Sludge thickening using MBR technology

Sludge is an unavoidable product of the sewage treatment process and its treatment and disposal is a significant consideration in the design of sewage treatment works. There are a number of technologies available for the stabilisation of sludge and the selection of the most appropriate technology is dependant on a range of factors.

In England and Wales the majority of sludge is treated at a regional Sludge Treatment Centers (STCs). The STCs receive sludge from local sewage treatment works and stabilise them, typically in anaerobic digesters. To reduce volume of stabilised sludge taken off-site the sludge is either dewatered or dewatered and dried.

Mesophilic anaerobic digestion, at 35°C, is the most common method of stabilising sludge in England and Wales. In the absence of molecular oxygen the biochemical pathways are different from aerobic treatment and the principal end products are carbon dioxide and methane. The methane produced is used as a source of energy to heat the digester. Normally more methane is produced than is required for heating and the excess methane can be exported into the national grid as a renewable fuel.

Although anaerobic digestion stabilises the sludge, further treatment is required to reduce volume of sludge taken off-site. The reduction in the volume of sludge is achieved by a combination of thickening, dewatering and, less commonly, drying. The thickening and dewatering process is often carried out using belt thickeners, presses or by centrifuge.

Although these processes reduce the volume of sludge taken away from the site, the liquors produced need to be treated before disposal to the environment. These liquors generally have very high concentrations of biochemical oxygen demand and ammonia and they can overload the existing on-site aerobic facilities.

Where it is not possible to treat the resulting liquors in the existing aerobic treatment plant they must be treated by a dedicated aerobic treatment process. A range of technologies have been applied to treat these liquors.

With a number of successful references in the United Kingdom, membrane bioreactors have been proven to be suitable for this application. In a membrane bioreactor the biological degradation of the pollutants in the sludge liquors is based on conventional activated sludge design. However, the physical barrier provided by the membranes ensures a solids free permeate. The combination of the biological and physical separation ensures the permeate is typically of such a high quality that it can be discharged directly to the environment without requiring further treatment in the existing aerobic facilities.

Membrane bioreactors offer a number of benefits compared to conventional activated sludge processes for the treatment of sludge liquors. A major one is the high MLSS concentration. This high concentration minimises the plant footprint while ensuring the long sludge ages required for ammonia removal.

Another advantage is that membrane bioreactors are not reliant on gravitational settlement to separate the MLSS from the treated effluent. This is a significant advantage in the treatment of sludge liquors where poor sludge settlement characteristics can cause conventional technologies to suffer from periods of poor effluent quality.
In the past five years the cost of membrane bioreactors has fallen significantly as membrane costs have reduced and confidence has grown in the life expectancy of the membranes. The cost effectiveness in combination with the high quality effluent makes membrane bioreactors a suitable technology for treating sludge liquors.