ACO Industries k.s.

Contact Jiří Loníček
Address Havlíčkova 260
582 22 Přibyslav, Czech Republic

Phone +420 569491232
Email jlonicek@aco.cz
Website www.povrchoveupravy.cz

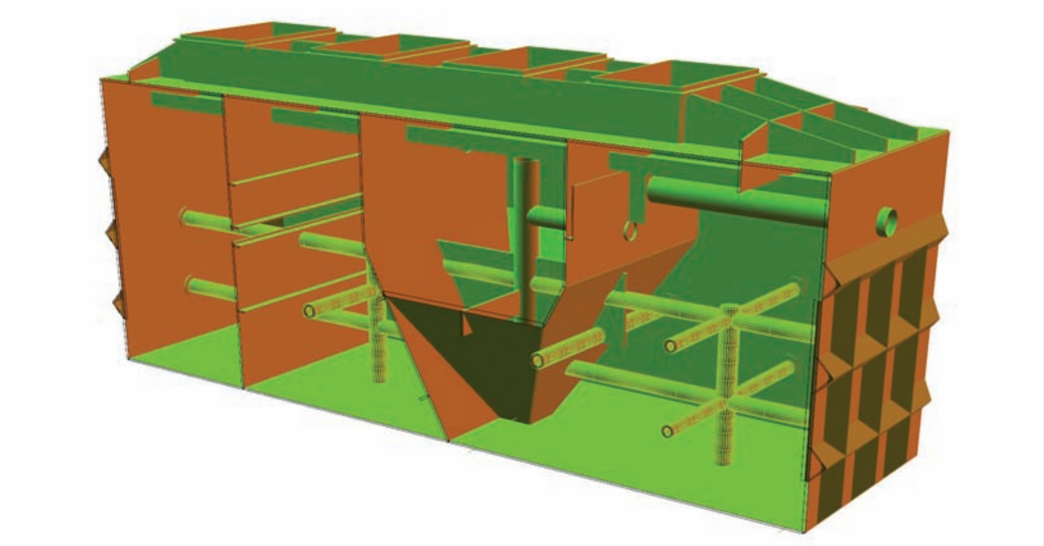
ACO is present with independent companies in over 40 countries on all continents.

ACO has its own production sites in 12 countries including Australia and the USA.

At the same time as respecting national cultural differences, the focus of our marketing activities is always the ACO brand with its excellent image, high quality standards and unique competence.

ACO Group is the worldwide leader in the manufacture and supply of corrosion-resistant polymer concrete and stainless steel drainage systems for external and internal applications. With more than 40 years of valuable experience in the removal and containment of wastewater, ACO is now entering the field of wastewater management with systems for the treatment and re-use of grey water.

ACO's modern, state of the art manufacturing plant produces high quality products which are used in projects world-wide.



Short Description

ACO Clara sewage treatment plant

This project regards a treatment plant for sewage; it is designed for the complete biological purification of domestic waste water. The mechanical pre-treatment part is formed of a sedimentation tank with a high buffer area volume. The biological part of the ACO Clara consists of an activation tank and a built-in final sedimentation tank. The activation tank is aerated by micro-bubble aeration.
The analysis part of the project consisted of the stress check and stability analysis of the polypropylene tank of the plant. The complicated geometry of the tank was modelled including all of the technological pipes and inner parts to optimize the polypropylene material consumption. The finite element stability analysis using the iterative solver was used to prove the critical multiplier of the loading greater than 2 ensuring buckling resistance of the tank.

Project Information

Owner: ACO Industries k.s.
Architect: ACO Industries k.s.
General Contractor: n/a
Engineering Office: ACO Industries k.s.
Construction Start: 12/10/2008
Construction End: 20/10/2008
Location: Přibyslav, Czech Republic

Characteristics and application

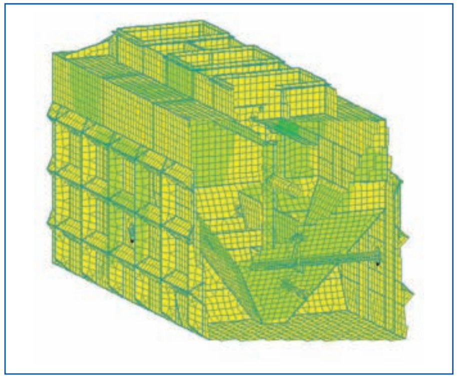
ACO Clara sewage treatment plants are designed for the complete biological purification of domestic waste water:

Treatment process

- Mechanical pre-treatment
- Biological treatment by activated sludge
- Final gravity sedimentation

Technical data

- Diameter D [mm] 2350
- Length L [mm] 2870
- Width W [mm] 2440
- Height H [mm] 2640



Technology description

The ACO Clara sewage treatment plant consists of a mechanical pre-treatment part and a biological compartment.
The mechanical pre-treatment part consists of a sedimentation tank with a high buffer area volume. The sewage water enters the ACO Clara unit via the inlet pipe and flows into the buffer area of the common buffer and storage tank. Settable solids fall to the bottom of the tank and floating matter is caught by a scum board, thus protecting the raw sewage air lift pump against blockage. Hydraulic peaks at the inlet of ACO Clara sewage treatment plants are absorbed in the buffer area. The pre-treated water is then pumped at a uniform flow rate from the buffer area into the biological part of the plant. Hydraulic peak equalising considerably increases the stable purification efficiency

The biological part of the ACO Clara consists of an activation tank and a built-in final sedimentation tank. The activation tank is aerated by micro-bubble aeration. The water goes from the activation tank into the final sedimentation tank, which enables treated water to be separated gravitationally from activated sludge. The treated water flows out of the sewage treatment plant through the outlet connection. The activated sludge falls to the bottom of the final sedimentation tank, from where it is pumped back

Used software: Nexis, ESA-Prima Win

as return sludge and also partly into the storage area as surplus sludge. The final sedimentation tank is optionally equipped with a skimmer for the automatic collection and removal of floating sludge from the water surface. This device reduces maintenance work during the operation.

Used Modules

- Linear static analysis of complicated shells
- Intersections
- Stability of shells
- Geometrical Nonlinearity
- Intelligent document

Analysis description

Plastics structures exhibit a viscoelastic behaviour, dependent on time of load exposition, temperature and stress level reached in the material. The analysis of the thermoplastics starts with the long term strength and creep modulus determination. The number of analysis necessary is then related to these conditions. In case of scrubber 2 crucial states were defined – working state and the short term loads states. Both states have the same geometry and model of the construction but differ in the modulus of elasticity and in the allowable stresses. As a result 2 independent linear analyses and 2 stability analysis were performed. 2 documents are enclosed.

Experience

The design of thermoplastic process equipment, using the appropriate design parameters and material properties can be completed with a combination of hand calculations and computer run Finite Element Analysis (FEA). FEA is necessary to determine peak stresses at discontinuities, corner joints, and to verify strain limits etc. For a complete FEA analysis to be executed for thermoplastic process equipment, a non-linear analysis should be accomplished. However, this is usually impractical due to time, lack of detailed material strength design data, and the relatively low allowable design stresses used. Satisfactory designs have been consistently accomplished by using a linear elastic FEA approach and by using a constant on required years of durability dependent creep modulus value for the design allowable stresses.

Measurements of fabricated thermoplastic structures indicate the linear elastic approach to be a viable and relatively accurate prediction of equipment stresses and deformations.

Conclusion

Complicated shapes of thermoplastic vessels require powerful tools for simplifying the geometry creation – intersections are the necessity.
Several linear solutions of the structure varying in creep modulus in relationship to the temperature, time of load exposition and the stress level reached must be analysed. Each of the linear analysis must also be complemented by the stability check of the construction for the same creep modulus value.
Sometimes the stability analysis does not give the positive values of the critical factors, depending on the geometry, loads and supports. Then the geometrical nonlinear analysis must be used to find out the remaining load bearing capacity of the structure, several nonlinear analyses with regularly increased loads have to be performed till the collapse of the solver gives the critical load factor value.
The number of equations solved normally varies between 100.000 – 1,000.000. So the requirements for really fast solver are great, mostly the iterative solver takes place.
All above mentioned features are included in ESA-Prima Win software, the best solution for FEA of the thermoplastics vessels I have ever used.