

Special issue on the 3rd EWaS International Conference on “Insights on the Water-Energy-Food Nexus” June 27–30, 2018, in Lefkada Island, Greece

Editorial

Advanced approaches on sustainable full water cycle management

This special issue of *Desalination and Water Treatment* presents a collection of seven papers initially presented at the 3rd EWaS International Conference on “insights on the Water-Energy-Food Nexus”. The conference was held on June 27-30, 2018, in Lefkada Island, Greece (<http://ewas3.civ.uth.gr/>). The conference was organized by the University of Thessaly/Civil Engineering Department (Chairman: Prof. V. Kanakoudis – University of Thessaly, Vice Chairman: Assist. Prof. E. Keramaris – University of Thessaly). EWaS series of conferences started in 2013, when the 1st EWaS Conference was held in Thessaloniki and the 2nd EWaS was held in Crete in 2016.

The conference focused on efficient water systems giving insights on the Water-Food-Energy Nexus. The current special issue of *Desalination and Water Treatment* was guest-edited by Professor Vasilis Kanakoudis and Dr. Stavroula Tsitsifli, (Civil Engineering Dept., University of Thessaly, Volos, Greece). The papers included in this special issue are based on the ones initially presented at the conference. However, they have been extended and revised by at least 50%, having gone through the standard peer-review process of the *Desalination and Water Treatment* journal. A short insight on each paper follows:

The paper of Azis et al. (2019) monitored membrane fouling in a pilot-scale submerged MBR system fed with municipal wastewater and operated under intermittently aerated conditions. Transmembrane pressure (TMP) was online measured on the membrane module during the whole operating period and permeability and resistance were estimated daily. The study concluded that TPM monitoring is an effective tool to detect the membrane fouling grade in order to apply the appropriate cleaning method. To control TMP increase owing to biosolids accumulation on membrane surface, successive backflushing cycles, backwash volume increase, air-cross flow velocity increase and in/ex situ mechanical cleaning were applied. Hydraulic cleaning resulted in TMP improvement and flux recovery of 40 and 32%, respectively. Ex situ and in situ mechanical cleaning led to TMP improvement of 25 and 39%, corresponding to flux recovery of 63 and 189%, respectively. Increased aeration intensity improved TMP and increased permeate flux by 63 and 56%, respectively. In the case of fouling that was caused by pore blocking and cake layer formation, chemical cleaning was implemented on the membrane module. Extensive chemical cleaning with NaOCl solution led to permeate flux increase of 90%, corresponding to TMP improvement of 44%.

Brika (2019) highlighted the conventional and non-conventional water resources in Libya, presenting an overview of seawater desalination technology in Libya. The paper highlights the need for sustainable irrigation methods and the need for cooperation at national and regional level. Brika (2019) suggests that desalination should be accommodated as a strategic and ultimate solution for the water shortage in the country. Manmade solutions (e.g. river) should continue to supply water as a secondary water source. Finally, water reuse and recycling should be also used as alternative methods and cooperation is needed between the government and the research institutes.

Dimkić (2019) presented multiyear temperature (T), precipitation (P) and river discharge (Q) trends across Serbia at annual, seasonal and monthly basis, from 1949 to 2016. The paper showed that Serbia recorded much

higher annual T in the last ten years (2007-2016). The overall average observed precipitation change in Serbia is relatively small (in the range of +10%/100 years) but a distinct upward P trend exists in the (south)western and a downward trend in the eastern part of the country. The direction of annual river discharge changes in Serbia is generally in accordance with the forecasts based on the IPCC scenario A1B and the observed T and P trends, while average Q trends have decreased by about 20-25% / 100 years. The paper compared the results of this research based only on observed changes, for which regional climate and hydrologic models (RCMs) were not used, with the results obtained for the near future by RCMs in different projects and studies.

The paper of Dimkić et al. (2019) presented three different Multi-Criteria Decision Analysis (MCDA) approaches in search for the best water management solution for the Pek River catchment area. The paper showed how optimal water management is addressed in a catchment that exhibits a declining water resources trend, in Serbia and demonstrated that three different MCDA approaches, if all input parameters are selected properly and consistently, do not result in any significant differences in the final selection of the best solution.

Papadopoulos et al. (2019) proposed a hybrid fuzzy-probabilistic approach to classify the hydrological drought. The analysis focuses on the annual cumulative discharge which is considered as a random variable. Based on a fuzzified version of the frequency factor method, the fitting between the empirical probabilities and the theoretical probability distribution is investigated with the assumption of Log-Normal and Log-Pearson III. This fitting is achieved by using Tanaka's fuzzy linear regression and hence, all the observed probabilities are included within the produced fuzzy band. Furthermore, a modified fuzzy regression model is also applied. An assumption of the mean value and the standard deviation regarding the log-transformed data can be simultaneously achieved based on the theoretical density probabilities and the sample. Based on the achieved fuzzy frequency factor curve, the fuzzy cumulative annual discharge which corresponds to each threshold of drought can be determined. In order to classify the intensity of hydrological drought, an ascending procedure is proposed by comparing the existent annual cumulative discharge and the fuzzified thresholds of the drought categories. The proposed methodology is applied in the case of the Evros River, Greece.

The paper of Spiliotis and Skoulikaris (2019) evaluated the measures proposed by the Programmes of Measures (PoMs) through the Water Framework Directive implementation process using integrated hybrid multicriteria methods. Multicriteria outranking methods are coupled with a 0/1 linear programming in which the cost of the measures is induced as a constraint. The monocriterion scores of the applied method, in which 6 criteria and 37 alternatives are integrated, is proposed for the prioritization of the supplementary PoMs. The case study area is the River Basin District of Central Macedonia, Greece. Fuzzy Analytical Hierarchy Processes are used to determine the weights of the criteria as crisp numbers even if fuzzy pairwise comparisons among the importance of the criteria exist. The research demonstrated the usefulness of the methodology when financial constraints do not permit the implementation of the whole set of measures.

Zerva et al. (2019) investigated the diversity of antibiotic resistance genes (*ermF*, *ermB*, *sul1* and *int1*) at the various stages of the biological treatment process in a full-scale municipal wastewater treatment plant (WWTP). Application of culture-independent molecular techniques resulted in the detection of similar genotype patterns throughout the entire treatment process. In addition, evidence that distinct *int1* genotypes are responsible for the expression of *sul1* and *ermF* genes in members of Gammaproteobacteria and Bacteroidetes respectively indicates possible microbe specificity at phylum level. The identification of similar ARGs patterns throughout the biological treatment process also denotes the necessity for the implementation of effective tertiary treatment methods, prior to effluent discharge in the recipient water bodies, other than chlorination and UV disinfection to diminish their dissemination threat.

The Guest Editors would like to thank all the authors for their worthy contributions to this special issue of Desalination and Water Treatment Journal. Furthermore, we would like to express our thanks to the Journal Editor, Prof. Miriam Balaban, for the faith she showed to the Guest Editors, and her help throughout the handling of manuscripts. We are also thankful to the several reviewers for the time and efforts they sacrificed to ensure high standards for the submitted manuscripts.

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