Gas Assisted Pressing of Oil Seeds

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In traditional production of edible oils from oilseeds with high oil content (rapeseed, sunflower) two separation steps are common practice: Initially mechanical drainage takes place in a screw press. Then oil remaining in the residual plant material is extracted with an organic solvent such as hexane.

Hexane extraction being a continuous process is highly efficient; however it involves strong requirements concerning production safety and environmentally detrimental emissions wherefore alternative processes are being discussed. In this work basic research about the possible enhancement of oil recovery by carbon dioxide dissolution under elevated pressure is presented.

It is known that viscosity of vegetable oil decreases dramatically when carbon dioxide is dissolved at pressures as low as 100 bar to 150 bar. This effect can be used to make mechanical expression of oil more efficient:

Mechanical pressure in a screw press has two contrary effects: on the one hand it is necessary to squeeze oil out of the pre-conditioned seed into the voids and the pressure difference acts as driving force for overcoming the flow resistance of the compacted bed allowing for drainage. On the other hand high mechanical pressure leads to further compaction and thus reduction of solid bed permeability, which on its part counteracts oil drainage. As a matter of principle there is a limitation of yield in mechanical oil expression, which is only reached at ideal pressure conditions. Viscosity reduction facilitates oil drainage and therefore may shift the limited yield to higher values.

In this presentation the enhancement of pressing yield by dissolution of supercritical carbon dioxide is demonstrated for rapeseed and soybeans. Experiments were carried out by means of uniaxial expression trials. For this a pressure vessel (∅ = 100 mm) allowing for simultaneous application of gas and mechanical pressure was constructed. Experiments using carbon dioxide and nitrogen at a gas pressure of 150 bar aimed at quantifying yield augmentation and identifying effects responsible for it. Critical contact time of carbon dioxide and oilseed was studied.

A remaining oil content below 5 % could be reached in uniaxial expression using carbon dioxide. It could be verified that other effects than viscosity reduction such as displacement play a certain role. Further the contact time reveals to be a decisive figure for successful gas assisted pressing of oil seed.