



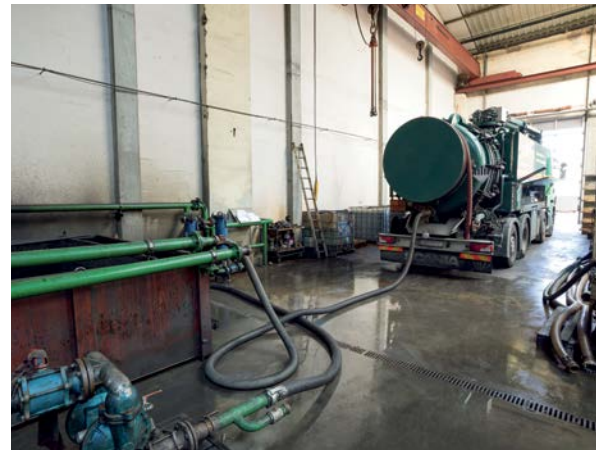
Recycling company employs electronic motor managers to simplify separation process

Highlights

- The company AVR GmbH specializes in the physical-chemical treatment of liquid wastes
- The aqueous fraction of the liquid needs to be separated as cleanly as possible from the oily fraction during the cleaning process
- Electronic motor managers (EMM) from Phoenix Contact use the motor as a sensor, so they can reliably detect the change in viscosity from the water phase to the oil phase, which reduces costs considerably

Customer profile

AVR GmbH (right), founded in Vienna in 1989, is one of the leading waste collection and processing companies in Austria. Between 25,000 and 30,000 tons of dangerous liquid industrial waste are processed in the company's systems every year. In order to protect



the environment, this waste is recycled or disposed of properly according to the guidelines prescribed by law. The company, which now has 28 employees on staff and sales of more than five million Euro, deals with waste of all kinds. However, it focuses heavily on the recovery of material from liquid wastes (Fig. 1).

“Using the electronic motor manager, our costs are reduced by around 1300 Euro per month.”

– Tobias Olbrich

To this end, a physical-chemical system is required to break down, separate, and neutralize acids, acid mixtures, concentrates containing metallic salts, emulsions, and oil-water mixtures, among others. In comparison to alternative physical-chemical systems, the AVR GmbH substitutes the new chemicals required by using the customer's disposable materials for the treatment of other wastes. This results not only in lower costs for the customer, but also in a reduced consumption of new chemicals and a minimized amount of sludge produced. In addition, the AVR GmbH has developed its own process that allows for re-refining oil from used emulsions (e.g., cooling lubricants used in turning, milling, and drilling machines) instead of just using it as an alternative fuel. This is an approach that is unique in Austria. It reflects the company's ambitions to be environmentally responsible, to act in an ecologically viable manner that is in conformity with the law, and to provide economic benefits for its customers.



Figure 1: AVR GmbH premises, Vienna (image source: AVR GmbH).

Challenge: Separation of oil and water

Regarding the recycling process for emulsions, the waste processors face the challenge of obtaining oil that is as clean as possible as an end product. Ideally, the oil contains almost no water (less than 3percent) and no mixed fatty acids. To achieve this, AVR GmbH must first pump the emulsion delivered into large tanks (Fig. 2). Because each delivery has different properties, the AVR laboratory



Figure 2: Tanks for separating the emulsions delivered.

staff analyzes a sample of the liquid each time. This way, it is possible to determine appropriate separating agents that will be added to the full tank. After a while, the oil separates from the water. Because of its lesser density, the oily fraction rises into the upper part of the tank, while the water sinks to the bottom (Fig. 3).

The setup shown in Fig. 3 illustrates the separation process described: the laboratory device on the left-hand side contains

the emulsion delivered. After adding the separating agents, a chemical reaction occurs in the intermediate container about 20 minutes later. Shortly thereafter, the oil will be almost completely separated from the water. Oil and water are then processed separately.

Change in viscosity as an indicator

In the past, the physical-chemical system did not include a sensor for detecting the transition from water to oil. A skilled worker was assigned to continually check the drain pipe visually and to take samples. This took three to four work hours per day.

Solution

The electronic motor manager (EMM) from Phoenix Contact can detect the viscosity change in the phase transition from

water to oil. It measures the real power of motors and monitors them for overload and underload, function, dirt, and wear. For this purpose, the system uses switching and signaling thresholds that can be customized to any number of parameters and values. This allows the EMM to be applied to a wide range of applications, from power monitoring to undervoltage detection and many other options in between. Identical or separate settings can be used for both directions of rotation. In the case of AVR, the parameter that is being monitored is the real power consumed, calculated from the current, voltage, and power factor of the connected motor.

Real power is independent of voltage fluctuations and drive load, so real power is much more precise than when only the current is taken into consideration. Motor monitoring is traditionally done one of two ways: power factor monitoring or motor current monitoring. The issue with this is that power factor ($\cos \phi$) monitoring only detects underload states, and a motor protection relay only detects overload currents. In contrast, real power measurement is completely linear from no load to full load, allowing the EMM to detect all critical load states of the motor via changes in the real power consumed. AVR makes use of the changed real power for separating water and oil (Fig. 4).



Figure 3: Illustration of the emulsion separation process in the lab.

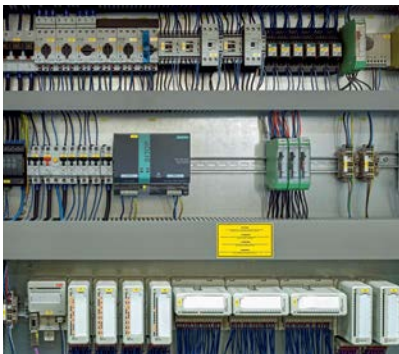


Figure 4: Control cabinet of the cleaning system with integrated electronic motor managers.

Results: Cost advantages associated with acquisition and implementation

As described, the EMM is a measuring device where the motor acts as a sensor. Due to the precise real power measurement, the motor manager has such a high

level of accuracy that it can even detect changes in viscosity. In the physical-chemical system, other sensors that were far more complex (e.g., Coriolis mass flow meters and separation layer sensors) did not function as planned. They could not properly

High level of security in any application area

Motor management from Phoenix Contact is synonymous with up-to-date real power measurement and perfect motor and system protection. Up to eight signaling and switching thresholds ensure maintenance cycles according to your requirements, enabling – in conjunction with continuous state monitoring and high sampling rates – the optimum availability of the system. Easy series-connected wiring allows for simple integration. More importantly, the EMM can then measure all motor parameters such as reactive, apparent and real power, current, voltage, power factor ($\cos \phi$), switching cycle and operating hour counters, and energy (kWh) meters. By taking advantage of these capabilities, the EMM turns any motor into a precise sensor; it is no longer required to install expensive external, application-specific sensors.

Data management is also simplified. The electronic motor manager always provides current information about the load states of the system. It can be used either as a stand-alone solution or in conjunction with a Profibus gateway. The measuring variables can be recorded, saved, and graphed over a longer period of time. This enables the analysis of critical states when troubleshooting, and it also allows for the implementation of Just In Time Maintenance.

separate the water and oil fractions. In addition, a sensor-based solution would have been much more expensive to acquire and implement. The expensive sensors would also need to be coupled to a PLC to handle the logic of detecting pump status.

The EMM, in contrast, works perfectly and is characterized by low investment costs. Apart from the economic price, the user can download free software, so there is no need to purchase an additional controller. The integrated motor protection and the diagnostic function can eliminate the need for some additional components.

However, automating the separation task achieves the most significant cost savings.

“Using the electronic motor manager, our costs are reduced by around 1300 Euro per month,” says Tobias Olbrich, general manager and managing director waste legislation, of AVR GmbH (Fig. 5). “So we did not think twice about choosing this device that convinces thanks to its cost-effectiveness, easy handling, and reliable functionality.”

Use in future projects

Olbrich and his team were also impressed by the reduction in time required to install the EMM. In contrast to other components, such as physical sensors in contact with the fluid, the EMM also proves to be maintenance-free. Using the EMM, the AVR GmbH makes the recycling process easier and more cost-effective. At the same time, the quality of the reusable oil is quite high, creating additional value from the emulsion process. The waste processor currently plans to expand the company’s existing systems and plans to use Phoenix Contact components for these projects. If a new tank container is required, AVR GmbH will certainly install an electronic motor manager.



Figure 5: Tobias Olbrich, general manager and managing director waste legislation of AVR GmbH.