New indicator proposed for assessing treated wastewater quality

The chemical, physical and microbiological characteristics of effluents from wastewater treatment plants are regulated by national and EU law for discharge into surface waters or reuse, but a wide variety of treatment options exist and monitoring all pollutants may be expensive. A new study from Italy proposes a new Wastewater Polishing Index (WWPI) to help decision makers and environmental managers rapidly assess treated water quality.

Many scientists would consider it necessary to measure all separate water quality parameters defined in law, but indices may simplify comparisons or monitoring over time. Several indices are defined for monitoring of ecosystem health or levels of pollution, but there are none for monitoring compliance to legal treatment standards. Legal limits for various pollutants vary internationally, but the study, partly funded by the EU ADRIASAFE project, considers that the WWPI is flexible enough to be redefined for use in various countries, and for multiple pollutants, by applying their prescribed methods to local conditions.

Italian effluent regulations specify 55 chemical, physical and microbiological parameters, many of which are expensive and technically difficult to measure so usually only the easiest and most representative pollutants are sampled. The proposed WWPI uses six criteria which are widely considered the most critical water quality parameters for reuse or discharge - suspended solids, biological oxygen demand, chemical oxygen demand, ammonia, total phosphorus and *Escherichia coli*. Each is measured in different units and ranges so must be transformed onto a common scale for combination into a unitless number.

Ratings curves are drawn for each parameter on a range of 0-100 where zero corresponds to a zero concentration, and 100 corresponds to the (local) legal upper limit for discharge or reuse. When combined, all criteria are treated equally, except for *E. coli*, which is scaled by 1.4, since it is considered the most important factor for reuse. As a result of the scaling, the WWPI is seven to 40 times more sensitive to *E. coli* than any other parameter.

Domestic sewage must be treated for many pathogenic micro-organisms which threaten human health, but many studies show the percentage removal rates for other micro-organisms are not lower than *E. coli*, particularly in constructed wetlands. Similar scaling may be needed where other parameters are added to the WWPI, according to local regulation.

The WWPI was tested by experimental measurements of influent and effluent at a pilot plant at Ferrara, Italy. Four treatment sequences were investigated, using different combinations of rapid filtration, horizontal subsurface flow (under planted beds) and a lagoon - such ‘natural systems’ (constructed wetlands, as opposed to chemical or UV disinfection methods) are used worldwide at medium-sized plants and generally produce consistent high-quality effluents.

Most countries fix quality limits for reuse of water without identifying appropriate treatments. Rapid filtration alone was not sufficient to reach a WWPI of 36 (corresponding to the Italian legal limit for wastewater reuse). Subsurface flow methods also could not guarantee WWPI<36, owing to persistent *E. coli*, but in combination, these methods achieved WWPI<36 consistently in summertime temperatures. Adding an aerobic pond as a third ‘buffer’ step both reduced *E. coli* and ensured a more consistent water quality. Such lagoons can be fitted around natural or recreational landscape features providing leisure and landscape value.

1. ADRIASAFE was supported by the EU INTERREG IIIA programme. See: www.provincia.fc.it/adriasafe


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Themes: Water