Effect of different carbon materials on the performance of microbial electrolysis cells (MECs) operated on urine and their microbial composition

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Urine is rich in nitrogen and phosphorous and can considerably reduce domestic wastewater treatment requirements if collected separately. Source separated urine has been shown to be suitable for energy production and nutrients recovery in bioelectrochemical systems. However, there are still several challenges to overcome mainly related to organics conversion into electrical energy.
In this study, anode performance of three microbial electrolysis cells (MECs) fed with urine using different carbon anodes, Keynol (phenolic-based), C-Tex (cellulose-based) and PAN (polyacrylonitrile-based) was compared. Two strategies were used to supply energy to the MECs; cell potential control (1st assay) and anode potential control (2nd assay). In both assays, the C-Tex MEC outperformed MECs using Keynol and PAN. The C-Tex MEC with anode potential control at -0.300 V generated the highest current density of 904 mA m^{-2}, which was almost 3-fold higher than the MEC with Keynol, and 8-fold higher than the MEC with PAN. Analysis of anodes textural, chemical and electrochemical characteristics suggest that the higher external surface area of C-Tex enabled the higher current density generation compared to Keynol and PAN. The microbial composition on each anode and its correlation with the generated current was also investigated. No significant differences were observed in microbial diversity of the biofilm present in the studied anodes. Nonetheless, C-Tex had higher dominance of bacteria belonging to *Lactobacillales* and *Enterobacteriales* suggesting its relation with higher current generation.