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Supercritical water oxidation for the treatment of hazardous effluents

Bushra Al-Duri
University of Birmingham, UK

This work presents supercritical Water Oxidation (SCWO) as the next generation of advanced processes for the treatment of hazardous compounds found in pharmaceutical, medical, laboratory and petrochemical effluents. SCWO is an advanced process based on the unique chemistry of water above its critical point (374.8°C and 25MPa). Unlike ambient water, SCW becomes miscible with all organics including stable hydrocarbons, polymers, biomass, as well as its miscibility with all gases. The reactions carried out in SCW are rapid (seconds to minutes), are highly efficient >99%, and produce no toxic emissions. This makes SCWO a strong contender to replace incineration for the destruction of non-biodegradable, chemically stable compounds found in effluents of the petrochemical industry. Furthermore, it shows great promise for the upgrading of heavy oils, production of hydrogen from biomass, to name a few applications. On a commercial scale SCWO passed through various challenges and is now on-route to the good. This work displays SCWO from fundamentals to commercialization, covering the existing concerns over the current prevailing treatment techniques and how SCWO offers advantages over such techniques. It reviews the chemistry of water and its relation to SCW behaviour, the kinetics of SCWO and SCWO reactor design. Further, it displays the main challenges, which face commercialization and the main existing SCWO commercial plants around the world.

Biography

Bushra Al Duri won a Research Grant Award of £750k from the EPSRC in Supercritical Coal Fired Power Plants, in collaboration with Electrical Engineering at Warwick University, Tsinghua University and NCEPU in China. Industrial partners are E-On UK Ltd., Emerson UK Ltd. and Scottish Powers. She is the lead Investigator in Chemical Engineering at Birmingham. She has recently returned from an EPSRC-supported UK-China Energy Conference in Beijing, where she represented the Project. Bushra completed 16 PhD programmes and has over 90 publications in Wastewater Treatment, Reactions & Biocatalysis, and Supercritical Fluids. She also has on-going collaborations with international institutions, including University of Tokyo. Her future plans include expanding of the research in Energy and Environment; focusing on combining existing processes with supercritical water technology as the next generation of processes for waste minimisation and energy production, which complies with the increasing concerns over carbon emission and hence global warming. Bushra was appointed as MEGS Deputy Director at the beginning of April 2011.

b.al-duri@bham.ac.uk

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