BRIEFING

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Oilseed Processing: An Overview

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Soybeans are the most commonly grown oilseed crop in the United States. However, Montana's growing conditions are not generally suitable for soybean production. In 2006, the most commonly produced oilseeds in Montana were as follows; canola (10,000 acres), safflower (39,000 acres), flax (35,000 acres), and mustard (7,000 acres).[1] Montana farmers also raise other oilseeds such as sunflower (3,600 acres in 2006) and camelina. Accurate estimates of camelina production in Montana are unavailable. In other parts of the country, cotton seeds and peanuts are processed for their oils. Processes used to separate oil and meal from oilseeds vary depending upon seed characteristics and other factors.

Montana's major oilseed crops are generally described as soft seeds. Soft seeds typically have oil content in excess of 30%. Their high oil content requires different processing techniques than those used for soybeans which generally have an oil content of less than 20%. This guide provides information about techniques employed to process oilseeds with high oil content and also identifies the issues associated with establishing oilseed processing operations.

Oilseed Processing

Seed preparation is the first step in any oilseed processing plant regardless of the oilseed feedstock. Seed preparation may include cleaning, de-hulling, cracking, rolling, flaking, de-shelling, or some combination of these processes. Foreign objects and certain seed coverings are removed during seed preparation. The removal of any metal or stone objects from the seed is required before further processing to prevent damage to the processing equipment.

Two main types of processes are used to separate oil from an oilseed. The first process is mechanical extrusion, in which the seed is mechanically pressed, allowing the oil to be separated from the meal. The second process is solvent extraction, which is often used in conjunction with some form of mechanical extrusion. The solvent extraction process applies a solvent solution to material that has been pre-pressed. The solvent bonds to oil in the pre-pressed material and an

[1] Acreage information was obtained from the National Agricultural Statistics Service.

oil laden solvent solution is then separated and further processed to separate the oil from the solvent. Mechanical extrusion typically recovers between 65% and 80% of the oil contained in a seed. Solvent extraction recovers over 95% of the oil contained in a seed.

Mechanical Extrusion

The basic mechanical extrusion process is relatively simple and usually used by low volume processors. In the simplest mechanical processes, seed is cleaned to remove any foreign objects and crushed by a mechanical extrusion process, which is often a screw press. When seed enters the screw press, pressure is exerted on the seed which forces oil through small openings in the sides of the press. The meal, which is too large to exit through these small openings, is extruded through a larger opening at the end of the press. This simple process removes approximately 65% to 75% of the oil in a seed.

The oil recovery rate of mechanical processors can be improved by adding heat to the process. In such processes, cleaned seed is heated as it enters the press, increasing the oil recovery rate by 5% to 10%. Small mechanical processors generally do not include a heating process.

Solvent Extraction

Solvent extraction processes are modified to fit the characteristics of each oilseed being processed. One method of solvent extraction is described here. The process uses using canola as its feedstock. Canola has an oil content of approximately 35% to 40%. As a result, some of the oil must be removed before a solvent is applied. The process for canola begins with cleaning and flaking the seed. The flaked seed is then heated and pre-pressed. The pre-pressing process is a mechanical extrusion process that removes some oil from the flaked material, reducing the oil content in the remaining material to about 20%. A solvent extraction process is more efficient when the oil content of the material is less than 25%. The solvent solution, which is often hexane based, is then applied to the material. The solvent solution bonds to the oil remaining in the material. The solvent laden material then passes through an extractor that separates the solvent solution from the meal. Next, the solvent and oil solution is processed to separate oil from solvent. Most of the solvent is recovered and reused, although some is lost during the process. Solvent extraction processes recover more than 95% of the oil contained in an oilseed.

The solvent extraction process is somewhat different for soybeans, because pre-pressing is not required to reduce oil content, which is generally less than 20% for soybeans. Soybean processing begins with dehulling, cracking, rolling and flaking. Once these steps have been completed, solvent is applied and the rest of the process for soybeans is similar to the process for canola.

Important Considerations

Potential oilseed processors should consider the advantages and disadvantages of both types of processing. A mechanical extrusion press with a one ton per day capacity is relatively inexpensive and can be purchased and equipped with basic accessories for $5,000 or less. Larger mechanical presses are available in the $10,000 to $500,000 range depending on the size and features of the press. Accessories may include electrical motors, heating systems, tanks, bins, augers, and oil filtration systems. Solvent based systems with capacities of less than 50 tons per day are not readily available. Typically, these systems are custom designed and, therefore, standard prices are not published.

The amount of labor required to operate the processing equipment is also important. Labor costs are a major operating expense. Some mechanical processing systems with capacities of 1 to 15 tons per day are designed to run without direct supervision for hours at a time while others require frequent supervision. Labor requirements per ton of production may vary considerably. For example, 5 ton and 10 ton systems manufactured by one particular company require the same amount of operating labor. Labor costs per ton of material for this company's 5 ton press are therefore twice as large as for its 10 ton press.

Environmental concerns for mechanical extrusion processes are relatively small compared to those associated with solvent extraction systems. Solvents such as hexane can damage the environment and present health hazards to operators if they are not handled correctly. Permits are required to operate solvent extraction systems in Montana. Additional costs will be incurred to obtain the correct permits to build and operate a solvent extraction system.

Solvent extraction systems recover more oil than mechanical systems, often in excess of 95% of the oil in an oilseed. Mechanical extrusion processes are generally capable of recovering 60% to 75% of the oil contained in a seed. Oil is typically more valuable on a per pound basis than meal. Therefore, a solvent based extrusion process may increase the revenue generated by the process. However, certain meal markets may pay a premium for meal with higher oil content and producers have to take account of potential effects on meal values of mechanical as opposed to solvent based processing.

Processor Size

To operate efficiently, oilseed processing plants must have sufficient feed stock available. Potential processors need to estimate the amount of seed they are going to need to operate the plant efficiently. This process will need to include estimates of the number of hours each day and days per year the equipment will be operated. Additional information about acreage requirements for small and large scale oilseed processing facilities is provided in AMPC Policy Issues Papers 87 and 88.

Summary

Oilseed processing may provide opportunities for farmers, ranchers and entrepreneurs to create a value added enterprise. This guide has provided an overview of available oilseed processing technologies. Additional information about oilseed processing, Montana oilseed production, and other related topics can be found at www.ampc.montana.edu.