BLOWER SPECIFICATION FOR **WASTEWATER TREATMENT**

A guide for industrial wastewater treatment processes

Water consumption is one of the main cost factors for operators in several industrial processes, like in the food and beverage industry, and managing the use – and disposal – of this precious resource takes careful planning.

According to the Institution of Chemical Engineers (iChemE), 70% of all extracted freshwater is used for agriculture alone, with a further 20% used in the production and processing industries, leaving just 10% for domestic use (e.g., drinking water). [1]

The industry uses vast quantities of water, both in the finished product as well as during the manufacturing process, for cleaning, cooling, cooking and generating steam. As a result, food and beverage processors generate copious amounts of wastewater, too, which must be disposed of appropriately to meet changing environmental regulations.

Rising costs for disposal and increasing utility costs drive the need for on-site, energy efficient and low-maintenance treatment applications.

In this guide, we explore the use of blower technology to help with the movement of large volumes of air during this water treatment process – designed to remove both organic and inorganic contaminants, such as fats, oils, sugars, proteins, and suspended solids, as well as a range of preservatives and man-made chemicals.

[1] https://www.icheme.org/media/4808/an-icheme-green-paper-water-management-in-the-food-and-drink-industry.pdf

THE BENEFITS OF **WASTEWATER TREATMENT** IN THE INDUSTRIAL SECTOR

AERATION SYSTEMS AND ENERGY

Aeration systems are the largest energy user in wastewater treatment, representing more than 60% of the total electricity cost, so improvements in efficiency can significantly reduce the overall costs of operation.

Up to 75% of compressed air costs will be spent on energy, so choosing the right aeration equipment can make a huge difference, substantially lowering lifecycle costs.

KEY FACTORS IMPACTING ON WASTEWATER TREATMENT

- Load shocks
- Temperature changes
- Increases in production
- Changes in manufacturing operations

Ensure compliance with stringent environmental regulations

Governmental wastewater discharge regulations must be adhered to, to avoid the heavy fines and legal consequences as well as the reputational risk, should contaminated water be discharged back into the watercourse.

Manage wastewater volume, composition and discharge requirements

Choosing the right technology is vital to promote process and wastewater efficiency through an entire operation. Wastewater from several industrial processing plants contains high concentrations of biochemical oxygen demand (BOD), chemical oxygen demand (COD), suspended solids (TSS), fats, oils and nutrients in varying concentrations.

Manage the waste stream effectively to help minimise energy consumption and the consumption of other resources

An added benefit of managing wastewater streams effectively is that other resources, such as energy costs, can be minimised. For example, by treating wastewater on site, operators can minimise their transportation costs and reduce the expense of external treatment facilities. Often, waste heat from site processes can be used to power this treatment process, helping to minimise site energy costs further.

Create additional revenue streams

There are several solutions that allow plants to meet discharge quality standards in a cost-effective way, enabling the use of wastewater as feed water for boilers, equipment cleaning and other ancillary activities. Elsewhere, operators can consider recovering and reusing organic matter for energy generation or converting nutrients into fertilisers.

AN OVERVIEW OF THE **WASTEWATER TREATMENT** PROCESS

In many applications, conventional activated sludge treatment systems are not capable of handling large, sudden variations in BOD, COD and nutrients. Therefore, the wastewater treatment process in many industries (like food and beverage, chemical and pharma, or pulp & paper) is normally broken down into four stages:

1 Pre-treatment/preliminary treatment

The first step of the process, commonly known as 'screening', starts with the wastewater or effluent entering the system where it goes through screens to remove any large solids. This step prevents any blockages in the system further downstream.

2 Primary treatment

This stage involves further removal of broken-down solids. This is completed by physical stylisation and additional filtration systems and can remove up to 60% of the suspended solids.

3 Secondary treatment

The main aim at this level is to remove suspended solids and residual organic matter, which can be achieved using aerobic and anaerobic processes. The activated sludge process involves an aeration tank where oxygen is supplied to microorganisms, resulting in the removal of dissolved biodegradable and organic matter.

4 Tertiary treatment

This stage is to further improve the effluent quality before it is discharged. It removes the contaminants that were not removed in previous treatment levels and involves a disinfection process using chlorine, UV light and ozone.

SECONDARY TREATMENT: HEART OF INDUSTRIAL **WASTEWATER TREATMENT**

The biological process takes place in the second stage of the wastewater treatment (WWT) process.

The pre-filtered wastewater that enters aeration tanks still contains ammonia and very small organic particles that could not be filtered out in the sedimentation tanks.

The aim is to feed the microorganisms present in the wastewater and thus effectively remove the waste and pollutants from it. The biological process is energy intensive, but it is a very efficient way of treating wastewater as it may take as little as 5-6 hours.

Let's explore the Biological process in the Industrial Waste Water Treatment

SOME TYPES OF PROCESSES

MBBR (Moving Bed Biofilm Reactor) and **Granular Sludge Treatment** are both technologies used in wastewater treatment processes to remove organic and inorganic pollutants.

1 MBBR (Moving Bed Biofilm Reactor)

1. BIOFILM PROCESS:
   - MBBR is a biological treatment process where a reactor is filled with plastic carriers that provide a surface for the growth of microorganisms.
   - These carriers move freely within the reactor, creating a constantly changing environment that enhances the treatment efficiency.
2. MICROBIAL GROWTH:
   - Microorganisms attach to the surface of the carriers and form a biofilm. This biofilm contains bacteria and other microorganisms that break down and consume organic pollutants in the wastewater.
3. HIGH SURFACE AREA:
   - The plastic carriers have a large surface area, which allows for a higher concentration of microorganisms compared to traditional activated sludge processes.
4. FLEXIBILITY:
   - MBBR systems are known for their flexibility and can be used for both industrial and municipal wastewater treatment. They are often employed to upgrade existing treatment plants or as a standalone treatment solution.
5. EFFICIENCY:
   - MBBR systems are generally considered more efficient than traditional activated sludge systems in terms of nutrient removal and overall treatment performance.

ADVANTAGES FROM MBBR PROCESS

- 50% less footprint for the tank compared to conventional activated sludge
- High depollution performance (micropollutants)
- Aeration is continuous to keep microorganisms alive in the tank
- Low turndown

2 Granular Sludge Treatment

1. GRANULAR SLUDGE CHARACTERISTICS:
   - Granular sludge refers to compact aggregates of microorganisms that form in wastewater treatment processes.
   - These granules have a well-defined structure with different layers, providing an optimal environment for microbial activity.
2. ADVANTAGES:
   - Granular sludge treatment offers several advantages, including a higher biomass concentration, better settling properties, and improved resistance to toxic substances.
3. ENHANCED PERFORMANCE:
   - The compact structure of granular sludge allows for a higher biomass concentration in the reactor, leading to enhanced treatment performance.
4. REDUCED FOOTPRINT:
   - Because of the improved settling characteristics of granules, the sedimentation tank size in a wastewater treatment plant can be reduced, resulting in a smaller overall footprint.
   - The entire process is done in only one tank, therefore aerobic and anoxic/anaerobic zones co-exist.
5. APPLICABILITY:
   - Granular sludge treatment is applicable to various wastewater types, including industrial and municipal wastewater, and can be used in different treatment processes.

ADVANTAGES FROM GRANULAR ACTIVATED SLUDGE PROCESS

- Compared to MBBR: no primary treatment needed
- 50% less footprint for the tank compared to conventional activated sludge
- High de-pollution performance (micropollutants)
- Aeration is cyclic
- High turndown

ROBUSCHI BLOWERS PORTFOLIO FOR **GRANULAR SLUDGE TREATMENT**

Turbo Blower in Wastewater Treatment

Oil-free Screw Blower Range

In summary, both **MBBR** and **Granular Sludge Treatment** are advanced biological processes that offer advantages in terms of treatment efficiency, flexibility, and reduced footprint.

They are commonly employed in modern wastewater treatment systems to meet stringent discharge standards and environmental regulations.

BLOWER AND **LOW-PRESSURE** EQUIPMENT SPECIFICATIONS

The introduction of oxygen is extremely important for the purifying process. By oxygenating activated sludge within the reactor with aeration air, blowers help break down organic compounds.

Such a critical process needs to be well designed and installed to ensure maximum performance – helping to protect uptime, avoid efficiency losses and avoid high maintenance costs.

MAXIMISING TOTAL COST OF OWNERSHIP

The blower with the highest-rated efficiency will not automatically provide the lowest overall energy consumption. There are many other variables and operating conditions to consider to select the most suitable aeration blower:

Step 1 CAPITAL INVESTMENT

Blower technology should be selected based on the precise application demands and operating parameters. This should be sized correctly to suit the manufacturing plant and its operating conditions, including:

- Minimum and maximum air pressures
- The compressed air flow required by the system
- The blower's overall energy consumption

Step 2 OPTIMISING ENERGY PERFORMANCE

Operators will want to ensure that their blower package has been optimised to minimise energy consumption as much as possible. Regulating speed with the use of variable speed drives and invertors, and minimising pressure drops can all have a positive impact on energy usage.

Step 3 LIFETIME SYSTEM MAINTENANCE

Maintaining the blower equipment professionally to ensure optimum performance and long life is another important consideration. Investing in machinery that is low maintenance by design, choosing genuine parts and lubricants, and considering oil-free options will all provide long term benefits.

TOTAL BLOWER **CAPABILITY**

Our Total Blower Capability concept is a comprehensive package of blower solutions that includes rotary lobe and screw technologies, efficient turbo blowers, and multistage centrifugal blowers.

Robox Turbo - From long lasting air foil bearings to best-in-class small footprint and easy maintenance throughout the range, the Robox Turbo is the hallmark of efficiency and low energy consumption.

New Blower Unit Design - Compatible with our Robox Lobe and Robox Screw layout, we've made it simpler than ever to change from one technology to another - embracing the ongoing shift in budgeting approaches from capital investment to total cost of ownership.

Multistage Centrifugal Blower - Durable, reliable, and efficient, Robuschi centrifugal blowers are manufactured using the finest materials and state-of-the-art machining tools available today.

Side Channel Blowers - Robox Side Channel blowers are oil-free, robust, and virtually maintenance free.

Depending on your application, we can offer a wide range of solutions. These include:

- Optimum performance and reliability
- Robust design and operations
- Reduced lifecycle costs
- ISO 8573-1 oil-free certification

WASTEWATER TREATMENT IN ACTION

Robuschi worked with EPS, a wet infrastructure specialist, on upgrading the wastewater treatment systems of Dairygold, a major dairy processor in Ireland.

The resulting installation delivered a 40% smaller footprint, 20% lower noise levels, and 25% lower energy consumption that resulted in savings of around £30,000 per annum.

The requirement was for a high-speed blower solution that would help with the aeration of the effluent coming from the dairy factory.

Five Robox Turbo blower units configured in parallel were supplied to the end user to provide aeration for the Mallow site's two settlements tanks and ensure standard standby capability.

Robox Turbo blowers were chosen over conventional rotary lobe blowers due to their outstanding energy efficiency, compact design, quiet operation and suitability for outdoor installations.

40% **smaller footprint**

20% **lower noise levels**

25% **lower energy consumption, resulting in savings of circa £30k per annum**