Gentle Meal Processing by Using a Fluidized Bed Desolventizer

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Motivation
The main by-product of rapeseed processing is meal which accounts > 60 % of the input quantity. Although rapeseed meal contains about 40 % valuable proteins it is applied only in a limited feed market due to its high amount of fibres and antinutritive components.

Possible alternative uses of rapeseed proteins in food and non food applications fail because they are irreversibly damaged after the conventional process and have lost their bioavailability and functionality. It is known that the desolventizing/toasting step after solvent extraction is the most critical processing step. To avoid protein damage in the case of soybean processing flash desolventizers are used, but these are not suitable for rapeseed meal.

Solution
Therefore a new desolventizer based on fluidized bed principle was developed. In a fluidized bed apparatus the material which is to treat is fluidized by a gas (or a liquid). Under these conditions a very high heat and mass transfer is ensured and coherent to that low thermal load of the treated material is guaranteed and low unit dimensions are possible. A very efficient way for hexane removal from the meal is the use of superheated hexane as fluidizing medium.

Experiments
All experiments were carried out in a test unit (Fig. 1).
- Diameter of fluidized bed chamber: 200 mm
- Max. batch mass: 3 kg

Two different processes were simulated:
- a) total flow condensation and
- b) partial flow condensation (Fig. 2).

The meal particles were fluidized by nitrogen and/or superheated hexane.

The bed temperatures were varied between 70 and 100 (120) °C, the residence time between 10 and 60 min.

Results
Desolventizing
Fig. 3 shows the obtained results regarding to hexane and simultaneous water removal. The target value of 350 ppm residual hexane can be reached.

Protein Quality
Fig. 4 shows the PDI of meals treated in the fluidized bed desolventizer in comparison to the same meal desolventized by drying at ambient conditions. The PDI values were determined by a method acc.to AOCS Ba 10-65.

Summary
By treatment in a new fluidized bed desolventizer rapeseed meal can be desolventized to < 350 ppm residual hexane without damaging the containing proteins.

Tab. 1 shows the main parameters of batch desolventizers which can be offered.