# บทความที่น่าสนใจประจำเดือนกันยายน 2557

## สาขาวิทยาศาสตร์และเทคโนโลยี

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| 1 | Title: | Prediction of micropollutant elimination during ozonation of a hospital wastewater effluent |
| | Author: | Yunho Lee, Lubomira Kovalova, Christa S. McArdell, Urs von Gunten |
| | Journal: | Water Research, Volume 64, 1 November 2014, Pages 134–148 |
| | Abstract: | Determining optimal ozone doses for organic micropollutant elimination during wastewater ozonation is challenged by the presence of a large number of structurally diverse micropollutants for varying wastewater matrice compositions. A chemical kinetics approach based on ozone and hydroxyl radical (radical dotOH) rate constant and measurements of ozone and radical dotOH exposures is proposed to predict the micropollutant elimination efficiency. To further test and validate the chemical kinetics approach, the elimination efficiency of 25 micropollutants present in a hospital wastewater effluent from a pilot-scale membrane bioreactor (MBR) were determined at pH 7.0 and 8.5 in bench-scale experiments with ozone alone and ozone combined with H2O2 as a function of DOC-normalized specific ozone doses (gO3/gDOC). Furthermore, ozone and radical dotOH exposures, radical dotOH yields, and radical dotOH consumption rates were determined. Consistent eliminations as a function of gO3/gDOC were observed for micropollutants with similar ozone and radical dotOH rate constants. They could be classified into five groups having characteristic elimination patterns. By increasing the pH from 7.0 to 8.5, the elimination levels increased for the amine-containing micropollutants due to the increased apparent second-order ozone rate constants while decreased for most micropollutants due to the diminished ozone or radical dotOH exposures. Increased radical dotOH quenching by effluent organic matter and carbonate with increasing pH was responsible for the lower radical dotOH exposures. Upon H2O2 addition, the elimination levels of the micropollutants slightly increased at pH 7 (<8%) while decreased considerably at pH 8.5 (up to 31%). The elimination efficiencies of the selected micropollutants could be predicted based on their ozone and radical dotOH rate constants (predicted or taken from literature) and the determined ozone and radical dotOH exposures. Reasonable agreements between the measured and predicted elimination levels were found, demonstrating that the proposed chemical kinetics method can be used for a generalized prediction of micropollutant elimination during wastewater ozonation. Out of 67 analyzed micropollutants, 56 were present in the tested hospital wastewater effluent. Two-thirds of the present micropollutants were found to be ozone-reactive and efficiently eliminated at low ozone doses (e.g., >80% for gO3/gDOC = 0.5). |
| | Database: | ScienceDirect |

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| 2 | Title: | Energy efficient reconcentration of diluted human urine using ion exchange membranes in bioelectrochemical systems |
| | Author: | Ryan C. Tice, Younggy Kim |
| | Journal: | Water Research, Volume 64, 1 November 2014, Pages 61–72 |
| | Abstract: | Nutrients can be recovered from source separated human urine; however, nutrient reconcentration (i.e., volume reduction of collected urine) requires energy-intensive treatment processes, making it practically difficult to utilize human urine. In this study, energy-efficient nutrient reconcentration was demonstrated using ion exchange membranes (IEMs) in a microbial electrolysis cell (MEC) where substrate oxidation at the MEC anode provides energy for the separation of nutrient ions (e.g., $NH_4^+$, $HPO_4^{2-}$). The rate of nutrient separation was magnified with increasing number of IEM pairs and electric voltage application (Eap). Ammonia and phosphate were reconcentrated from diluted human urine by a factor of up to 4.5 and 3.0, respectively (Eap = 1.2 V; 3-IEM pairs). The concentrating factor increased with increasing degrees of volume reduction, but it remained stationary when the volume ratio between the diluate (urine solution that is diluted in the IEM stack) and concentrate (urine solution that is reconcentrated) was 6 or greater. The energy requirement normalized by the mass of nutrient reconcentrated was 6.48 MJ/kg-N (1.80 kWh/kg-N) and 117.6 MJ/kg-P (32.7 kWh/kg-P). In addition to nutrient separation, the examined MEC reactor with three IEM pairs showed 54% removal of COD (chemical oxygen demand) in 47-hr batch operation. The high sulfate concentration in human urine resulted in substantial growth of both of acetate-oxidizing and $H_2$-oxidizing sulfate reducing bacteria, greatly diminishing the energy recovery and Coulombic efficiency. However, the high microbial activity of sulfate reducing bacteria hardly affected the rate of nutrient reconcentration. With the capability to reconcentrate nutrients at a minimal energy consumption and simultaneous COD removal, the examined bioelectrochemical treatment method with an IEM application has a potential for practical nutrient recovery and sustainable treatment of source-separated human urine. |
| | Database: | ScienceDirect |

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| 3 | Title: | Evaluation of ATP measurements to detect microbial ingress by wastewater and surface water in drinking water |
| | Author: | Óluva K. Vang, Charlotte B. Corfitzen, Christian Smith, Hans-Jørgen Albrechtsen |
| | Journal: | Water Research, Volume 64, 1 November 2014, Pages 309–320 |
| | Abstract: | Fast and reliable methods are required for monitoring of microbial drinking water quality in order to protect public health. Adenosine triphosphate (ATP) was investigated as a potential real-time parameter for detecting microbial ingress in drinking water contaminated with wastewater or surface water. To investigate the ability of the ATP assay in detecting different contamination types, the contaminant was diluted with non-chlorinated drinking water. Wastewater, diluted at 104 in drinking |

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| | water, was detected with the ATP assay, as well as 102 to 103 times diluted surface water. To improve the performance of the ATP assay in detecting microbial ingress in drinking water, different approaches were investigated, i.e. quantifying microbial ATP or applying reagents of different sensitivities to reduce measurement variations; however, none of these approaches contributed significantly in this respect. Compared to traditional microbiological methods, the ATP assay could detect wastewater and surface water in drinking water to a higher degree than total direct counts (TDCs), while both heterotrophic plate counts (HPC 22 °C and HPC 37 °C) and Colilert-18 (Escherichia coli and coliforms) were more sensitive than the ATP measurements, though with much longer response times. Continuous sampling combined with ATP measurements displays definite monitoring potential for microbial drinking water quality, since microbial ingress in drinking water can be detected in real-time with ATP measurements. The ability of the ATP assay to detect microbial ingress is influenced by both the ATP load from the contaminant itself and the ATP concentration in the specific drinking water. Consequently, a low ATP concentration of the specific drinking water facilitates a better detection of a potential contamination of the water supply with the ATP assay. |
| Database: | ScienceDirect |

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| 4 | Title: | Development of a steady-state mathematical model for MEE-TVC desalination plants |
| | Author: | Ibrahim S. Al-Mutaz, Irfan Wazeer |
| | Journal: | Desalination, Volume 351, 15 October 2014, Pages 9–18 |
| | Abstract: | Multi-effect evaporation with thermal vapor compression (MEE-TVC) is one of the most effective desalination method. It plays a vital role in the production of fresh water in many regions of the world especially in the Arabian countries. A steady-state mathematical model of MEE-TVC system and its solution procedure are developed based on the basic laws of material balance, energy balance and heat transfer equations with correlations for physical properties estimation. The influence of important design and operating variables on the performance of the plant is investigated. These parameters include number of evaporation effects, motive steam pressure, top brine temperature, temperature difference across effects and feed water temperature. The purpose of this paper is to develop a mathematical model of the MEE-TVC systems and compare the results with the existing plants. A MATLAB program is also used to solve the model equations. The model validity is examined against some commercial MEE-TVC systems. Good agreement is obtained between data of these systems and model predictions. |
| | Database: | ScienceDirect |

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| 5 | Title: | Effects of pH and temperature on forward osmosis membrane flux using rainwater as the makeup for cooling water dilution |
| | Author: | Wendong Wang, Yinting Zhang, Mariem Esparra-Alvarado, Xiaomao Wang, Hongwei Yang, Yuefeng Xie |
| | Journal: | Desalination, Volume 351, 15 October 2014, Pages 70–76 |
| | Abstract: | Cooling water plays an important role in maintaining proper temperatures for many industrial processes. To compensate for water loss and to maintain proper cooling water quality, fresh water must be added to the circulating system. In this study, we evaluated the feasibility of forward osmosis using rainwater as the makeup water source for the cooling water. It was determined that the average water flux was 1.75 L/(m2·h) at 23 °C and decreased gradually to 0.65 L/(m2·h) after the draw solution was diluted 4 times. Although the changes in pH had a small direct effect on the water flux, the existence of sodium hydroxide would promote the dissolution of more carbon dioxide into the feed solution and thus inhibit the permeation process. However, the temperature showed a notable effect on the water flux. By increasing the temperature of the draw solution from 3 °C to 50 °C, the membrane flux increased approximately 10 times. During the extended operation, no decreases in flux were observed as a result of membrane fouling, even when 50 mg/L kaolin or 25 mg/L sodium alginate was added to the feed solution. |
| | Database: | ScienceDirect |

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| 6 | Title: | Seawater for phosphorus recovery from urine |
| | Author: | F.J. Rubio-Rincón, C.M. Lopez-Vazquez, M. Ronteltap, D. Brdjanovic |
| | Journal: | Desalination, Volume 348, 1 September 2014, Pages 49–56 |
| | Abstract: | The direct use of seawater as secondary quality water for toilet flushing can function as a free unlimited magnesium source for phosphorus recovery from urine through chemical precipitation. This research assessed the precipitation of phosphorus present in urine in the form of struvite as a result of mixing with seawater. Taking into account the different feces and urine collection systems available, seawater was mixed with (a) non-hydrolyzed urine to mimic water-flush urinals and (b) hydrolyzed urine to mimic water-free urinals. Different seawater-to-urine mixing ratios were analyzed taking into account the water volume commonly used by conventional toilets, urinals and urine-diverting toilets. Up to 99% phosphorus removal was observed at seawater-to-urine ratios below 3.3:1.0 (as the ones reached by water-less and water-saving urinals). Above this ratio the hydrolysis process in non-hydrolyzed urine is inhibited. Phosphorus removal occurred through the formation and precipitation of struvite; less struvite crystals were observed at Ca/PO4-P ratios higher than 0.8. Seawater can be used as a source of ions for phosphorus recovery from urine; water-free urinals, diverting toilets and water-flush urinals operating with seawater-to-urine ratio lower than 3.3:1.0 (like water-saving systems) can provide better |

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| | conditions for phosphate precipitation using seawater as magnesium source. |
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| Title: | Modeling water demand when households have multiple sources of water |
| Author: | Lassina Coulibaly, Paul M. Jakus, John E. Keith |
| Journal: | Water Resources Research, Volume 50, Issue 7, July 2014, Pages 6002–6014 |
| Abstract: | A significant portion of the world's population lives in areas where public water delivery systems are unreliable and/or deliver poor quality water. In response, people have developed important alternatives to publicly supplied water. To date, most water demand research has been based on single-equation models for a single source of water, with very few studies that have examined water demand from two sources of water (where all nonpublic system water sources have been aggregated into a single demand). This modeling approach leads to two outcomes. First, the demand models do not capture the full range of alternatives, so the true economic relationship among the alternatives is obscured. Second, and more seriously, economic theory predicts that demand for a good becomes more price-elastic as the number of close substitutes increases. If researchers artificially limit the number of alternatives studied to something less than the true number, the price elasticity estimate may be biased downward. This paper examines water demand in a region with near universal access to piped water, but where system reliability and quality is such that many alternative sources of water exist. In extending the demand analysis to four sources of water, we are able to (i) demonstrate why households choose the water sources they do, (ii) provide a richer description of the demand relationships among sources, and (iii) calculate own-price elasticity estimates that are more elastic than those generally found in the literature. |
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| Title: | Optimal plant water-use strategies under stochastic rainfall |
| Author: | Stefano Manzoni, Giulia Vico, Gabriel Katul, Sari Palmroth, Amilcare Porporato |
| Journal: | Water Resources Research, Volume 50, Issue 7, July 2014, Pages 5379–5394 |
| Abstract: | Plant hydraulic traits have been conjectured to be coordinated, thereby providing plants with a balanced hydraulic system that protects them from cavitation while allowing an efficient transport of water necessary for photosynthesis. In particular, observations suggest correlations between the water potentials at which xylem cavitation impairs water movement and the one at stomatal closure, and between maximum xylem and stomatal conductances, begging the question as to whether such coordination emerges as an optimal water-use strategy under unpredictable rainfall. Here mean transpiration <E> is used as a proxy for long-term plant fitness and its variations as a function of the water potentials at 50% loss of stem conductivity due to cavitation and at 90% stomatal closure are |

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| | explored. It is shown that coordination between these hydraulic traits is necessary to maximize <E>, with rainfall patterns altering the optimal range of trait values. In contrast, coordination between ecosystem-level conductances appears not necessary to maximize <E>. The optimal trait ranges are wider under drier than under mesic conditions, suggesting that in semiarid systems different water use strategies may be equally successful. Comparison with observations across species from a range of ecosystems confirms model predictions, indicating that the coordinated functioning of plant organs might indeed emerge from an optimal response to rainfall variability. |
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| 9 | Title: | River scale model of a training dam using lightweight granulates |
| | Author: | B. Vermeulen, M.P. Boersema, A.J.F. Hoitink, J. Sieben, C.J. Sloff, M. van der Wal |
| | Journal: | Journal of Hydro-environment Research, Volume 8, Issue 2, June 2014, Pages 88–94 |
| | Abstract: | Replacing existing river groynes with longitudinal training dams is considered as a promising flood mitigation measure in the main Dutch rivers, which can also serve to guarantee navigability during low flows and to create conditions favourable for ecological development. Whereas the bed response in the streamwise uniform part of a river trained by a longitudinal dam can be readily predicted, the bed response at the transition zones is unclear. In the present study, we investigate the local morphological effects resulting at the intake section of a longitudinal training dam, where the flow is distributed over the main channel and a side channel in between the dam and the river shore. A sediment recirculating model with a nearly undistorted geometry with respect to the prototype was setup. Lightweight polystyrene granulates were used as a surrogate for sediment, to properly scale the Shields parameter without compromising Froude scaling, and reach dynamical similarity. A laser scanner allowed collecting high-resolution bed elevation data. Results obtained under typical low flow and high flow conditions show a general deepening of the bed in the area adjacent to the training dam, in response to narrowing of the main channel. Scour at an upstream river groyne embedded in the model showed a scour hole which was deeper than realistic. Throughout the entire domain, bedforms developed featuring geometrical properties that reproduced the prototype conditions appropriately. Based on a comparison with characteristics from the River Waal, regarded as the prototype without a longitudinal dam, lightweight sediments were considered to be a proper choice for this study, in which bedload is the main sediment transport mode. The main conclusion regards the absence of significant morphodynamic developments at the intake section, both during the high flow experiment and during the low flow experiment, which can be attributed to the alignment of the dam with the local streamlines. |
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| Title: | Physical-scale model designs for engineered log jams in rivers |
| Author: | Michael S. Gallisdorfer, Sean J. Bennett, Joseph F. Atkinson, S. Mohammad Ghaneeizad, Andrew P. Brooks, Andrew Simon, Eddy J. Langendoen |
| Journal: | Journal of Hydro-environment Research, Volume 8, Issue 2, June 2014, Pages 115–128 |
| Abstract: | Stream restoration and river engineering projects are employing engineered log jams (ELJs) increasingly for stabilization and in-stream improvements. To advance the design of these structures and to evaluate their morphodynamic effects on corridors, the basis for physical-scale models of rivers with ELJs is presented and discussed. The prototype selected is the Big Sioux River, SD, chosen because ELJs will be used to mitigate excessive bank erosion. The underlying theory of physical-scale modeling and all primary and secondary scaling ratios are presented for two boundary conditions, a fixed- and movable-bed, given the experimental constraints of the intended facility. The scaling ratios for the movable-bed model sediment are relaxed, allowing for the use of typical experimental flows, facilities, and materials. Proposed ELJ designs are based on proven field installations, and these structures also are scaled to natural timber dimensions to be used in the prototype. Preliminary results from these physical models show that (1) ELJs greatly decelerate flow near the structure and accelerate flow in the main portion of the channel, yet spatially averaged flow velocity and depth remain unchanged, (2) derived drag coefficients for the ELJs based on force measurements vary from 0.3 to 0.7 depending on the scaling velocity employed, and (3) while significant localized erosion and deposition occurred in the vicinity of the ELJ, these effects extended well downstream of the structure and across the entire channel. Although physical experimentation using wood is not uncommon, the use of physical scaling theory appears to be employed infrequently, which potentially could limit the applicability of the results obtained. It is envisioned that the procedures outlined here would become more widely used in experimental research of rivers and in river restoration design. |
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