Aalto University
School of Engineering

Dissertation Release **21.08.2020**

Can we efficiently engineer a hydrogen production process similar to how nature produced fossil fuels?

Title of the dissertation	Hydrogen Carriers from Industrial Biomass via Sub/supercritical water
Contents of the dissertation	The ensued transition to a Hydrogen-based economy is currently constrained with a more than 90% market share produced from fossil-sourced technologies. As it is known, fossil fuels originate from organic material exposed to heat and pressure in earth's crust for millions of years. This study investigates Sub/supercritical water, a process operating at similarly elevated conditions, replicating nature's work, but only in the span of seconds to hours. The technology is envisaged to act as transitional solution to produce low-carbon fuels and materials in the near future. Specifically, for sectors in which, 100% electrification is limited or waste valorization is functionally needed. This research, a process modelling and technology evaluation study provided insights on the contribution of water in the organic and inorganic conversion mechanisms taking place in sub/supercritical water. Whereas, rather than being a processing penalty in traditional systems, water acts as a solvent, catalyst, a source of H_2 molecules and a capture/binder for carbon which would have else contributed to GHG emissions. The multi-purposeful presence of water leads to a resource and energy efficient production process for circular waste solutions, matching and even exceeding some of the other renewable energy based technologies currently under development. In addition, the study complimented the technical understanding with knowledge on the socio-economic and environmental impact of the technology, as well as possibilities for industrial symbiosis within existing infrastructure, namely in the production of pulp and paper.
Field of the dissertation	Energy Engineering
Doctoral candidate	Mohamed Magdeldin, M.Sc. (Eng) Born in 09.06.1987
Time of the defence	04.09.2020 12:00
Place of the defence	Aalto University School of Engineering, lecture hall 216 (K1), Otakaari 4, 02150 Espoo. Virtual attendance via Zoom link https://aalto.zoom.us/j/67568977557
Opponent	Professor, D.Sc. (Tech.) Mikko Hupa Åbo Åkademi University, Finland.
Supervisor	Professor, D.Sc. (Tech.) Mika Järvinen Aalto University School of Engineering, Department of Mechanical Engineering
Electronic dissertation	https://aaltodoc.aalto.fi/handle/123456789/49
School of Engineering electronic dissertations	https://aaltodoc.aalto.fi/handle/123456789/49

Aalto University
School of Engineering

Doctoral candidate's contact information

Mohamed Magdeldin
Sumitomo SHI FW
Metsänneidonkuja 8,
Espoo, 02130, Finland.
+358 40 631 2120
mohamed.magd@aalto.fi