Improving the management of an MBBR system and reducing its energy consumption with Robuschi technology.

WASTEWATER TREATMENT IN A PAPER MILL: A CHALLENGE ROBUSCHI WON

Wastewater treatment is something of a customisation task, where the solution has to be tailor-made for the individual paper mill. Surely, when the challenge takes the form of limited space and a need to discharge safely into surface water, the answer is a plant design that combines innovative biological technology with a screw compressor.

Wastewater treatment in a paper mill can be optimised in a number of ways, but having to adapt an existing system set-up, where there are limits due to the plant configuration, undoubtedly complicates the job. It can always be done though. The secret lies in finding the technological solution that best fits the particular features of the site. That's what happened in Lucca, at the plant of one of the leading corrugated cardboard manufacturers of the paper industry - Toscopaper. Robuschi, in partnership with Italprogetti (which looked after the engineering side), supplied the waste water treatment technologies, working to offer the best solution for the real system needs in terms of efficiency, reliability and easy maintenance.

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BIOFILM TECHNOLOGY

The task was to intervene on an existing system that no longer met the development needs of the paper mill. The solution was developed by Italprogetti (www. italprogetti. it), deciding to use a type of technology that it had so far applied only in the field of municipal waste water treatment, adapting it in this case to the specific plant characteristics. We're talking about an MBBR (Moving Bed Biofilm Reactor). «With this type of biological treatment,» explains Daniele Bacchi, Head of the Waste Water Treatment Sector for Italprogetti, «bacterial colonies - able to clean the water by breaking down the organic matter in it - aren't free to move around in the water; they remain attached to special plastic supports called 'carriers'. These, in turn, are kept in motion inside the reactor thanks to the stirring action of the aeration process whose job is to provide the system with the oxygen needed for the treatment, by injecting compressed air. Special grilles installed in the biological reactor prevent the carriers from emerging along with the treated water. This avoids any risk of biomass loss apart from the excess which, spontaneously detaching itself from the carriers, is then taken away by the biological system.

CUSTOMISED SOLUTION

«We've renewed an existing water pre-treatment process with a biological solution that meets the needs of the paper mill, thereby creating an efficient new system» says Daniele Bacchi, Head of Italprogetti's Wastewater Treatment Dept. This is a decidedly important aspect, especially in the paper industry where the traditional processes with activated sludge with a sedimenter produce sludge flocs that are particularly lightweight and so don't settle well. The risk of dragging the biomass along with the treated water is considerable. «In these conditions, the use of MBR technology (even in the case of running problems, dosing errors, etc.) ensures the persistence of the bacteria in the tank and therefore the recovery of the system, restoring optimum conditions in a short time and reducing the volumes in question by 2 or 3 times compared with traditional technology». And that's not all. The type of effluent also displayed certain distinguishing aspects: a high inlet COD, a high fraction of organic substances with poor biodegradability, and a high concentration of calcium. «These needs called for not only an MBBR system but also the adoption of other technological solutions to prevent the substantial low-biodegradable fraction from invalidating the outlet COD result and to prevent the calcium from falling onto the carriers, limiting their effectiveness». To resolve the problem, the last of the three MBBR reactors installed in series was given over to the recycling of the activated sludge. «This meant the low-biodegradable fraction of COD could be kept under control, while the calcium level was managed by carefully monitoring the pH in the reactors and dosing a product that prevents it from falling». The result is a system with capacity rates of 1000m^3 per day, with a COD of about 4,500mg/l on the inlet and 80-100mg/l on the outlet - far below the limit value for the authorisation of discharge in surface waters (160mg/l).

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THE CHOICE OF THE SCREW COMPRESSOR

The Italprogetti solution also meets another of Toscopaper's specific needs. Apart from having to choose a technology that reduces the volumes in general, one of the particular features of this intervention was the very limited space available. As Bacchi explains, «that's why we needed a solution with very tall reactors - over 8 metres - for which a traditional technology such as the lobe blower

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one would have been extremely wasteful in terms of energy. In the end, we opted for two WS 85/3P compressor units of the Robuschi ROBOX SCREW Low pressure range (www.robuschi.com) which, thanks to their boosted efficiency, have allowed us to reduce the power levels and so obtain great benefits in relation to system operating costs. The two compressor units each work with a pressure level of 880 mbar, with a capacity of 1,994 Nm^3/h at the maximum working point». The Robuschi compressors are oil-free, guaranteeing operation that's even more environmentally friendly (Certification Class 0, in accordance with ISO 8573-1); their minimum sound emissions ensure quiet operation thanks to the high-yield internal compression, silencers and the latest noise enclosures whose simple, sturdy form makes them easy to service. One of the reasons that make this plant engineering choice ideal for bringing an existing system up to date is its ability to improve and simplify system management, and reduce energy consumption - a goal highlighted by Bacchi himself. «For this purpose, we worked with Robuschi to implement a monitoring of the compressors. The company was able to modify their initial set-up, intervening on the compressor pulleys and belts to optimise their lifespan, maintenance and, above all, energy consumption». The Robuschi compressor, explains the engineer, is a screw solution rather than the traditional lobe blower, «guaranteeing continuous air flow. In addition, there is an inverter which modulates the blower speed according to the concentration of dissolved oxygen in the tank, dispensing just the amount of air strictly needed and keeping the dissolved oxygen at an optimum level, at the same time reducing energy consumption. The screw compressor also allows higher delivery pressure values than the lobe solutions; it's therefore the best choice for vertically developed systems, and can easily be modulated to deal with capacity peaks. But the most interesting aspect is that, especially with significant heights, energy wastage is reduced by approx. 15-20% compared with traditional solutions, depending on the working conditions». A notable advantage that helps ensure a quick economic return on the investment made for the system.

OPPORTUNITIES IN PAPER SECTOR

The innovative wastewater treatment system adopted by Toscopaper has been operating successfully since 2013, and the collaboration with its suppliers continues via a constant assistance service. A system check is carried out every 15 days to measure the vital functions; the operators go directly to the plant to personally verify that all the parameters are being met. There's also a remote monitoring system however. «Our goal for this year» concludes Bacchi «is to apply this technology again in other companies of the paper industry».

Daniele Bacchi, head of Italprogetti's wast water treatment dept.:

1. The wastewater treatment system created by Italprogetti for Toscopaper: an MBBR (Moving Bed Biofilm Reactor). The paper mill produces corrugated cardboard and is particularly attentive to the environmental aspect (certified EMAS, ISO 14001 and FSC).

2.-**3**. The Robuschi compressors are oil-free and have minimal sound emissions and a simple, sturdy form.
The photo shows the two WS 85/3P compressor units of the ROBOX SCREW Low pressure range, used in the Toscopaper system.