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Subcritical water based technologies for extraction processes and biomass conversion : a review

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Subcritical water (SW) based technologies (also known as pressurized hot water) has proved to be an alternative technique for the extraction of active compounds (especially wet) from different biomass materials with mild operating conditions, short process times, and environmental sustainability.

In our technical center specialized on supercritical fluids (IFS), we are seeing a growing interest for SW based process coming from industries (i.e. cosmetics and food supplements) which are looking for greener, innovative technologies. One interest lies in the solvability of SW (180 °C - 100 bars) comparable to that of methanol or ethanol. Besides, SW extraction enable to work on relative humid biomass such as algae, crops wastes (1-2).

We have therefore made a review of SW based applications from lab-scale to industrial scale. First part consists of a bibliographic review of latest scientific articles (2016-2017) in order to get an overview of academic research activities on SW (goal, material and method, biomass). We observe two main trends: subcritical water extraction process to get active compounds rich in antioxidants and phenolic compounds - subcritical water for bioraffinery purpose such as hydrolysis of hemicellulose, extraction of polysaccharides. In both cases, a large part of biomass treated are by-products or waste. The second part of our survey is turned towards industries and market. Indeed, as for any implementation of a new process, key point for industrialization lies on availability of technical platforms or industrial-scale pilot. Quite recently, companies either in Europe or Canada appear on market to offer this kind of facilities. Besides, those companies propose bio-active compounds produced through SW technologies. Our review ended with a general web watch view on subcritical water extraction compared to supercritical CO₂ extraction applications. Therefore, it is interesting to note that unlike CO₂ extracts, different market names are used for SW Extracts such as PHYTOCLEANTM Blue extractionTM.

Reference

- [1] Phillip. E. Savage, Qingqing Guan, Jacob G. Dickinson, Peter J. Valdez, Shujaiddin Chang, Valorization of Aquatic Biomass via Supercritical Fluid Processes, **2012**, *10th international symposium on supercritical fluids San Francisco*
- [2] Extraction of high-value added compounds by subcritical water and fractionation by membrane processes : valorization of vine and wine by-products by eco-innovative processes, *Thesis Sami Yammine, Martine Mietton-Peuchot, University of Bordeaux, 2016*