Technologies of oilseed pressing and their effect on the nutritional value of the press cake

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A purely mechanical way to process oilseeds keeps gaining in popularity, in particular with small and medium-scale producers, for processing locally grown crops. Thanks to the availability of presses and other equipment at diverse capacities, lines can be assembled to process between 2,000 and 400,000 tonnes of oilseeds per year. The most common criteria for the categorization of these technologies are 1) one-step vs. two-step setup and 2) depending on the presence or absence of a pre-heating step – cold or hot pressing.

In the past, producers aimed their effort in two directions: The first was to achieve the highest possible oil yield. The best standard technology that achieves this is the two-step, or alternatively one-step, hot pressing (WP2, WP1), where a stack cooker is placed before the press. The exposure to heat, however, causes a deterioration in oil quality, namely an up to ten-fold increase in phospholipid content compared to cold pressing. The second was to gain a high-quality oil that is rich in vitamins, enzymes, antioxidants, but low in phospholipids. The latter priority is fulfilled by the cold pressing technology, in which the resulting high quality oil comes at the cost of a lower yield.

Currently, emphasis is being increasingly put on the quality of the press cake as a resource for the animal feed and food industries. The goal of oilseed processing here is to secure the best digestibility of the cake. For such processing, extrusion has proven to be the most effective method, bringing about a number of benefits for the pressing process. Extrusion causes the disruption of cellular structures, thus increasing the oil yield in the subsequent pressing step. During extrusion, a significant reduction in the content of the thermolabile antinutritional substances occurs. These substances naturally act as protection against pests (e.g., urease activity, trypsin inhibitor, lectins, saponins in soya, glucosinolates in rape, gossypol in cotton), but decrease the seeds' digestibility. Also, thanks to an evenly distributed heating during extrusion, the seeds are sterilized as the germs (bacteria, mould, and other pests) are destroyed, and a longer shelf life is achieved as the production of microbial toxins ceases. Extrusion is also a very gentle process, heating up the seeds by their exposure to high pressures for a very short time.

If the recommended extrusion parameters are maintained (mainly the heat exposure), the potential negative effects of high temperatures are eliminated while keeping the good digestibility of the proteins. On the other hand, process parameters, common in the stack cookers in the technologies WP2 and WP1, such as high temperature and long residence time, or low moistness of the source material, are linked with the creation of the products of the Maillard reaction, which significantly lower the digestibility of the cake. Also, the content of reactive amino acids (lysine, cysteine, and methionine) is reduced in such conditions.

The following table presents the advantages (+) and disadvantages (-) characteristic of the various processing technologies. The comparison involves three main oilseeds:

Oilseed	**CP1/CP2**	**EP1/EP2**	**WP1/WP2**
Rapeseed	+high quality oil -low oil yield -high content of antinutritional substances in the cake -low cake digestibility -presence of germs	-medium quality oil +high oil yield +low content of antinutritional substances in the cake +high cake digestibility +absence of germs	-low quality oil +high oil yield +low content of antinutritional substances in the cake -medium cake digestibility +absence of germs
Sunflower	-medium quality oil +low oil yield +low content of antinutritional substances in the cake +high cake digestibility -presence of germs	-medium quality oil +high oil yield +low content of antinutritional substances in the cake +high cake digestibility	-low quality oil +high oil yield +low content of antinutritional substances in the cake +medium cake digestibility

Soya	not recommended due to a high content of antinutritional substances	-medium quality oil +high oil yield +low content of antinutritional substances in the cake +high cake digestibility	-low quality oil +high oil yield +low content of antinutritional substances in the cake +medium cake digestibility

Each oilseed produces a cake with specific nutritional properties. This has to be taken into account when choosing the particular processing technology, in order to achieve the best nutritional parameters. The aim of the heat treatment by extrusion is to eliminate the antinutritional substances and germs of pathogens, while maintaining maximum digestibility of the protein (minimizing the products of the Maillard reaction).

In addition, implementing an appropriate seed pre-treatment method, such as peeling (dehulling), can result in significant changes to the nutritional parameters of the cake. A partial removal of hull from the seeds can decrease fibre content in the cake, which is important for soya and rapeseed, but especially for sunflower. A cake made from unhulled sunflower seeds is virtually unusable for the nutrition of poultry and pigs, but also quite badly digestible even for ruminants (cattle, sheep, goats) due to the elevated fibre content (particularly lignin). For the nutrition of monogasters, dehulling (peeling) is always important, as it increases the relative content of protein, which is the main asset of these feed sources.

Each pressing technology variant has its benefits and negatives. Thus, choosing the right one always depends on the particular situation and customer requirements.