Water Solutions

Treat the Compounds in your Effluent

WWTP Design to Target Effluent compounds

A Scientific Approach for Treating Effluent Based on Wastewater's Chemical Composition and Compounds.

Are you on the verge of implementing an ETP solution to a problem that you haven't entirely defined?

At FUTURA, we completely advocate designing and establishing a WWTP based on the compounds present in the effluent which is a complex and highly specialized process; rather than following any set blanket thumb rules which is generally the case with conventional systems where often experiences from other chemistries are used, repackaged, replicated and re-purposed as WWTP design basis added with hope-help by divine interventions for a successfully operating plant

We at FUTURA, choose to hold ourselves to a far higher standard coupled with scientific temperament where we fully avoid a "guessing game". For us, it is vital to ensure the success of each and every project we take up. Our research and development in wastewater treatment technologies is a normal constant and with this can provide opportunities for improved treatment efficiency, cost-effectiveness and a good bang for your buck.

By not establishing suitability of any envisaged WWTP design basis, the fallout after execution would include any combination of the following:

- **Overdesign and Inflexibility:** To compensate for basic incompetency, the system can be overdesigned which ultimately would have impact on CAPEX & OPEX. Additionally, the system may not allow for flexibility in the treatment process that can be easily switched ON & OFF or certain mid-processes bypassed at a moment's notice.
- **Modular Design:** Such systems would not have prioritized modular designs that allow for easy expansion or modification of the treatment process. This approach can maximize the risk of inadequate treatment capacity.
- **General Treatment Processes:** Starting without well-established, versatile treatment processes cannot handle a broad spectrum of contaminants. An advanced, layered and pre-simulated system offer a good degree of flexibility.
- **Buffer Capacity + Buffer Capacity + Buffer Capacity:** This is largely the only problem solving mantra incorporated in conventional systems completely ignoring the root cause. This leads to a higher CAPEX & higher land space area which would have been better allocated for production.
- **Automation, Monitoring and Adjustment:** To what degree can one really automate systems which come with core design problems and largely function on hope? Real-time monitoring of key parameters can help as long as they can make process adjustments without or with minimal human intervention.

- **Regulatory Compliance:** How many WWTP owners & operators can really claim that the plant is designed to meet relevant regulatory requirements, even in cases of uncertain effluent composition? "Managing" the situation is the quagmire that most are caught up in. This is a classic symptom where a solution is employed to a problem not understood properly.
- **Long-Term Planning & Sustainability:** Such systems make the end-users only live in the present. They do not account for potential for changes in effluent composition over time, especially if the source of the wastewater / upstream production techniques may change. This leads to the need of expensive and time consuming WWTP overhauls whereas if planned properly, can be streamlined with just minor adjustments & modifications.

So, what do we do then?

It all starts with effluent characterization.

The compounds and chemistry of the effluent play a pivotal role in determining the type of treatment that a wastewater treatment plant (WWTP) should employ. Different compounds require specific treatment processes for effective removal. The selection of treatment processes should be based on a thorough characterization of the wastewater, including the identification and quantification of the compounds present. Regulatory requirements, as well as the desired effluent quality, must also be considered when determining the appropriate treatment technology. Additionally, pilot-scale testing may be conducted to evaluate the performance of various treatment options for a particular effluent. Ultimately, the goal is to design a WWTP that can effectively and efficiently treat the specific compounds present in the effluent while meeting environmental regulations and sustainability objectives. Here are some inclusions we factor for the treatment process selection

1. Organic Compounds

- Biodegradable & Hard-to-Biodegrade Organics: From aromatics to aliphatic, from linear hydrocarbons to surfactants, from organic salts to organic solvents, from amines to amides to imines, from nitrogenous to heterocyclic compounds – we factor them in isolation as well as their combinations, determine their tendencies to form transitionary or transitory compounds and then decide on what to do.

2. In-organic Compounds

- Heavy Metals: Effluents with elevated levels of heavy metals, like lead, cadmium, or mercury, typically require a robust precipitation or adsorption processes to remove these contaminants for which we have dedicated systems.
- Suspended Solids: We employ targeted equipment's and measures ranging from simplest settling tanks and filter presses to complex DAF – Screw Press systems to deal with suspended solids. The placement of the clarification-filtration process is as vital as the oxidation stage.

3. Operating pH & Toxic Compounds

- Depending on the target pollutant, our employed process can be in operational in either acidic or alkaline pH levels. This coupled with other toxic compounds require apt selection of system / equipment MOC's to establish a superior operational life of the system components.

4. Salinity and Total Dissolved Solids (TDS)

- High salinity or TDS levels impact the choice of treatment processes. We factor levels of these dissolved solids, categorize them if needed for differential treatments to achieve economical and viable throughputs from downstream desalination processes.

You might be wondering, how does it all come together?

Understanding the compounds and chemistry of the effluent and how they behave during oxidation is fundamental to designing a wastewater treatment plant that effectively and efficiently removes contaminants, complies with regulations, and minimizes environmental impact. It also supports the sustainable management of resources and ensures the safety of the WWTP operators and surrounding communities. Wastewater characterization involves determining the physical, chemical, and biological properties of the effluent. Here are the steps and methods we typically use to characterize a wastewater stream:

1. Sampling

At first we collect representative samples of the wastewater. If not available for the greenfield project along with the end-user it is generated at laboratory level. Physical Parameters:

- **Flow Rate:** We measure not only the total flow rate, but also the mean and median flows to establish shock load handling capability in the WWTP to be designed.
- **Temperature:** Effluent Receiving, Operating & Ambient Temperatures around the plant where the WWTP is to be established are noted. This bears relevance to not only system design but also equipment MOC's and equipment throughput capacities.
- **Color, Odor & Turbidity:** These provide initial clues about the stages where pre-treatment, disinfection and polishing of the wastewater is to be done
- **Existing V/s New Installation:** Determining whether the above flow rates are from existing installation or from an upcoming expansion or a new fresh requirement

2. Chemical Parameters

- **pH:** Effluent receiving pH, Operating pH and control pH ranges are established by process simulations.
- **Total Suspended Solids (TSS):** Quantification of the concentration of suspended particles and their particulate size distribution.
- **Chemical Oxygen Demand (COD) & Ammoniacal Nitrogen (NH3-N):** Quantification the amount of molecular high potential oxygen required to chemically oxidize organic, inorganic & nitrogenous matter in the effluent and contingency planning for any transtionary and transitory compounds as oxidative products.
- **Biochemical Oxygen Demand (BOD):** Establishing receiving, operating and output COD:BOD ratios to establish staging of biodegrability.
- **Heavy Metals:** Determine the presence and concentration of heavy metals, which can be toxic as well as interfering elements during forced oxidation reactions.
- **Organic Compounds:** Identify specific organic salts & compounds present in the wastewater that can be separated by acid-base extraction techniques.
- **Pathogens:** Assess the presence of resilient bacteria, viruses, and other pathogens, which may require targeted & omnipotent disinfection.
- **Total Dissolved Solids (TDS):** Quantify the concentration of dissolved solids at receiving, operating and output levels which can impact the design and operating criteria for downstream desalination units.

3. Process Simulation & Data Analysis

Analyze the data obtained from treatability studies to establish plant level operations, the wastewaters' in-situ characteristics, including system vulnerabilities.

4. Regulatory & Re-use Requirements:

Ensuring that the treated water characterization aligns with regulatory or re-use requirements and standards.

5. Pilot Testing:

As a means of bolstering confidence, it may be prudent to conduct pilot-scale testing on the end-user site, which would help ascertain the wastewater treatment process's effectiveness.

Once the wastewater is thoroughly characterized, treatment processes can be selected and designed to effectively remove or reduce the identified contaminants and meet regulatory or re-use requirements. The data collected during wastewater characterization & treatment simulation is fundamental for designing a wastewater treatment plant and optimizing its operation.

What is the objective of this approach?

1) Regulatory Compliance:
First to be specified here is ensuring compliance with local, state, and federal regulations regarding discharge limits for specific contaminants.

2) Flow Rate and Variation:
Established WWTP capacity to treat average and peak flow rates of wastewater with ability to handle variations in mean flow.

3) Establishing a Truly Advanced - Automated - Reliable Treatment Process:
Establishing of a marvel process that rids the need to “manage” the situation at the end of the day. Peace of mind to WWTP operators as well as Production personnel so that both can co-exist.

4) Solids’ Handling made Easy:
Achieving a system where produced sludge is non-toxic & non-leachable for safe and economical handling and disposal.

5) Infrastructure Design:
Apt, corrosion-resistant and minimalistic infrastructure that are appropriate for the specific compounds in the effluent.

6) Energy Efficiency:
Optimized design for energy efficiency, considering the energy requirements of various treatment processes with explored opportunities for energy recovery.

7) Monitoring and Control:
Robust monitoring and control system implemented to continuously assess the performance of the WWTP and adjust treatment processes as needed.

8) Operator Delight & Safety:
Our systems are well appreciated by WWTP operators not only for their ease of handling but also for the safety interlocks provided in the system.

9) Long-Term Sustainability:
Considered resilience to climate change, production dynamics and changes in wastewater composition.

10) Environmental Impact:
Our plants come after assessment of the potential environmental impact from the WWTP, including the discharge of treated effluent, volatile emissions and the disposal of residual solids. They come with prior implemented measures to mitigate adverse effects.

11) Economic Feasibility:
First time users may be disappointed, but WWTP owners with past experience would infer that the cost of building, operating, and maintaining our Advanced WWTP’s appropriated with the benefits and regulatory compliance they bring with them relative to their conventional installations are economically logical in the long run.

About Us

Futura as the name implicates- technologies and advancements of the future. We are ex-industry stalwarts with the purpose and vision of bringing specialized knowledge, value added products, services and solutions to you which will help your businesses grow and be profitable & sustainable.

Many of our process technologies are a result of Innovation, Process Development, Research and Strategic Technology Tie-ups with International Companies with R&D facilities having core expertise in the subject field. We have associations with many industry leading solutions and service providers to provide and end-to-end and seamless delivery for your needs.

Why Us

Having already supported over 120+ customers long term, we specialize in what we do. All our core capabilities, products and solutions are backed by our own knowledge and are developed inhouse and hence we are not dependent on any vendor or service provider to commit and deliver.

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