-of-effluents-with-high-concentrations-of-ammonia.
[3] Panaitescu, Ileana-Irina*. Operational management of wastewater treatment plants / Managementul operational al statiilor de epurare.* Bucharest, Politehnica Publishing House, 2014.