

## Natex vision for a proximate future in the field of supercritical CO<sub>2</sub> applications on industrial scale

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### Abstract

In the present work will be presented our perspective and the trends that are designing themselves for supercritical CO<sub>2</sub> extraction. Following topics are discussed: food industry, cosmetic and pharma industries, renovation of old plants (refurbishment), technologies for cleaning with CO<sub>2</sub>, special applications, and future developments. Technical and technological risks and major factors influencing the industrialisation of the processes will be addressed.

A subject that with the advising of time becomes more and more pressing is renovation of older CO<sub>2</sub> industrial plants. The first wave of CO<sub>2</sub> industrialization and implantation of industrial plants occurred in the decades of 1970's and 80's. Examples of first industrial plants will be addressed. These plants are/will reach their end of lives in the next years, and this poses the challenge of extending their lifetimes, upgrading or replacement.

A second subject is the identification of potential industrial applications of supercritical CO<sub>2</sub> extraction. Within this subject we identify 4 main directions:

The first direction to be addressed are the food and meal industry. A prominent place is already occupied by extraction of spices and herbs in Europe and India and also decaffeination of coffee and tea. The production of protein powders, the defatting of pressed cakes and hence obtaining very rich protein meals both for animal and human nutrition with the added advantage of larger shelf lives on solvent free basis is becoming a lot of interest. Defatting of animal meal and by-products of the meat processing industry – these processes seem to be the ones benefitting most of the economy of scale supercritical CO<sub>2</sub> technology allows. Deodorization of food raw materials and fish oil deodorization are also getting increased interests on the part of the industry.

On the second direction of developments, we address the cosmetic and pharma industries: the extraction of medicinal plants (e.g. cannabis), extraction of special oils (oils rich in unsaturated species, carotenoids, antioxidants and other functional active ingredients) from plants or algae biomass.

A third direction is occupied by the cleaning technologies: removal and recovery of solvents and additives by using CO<sub>2</sub> technology: removal of additives and solvents, extraction of mono and oligomers, plasticizers and VOC's from plastics, degreasing or cleaning the metallic cuttings and powders (magnesium cuttings, steel filings). Recycling or gentle removal of organic solvents from final products or complex mixtures can also be addressed. Removal of TCA from cork, cleaning of cereals like rice from other undesired compounds are also still under big attention for the relevant companies.

A fourth direction emerges with speciality applications. Here we will address the drying of aerogels and wood impregnation.

Further topics including sulphur-free wood pulping with Carbocell process, extraction of new algae species, defatting of single cell proteins, recycling of Lithium-ion batteries, pasteurisation with CO<sub>2</sub>, high-pressure CO<sub>2</sub> supported continuous deoiling, increased activities in simulation and use of AI for optimisation and prediction of high-pressure processes, can be mentioned.