Ultrasound-assisted extraction of oilseeds: study on hempseeds (Cannabis sativa L.)

PIAZZA L. (1), GIROTTO F. (1), ESPOSITO M. (1)
1 Universitdegli Studi di Milano - Departmnt of Environmental Science and Policy, Milano, Italy

There is a growing interest for ultrasound inclusion in extraction of oil (soybean, almond, sunflower), proteins and bioactive compounds (polyphenols, polysaccharides, anthocyanins) from different sources. It is commonly agreed that ultrasonic assisted extraction (UAE) advantageously improves conventional oil extraction technology because of high extraction yield, shorter extraction time and low energy demand. During the UAE of vegetable materials, the result of the cavitation phenomena is an enhanced material transfer from inside the cells to the external environmental.
Oilseed-matrix consolidation is a crucial factor when talking about oil expression because, as the cake consolidates, the coefficient of permeability inevitably decreases. Thus, any treatment that extensively ruptures cell walls reduces rigidity and hardness of the oilseed press-cake, while improving the oil expression. Such process intensification was investigated in the present study through the introduction of the ultrasound (US) technology. Screw pressing of Cannabis sativa L. seeds was operated using a pilot scale equipment set at three different pressures to understand the correlation with the ultrasound effectiveness. Samples of non-exhausted press-cakes were tested for objective instrumental indices of compressibility and oil expression yields prior and after the US treatment.
Main results are as follow. US led to a drag resistance reduction within press-cakes, improving oil flowability through a decrease in the material cohesiveness and adhesiveness. Consistently, sonication favoured oil extraction yields and oil antioxidant capacities, which increased with respect to the untreated samples, respectively equal to +19.2% and + 29.4% for the press-cake screwed at low pressure, to +21.8% and + 49.3% at medium pressure, and to +15.4% and + 0.5% at high pressure. Overall, US highest effectiveness was accounted for samples screwed at medium pressure.
In conclusion, press-cake compressibility can be sucessfully described by macroscopic texture parameters; indeed, their decrease is linked to higher oil expression efficiencies. Sonication can help boosting oil extraction yields reducing drag resistance within the mechanical screwing equipment. These outcomes offer good potentials for US application in the hempseed technology and, more extensively, in the oil seed industry.