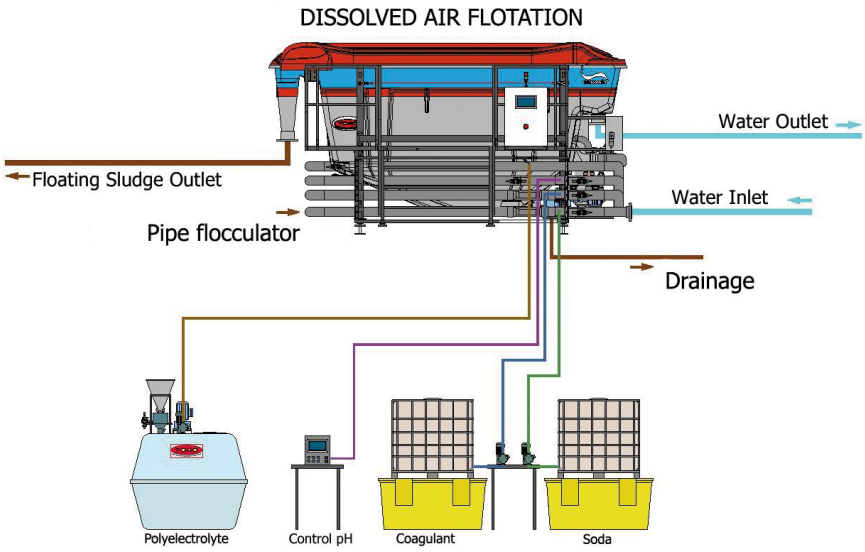
Biological Wastewater Treatment for Poultry Farms using MBBR Process and Dissolved Air Flotation system:

Poultry processing plants, as in many other food processing activities typically are high water users. For broilers, 5 to 10 gallons of water are used to process one 5 pound, average-sized chicken. When processing turkey the volume of water is even higher with average weight of slaughtered turkeys exceeding 4 times that of a chicken. It is not unusual for a typical poultry processor to generate 1,000,000 to 1,500,000 gallons of wastewater daily.

This water will be laden with fats, proteins and carbohydrates from meat, fat, blood, skin and feathers. The water is also polluted with a fair amount of grit and other inorganic matter. Waste load can be determined by a number of different measurements, including BOD (biochemical oxygen demand), TSS (total suspended solids concentration), COD (the chemical oxygen demand), and FOG (fats, oil and grease), but poultry plant wastewater is most often tested for BOD -which is a measure of the amount of oxygen needed to degrade the organic matter (feathers, fat and blood) in the wastewater.

Poultry processing plants are required to remove the majority of all soluble and particulate organic material in their generated wastewater prior to any discharge from the plant. This process needs to take place in order for the plant to be in compliance with local, state and federal environmental regulations.

WATEQ CANADA custom configures a full treatment system that can screen and treat the wastewater to discharge levels that meet or often exceed local municipal requirements.



Stage 1 Emulsion Cracking/pH Adjustment:

pH is lowered to ~3.5 with the pH controller using acid. A coagulant de-emulsifier is added to break any emulsion.

Stage 2 pH Adjustment/Precipitation and Coagulation:

pH is adjusted to ~8.5 using caustic and a coagulant is added such as Alum or PAC to cause further de-emulsification and precipitation of the solids. A “pin floc” is developed indicating the emulsion and the suspended solids are precipitated.

Stage 2 - Flash Mix:
The wastewater with it's precipitated pin floc is introduced to the flash mix zone where a polymer flocculent is added. This stage maximizes flocculent dispersion throughout the coagulated wastewater.

Stage 3 - Flocculation:
The wastewater is now introduced to the slow mix zone to agglomerate the floc into larger particles suitable to be enmeshed with the air bubbles.

Dissolved Air Flotation (DAF):
The flocculated wastewater is introduced into the DAF inlet where the floc particles are comingled with a pressurized dissolved fine bubble recycle stream. The floc particles attach to the bubbles and float to the surface where they are mechanically skimmed into the float scum sludge chamber. The clarified treated water then exits the end of the DAF and flows downstream to sewer or further treatment if necessary. The DAF system bubbles come from a Recycle Air Dissolving system that takes a portion of treated effluent, pressurizes it and introduces air to be dissolved. The dissolved air comes out of solution and forms a fine bubble stream when the pressure is released at the DAF entrance in the presence of floc wastewater.

Moving Bed BioReactor (MBBR)

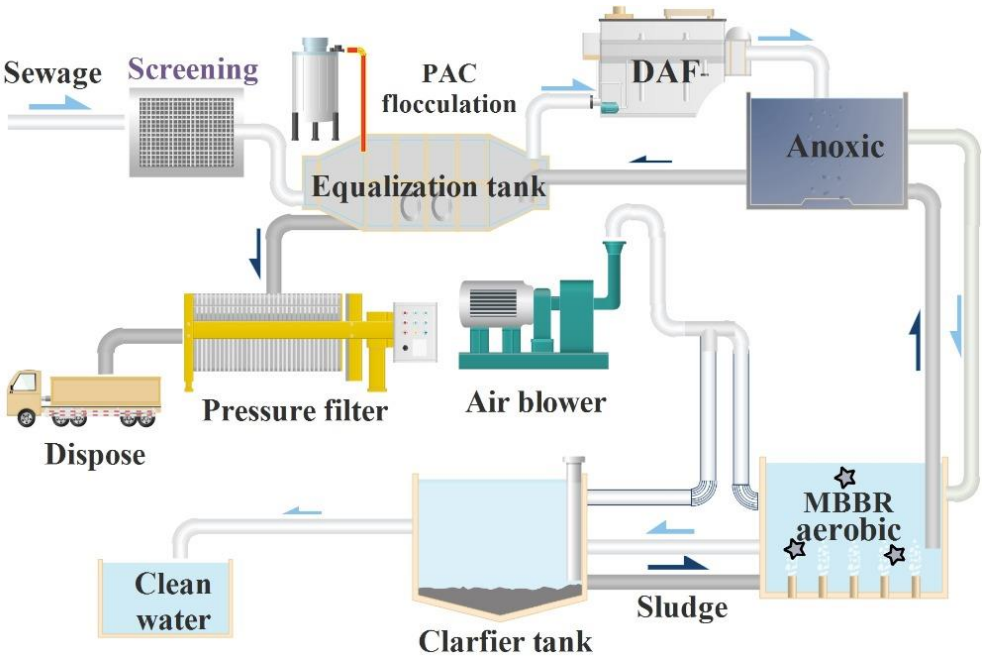
The Moving Bed BioReactor (MBBR) is a standalone wastewater treatment system used for the reduction of soluble organics and nutrients. The key to the system is the plastic media which provides a suitable home for biological colonies of bacteria and protozoa to grow and flourish. The MBBR technology is a straightforward flow through design with no sludge recycling or backwashing is necessary. The media are contained within the vessel(s) and mixing energy is applied via coarse bubble aeration. If de-nitrification is needed mechanical agitation will be applied in place of aeration. The MBBR is a flexible biological platform with easy future expansion, just add media.
Operational control parameters are relatively simple. All that is required is monitoring of DO (keep above 2ppm) in the reactor via continuous automated control; test the daily organic COD feed (proxy for BOD); and dip strip check the nutrient levels in system. The several installation options ensure maximum exposure of MLSS to the media. The bacteria adhere to the media while digesting waste from the plant effluent stream. The result is a resident population of biomass that removes BOD and COD efficiently.
WATEQ CANADA worked to develop a complete characterization of the wastewater. The regulatory authority in Ontario set the discharge effluent limits as shown below:

BOD	5 ppm
TSS	10 ppm
FOG	15 ppm
NH3-N	1.5 ppm

These stringent requirements dictated the need for nitrification. Nitrification is the process of biologically converting NH3 to nitrates.
The **MBBR** is having very high performance, compact yet greatly scalable, easy to operate, and complete with backup capabilities.
The MBBR process utilizes a polyethylene media to provide a 'home' for the bacteria to grow and cultivate. This media is placed inside a tank that has a blower manifold at the bottom. The wastewater continuously flows into and out of the reactor. The blower provides oxygen as well as mixing energy to assure interaction between the biofilm on the media with the wastewater. The design of this system offers several important advantages: (i) it requires small footprint, (ii) the biofilm provides protection of the bacteria from toxic infiltrations, (iii) the process is continuous and has one control point (Dissolved Oxygen - DO), meaning that it is very easy to operate, and (iv) the system is scalable – more media can be added down the road to provide increased loading capacity. The MBBR process has been designed in two stages one or two reactors. The reason for the two reactors is due to the high removal rates necessary and the nitrification requirement. Nitrification occurs when the organic load in the water is at its minimum. Thus, the first reactor removes the bulk of the BOD and the second reactor will remove the remaining BOD and achieve the nitrification process. The next unit operation will be separation of the

biomass from the water. Again, DAF is the system of choice for its efficiency and compactness. In fact, many of the existing plants DAFs that are after the MBBR process utilize between 0 and 5 ppm of flocculant to achieve the required results. Thus, the operational costs of the system are extremely low. The anticipated effluent from this process will often meet the performance requirements of the system. However, to assure continuous compliance, a final unit operation will be employed – media filtration. Media Filtration provides fine filtration of any "carry-over" of solids from the DAF clarification process. Four media filters have been incorporated into the design to provide continuous operation while backwashing is cycled through the system. The filtered water will provide the source of the backwash process. After the media filters, the water will be discharged by gravity to the marsh field in accordance with permit limits.

Summary: The system has been a terrific success and allowed the Chicken/ Turkey processing facility to achieve all the goals set forth.



An example from a process flow diagram.